

***Kodiak Rapid Launch/Medium Lift Project
Economic Benefits Analysis***

*Prepared for:
The Alaska Legislature,
Legislative Council
and the
Anchorage Economic
Development Corporation*



Research-Based Consulting

Juneau
Anchorage

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Executive Summary

Alaska Aerospace Corporation's (AAC) Rapid Launch/Medium Lift project includes construction of a new launch pad, vehicle processing facility, and rocket motor storage facility at the Kodiak Launch Complex (KLC), on Narrow Cape, Kodiak Island, 44 miles from the city of Kodiak. The purpose of this study is to predict the economic benefits to Alaska associated with development of rapid launch/medium lift capabilities at KLC.

About the Rapid Launch/Medium Lift Project

AAC's rapid launch facility would allow the launch of small payloads (3,800 lbs.) into orbit with 24 hours of notification. KLC would be the only rapid launch facility in North America. AAC's Rapid Launch/Medium Lift project also would make possible the launch of rockets carrying payloads three to four times heavier than is now possible from the Kodiak spaceport. Medium lift includes 12,000 to 20,000 pound payloads.

These facilities would have a number of benefits for AAC and its customers, including lower overhead costs per launch, increased KLC launch capacity (more than double), and concurrent (multiple customer) launch capacity. The new proposed launch pad, Launch Pad 3, and the Vehicle Processing facility, could be fully operational by summer of 2012. The rocket motor storage facility is currently under construction.

It is outside the scope of this study to comprehensively assess the national and global demand for KLC launch services. The market is highly complex, competitive, and evolving, and a function of a broad range of political, economic, and national security forces. AAC officials estimate that with fully developed rapid launch and medium lift capabilities, launch activity could increase from its current level of about one launch per year to as many as four to six launches per year. This report addresses the economic benefits to Alaska associated with such an increase in launch activity.

Key Study Findings

Research conducted for purposes of this study indicates that:

- Rapid launch capacity will become increasingly important in the U.S. for several reasons, including growing need for quick replacement of damaged or aging satellites and immediate placement of new satellites over areas of national security significance or areas where natural disaster has produced urgent, enhanced communications needs.
- Development of rapid launch capability at KLC would position Alaska to play a key role in the Department of Defense's new Operationally Responsive Space (ORS) initiative. ORS will place greater national security reliance on the rapid launch of small satellites on small launch vehicles.
- The Kodiak Launch Complex is viewed by key industry participants as an efficient, low-overhead, state-of-the-technology launch complex, with significant potential for increased launch activity.

Employment and Income Benefits

Construction-phase economic benefits: Construction of new facilities needed for rapid launch/medium lift capability would include approximately \$40 million in in-state spending (additional out-of-state spending will be required for equipment and fabricated components). The statewide economic impact of in-state spending would include an annual average of 130 construction and support sector jobs over the two to three-year construction period and a total of \$24 million in payroll (about \$8 million annually). This includes Kodiak area impacts of approximately 80 direct and indirect jobs annually and \$15 million in total payroll (\$5 million annually).

Operations-related economic benefits: Today, AAC directly employs 38 workers in Anchorage and Kodiak, and provides additional jobs in Kodiak for workers through various services contracts. During launch periods the number of personnel on site increases substantially depending on the requirements of the parties engaged in the launch, including the owners (or their reps) of the rocket and payload, manufacturers of the rocket and its components, and launch facility personnel. Launches require engineers, technicians and specialists in communications, safety and security, meteorology, and other areas of expertise. A launch campaign may require 50 to 100 people, during a typical six-week launch window.

Regarding potential employment effects, a four-fold increase in launch activity at KLC would result in:

- A critical-mass level of activity where key businesses in the rocket industry would look to establish a permanent presence in Alaska, including businesses that build rockets and rocket components under contract (primarily to the federal government). Manufacturing of rocket components is unlikely in Alaska, but personnel needed to support assembly and maintenance of these components could be based in Alaska.
- Direct permanent employment in Alaska in support of Kodiak launches that would total the annual equivalent of approximately 150 jobs. These workers would earn a total of about \$11 million in payroll annually.
- A total permanent employment impact from the rapid launch/medium lift project, including all direct, indirect and induced effects, of approximately 250 jobs. Similarly, direct, indirect, and induced payroll would total approximately \$15 million annually.
- Continuing though more numerous spikes in activity around launch windows as temporary, non-resident workers and others travel to Kodiak to support or observe launches.

In terms of where new jobs will be based, clearly some additional employment would occur in Kodiak due to community's immediate proximity to the launch complex. However, businesses looking to establish a presence in Alaska in support of Kodiak launches will consider a number of logistical, cost, and quality of life factors in determining where to base employees. Proximity to Alaska headquarters for engineering, technical and other professional service firms, access to varied arts, cultural and entertainment opportunities, school selections, and a range of other factors work in Anchorage's favor in the regard. While it is not possible to predict with any certainty where new space industry jobs in Alaska would be based, both Anchorage and Kodiak could expect to see new jobs and related economic activity.

Other Benefits

Elsewhere in the country, where the rocket launch industry is more mature, strong linkages have developed between the industry and other sectors of the economy. Though such linkages in Alaska are relatively limited, a substantial increase in launch activity at KLC, and resulting support industry growth in Alaska, could bring other benefits in addition to the jobs and income described above. These could include benefits in:

- **Alaska higher education:** University research and higher education in Alaska are already connected to the space industry through the Alaska Space Grant Program (ASGP), established at the University of Alaska Fairbanks in 1991 under a grant from NASA's National Space Grant College and Fellowship Program. Increased launch activity in Alaska could provide a broader platform for enhancing the university's connection to the space industry by providing new educational, research and development opportunities.
- **Military and other R&D:** Many of the firms engaged in the rocket launch business are also involved in a broad range of military product development and systems research projects. A growing presence in the space industry, coupled with the state's already very strong military presence, could result in a new level of high-tech national-defense research and development in Alaska.
- **Economic diversification:** Economic development professionals point to Alaska's need to diversify its natural resource dependent economy to include more knowledge-based industry activity. The term "knowledge-based industries" refers to industries that are human-capital intensive and often technology intensive relative to other industries. The space industry offers knowledge-based economic development and diversification for Alaska.
- **Travel and tourism:** Spectator travel to Kodiak for launch viewing is not likely to become an important source of economic activity (rapid launches by definition would largely be short-notice events, not conducive to advance planning for resident or nonresident travel to Kodiak to witness launches). Medium lift launches, however, could draw visitors to Kodiak.

The following report provides more detailed information on AAC's rapid launch project, the impact of AAC at its current level of operations, the national economic impact of the space industry, and the potential economic benefits in Alaska of a substantial increase in launch activity at KLC.

Purpose of the Study

Alaska enjoys significant economic activity related to Alaska Aerospace Corporation (AAC) operations, particularly in Kodiak and Anchorage. According to a January 2009 study, 235 jobs and \$12.5 million in annual labor income in Alaska are the direct or indirect result of AAC operations.¹ Recently, AAC has initiated a major development program that, if fully implemented, has the potential to substantially increase the economic benefit of the aerospace industry in Alaska.

AAC's concept to develop rapid launch/medium lift capabilities at the Kodiak Launch Complex (KLC) could generate a significant increase in launch activity in Alaska, along with a variety of attendant economic benefits. AAC has 14 successful launches since its first launch in 1998. AAC believes that activity at KLC would increase to four to six launches annually with development of the rapid launch/medium lift facility. At that level, an order-of-magnitude increase in KLC-related economic activity in Alaska is possible. The purpose of this study is to identify and, to the extent possible, quantify that economic activity and other related benefits.

Scope and Methodology

The scope of this research includes analysis of direct and indirect employment, payroll and business benefits in Kodiak associated with an increase in launch activity; assessment of the likely increase in economic activity in Anchorage linked to increasing launch activity in Kodiak; and a discussion of a range of other potential benefits related to aerospace industry "cluster" development in Alaska. These benefits can arise in areas related to university-level research and education, professional and technical services, and others.

Research conducted as part of this study included interviews with high-level aerospace industry executives from across the country, including Florida, Virginia, Utah, Colorado, and elsewhere. These interviews produced information on launch-related staffing needs, aerospace cluster development, the future of aerospace activity in the U.S. and globally, and a range of other information. A variety of documentation was also compiled and reviewed, including Federal Aviation Administration commercial space launch data, studies of the national economic impact of the space transportation industry in the U.S., local and regional assessment of aerospace cluster development, and other materials.

This report includes a brief profile and history of AAC and the Kodiak Launch Complex, a description of the rapid launch/medium lift concept, an overview of the national aerospace industry and its economic impact, and finally an assessment of the Alaska benefits of successful development of rapid launch/medium lift capabilities at the Kodiak Launch Complex.

¹ "The Economic Benefits of the Alaska Aerospace Development Corporation, FY 2008." Prepared for Alaska Aerospace Corporation, January 2009, by Northern Economics.

Profile of AAC and the Kodiak Launch Complex

Alaska Aerospace Development Corporation (AADC) was formed in 1991 by an act of the Alaska Legislature. AADC was created as a public corporation charged with promoting, financing, developing and operating space launch and related facilities in Alaska.² The first AADC Board of Directors was named in 1992 and site selection and design for the Kodiak Launch Complex (KLC) were initiated the following year. Construction of KLC commenced in 1998 and the first rocket was launched that same year. Since 1998, KLC has had 14 successful launches including eight target missiles for the U.S. Missile Defense Agency (MDA), four launches for the U.S. Air Force, one for the U.S. Army, and one for the National Aeronautics and Space Administration (NASA). Two satellite launches are planned for 2010. In 2009, AADC formally changed its name to Alaska Aerospace Corporation (AAC).

KLC is located on Narrow Cape, 44 miles south of the community of Kodiak. KLC has been developed as a state-of-the-industry launch complex with its launch and launch support facilities gradually expanded to include six buildings and two launch pads. The Integration Processing Facility (IPF) provides 5,500 square feet of in-door work area for horizontal processing of rockets before placement at either launch pad. The Launch Service Structure (LSS) houses Launch Pad 1 (LP-1) and provides an all-weather facility for vertical processing of rockets in final preparation for launch. The Spacecraft and Assemblies Transfer (SCAT) Facility is a roller-mounted structure on rails that houses Launch Pad 2 (LP-2) and serves as an arctic entry for either the IPF or the LSS. The Payload Processing Facility (PPF) provides a 4,800 square-foot clean room for the processing of spacecraft before integration with the rocket at either launch pad. The Maintenance Support Facility (MSF) provides large storage areas, machine and electrical shops, shipping and receiving areas, and the offices for the full-time KLC administrative, technical, and engineering personnel. The Launch Control Center (LCC) is the technical and operational hub of launch operations during the mission. The LCC provides office space, telecommunications capability, and launch control capabilities to the range users of KLC.



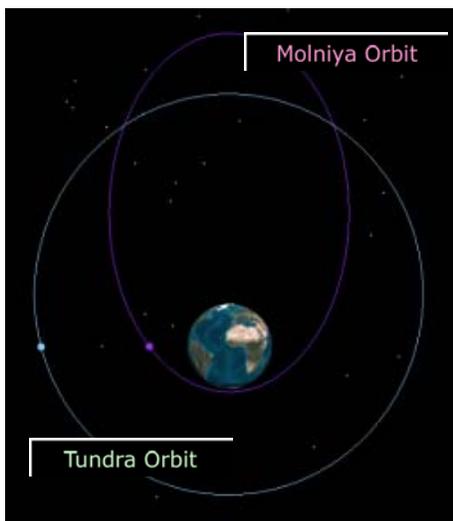
KLC Launch Pad 1

In addition to the fixed assets at KLC, AAC also owns and operates a mobile Range Safety and Telemetry System (RSTS) that consists of two identical systems. For launches from KLC, one RSTS system remains at KLC while its sister system is deployed to either King Salmon or Cordova, Alaska. The RSTS is also deployable to locations around the world where it can support launches from other launch complexes besides KLC. The RSTS has supported a launch from Vandenberg Air Force Base (VAFB) from KLC; acting as a satellite ground

² "Alaska Aerospace Development Corporation 2008 Annual Report."

station relaying mission critical data to the launch decision makers at VAFB. In 2009, a local Kodiak construction company was awarded a \$7.0 million contract for Phases 1 and 2 of the Rocket Motor Storage Facility (RMSF) construction project.

KLC was designed to support launches into polar orbit, including circular and highly elliptical Tundra and Molniya orbits. These are orbits that are not achievable from Lower 48 spaceports. A Tundra orbit is a type of elliptical geosynchronous orbit with a high inclination (usually near 63.4°) and an orbital period of 24 hours. A Molniya orbit is similar to Tundra in that it has the same inclination, but the orbital period is only about 12 hours instead of 24 hours. The only current U.S. user of Tundra orbits is Sirius Satellite Radio, which operates a constellation of three satellites. Satellites placed in Tundra orbit spend most of their time over a specific area of the Earth, a phenomenon known as apogee dwell. Satellites placed in Tundra and Molniya orbits heretofore had to be launched out of Russian launch sites (including the Sirius Radio satellites).



With Tundra orbits, two satellites can provide continuous coverage for a single large area while with Molniya three satellites can provide continuous coverage for two different areas. Sun synchronous (Polar) orbits are synchronized with Earth's rotation to always be in sunlight.

KLC is one of four U.S. spaceports licensed by the Federal Aviation Administration's Commercial Space Transportation (AST) to operate commercial launches. AST also has licensed the California Spaceport at



Vandenberg Air Force Base, Spaceport Florida at Cape Canaveral Air Station, and the Virginia Space Flight Center at Wallops Island.³ Kodiak is the only commercial launch complex in the U.S. not co-located with a federal facility.

KLC's Competition

The U.S space industry operates in a competitive landscape that is a blend of public (government) fixed assets and private operational resources. KLC has a number of advantages relative to other spaceports in the U.S. KLC's location on southwestern Kodiak Island offers thousands of miles of unrestricted down-range launch area over the North Pacific Ocean, with launch azimuths (launch directions) ranging from 110° to 220°, which encompasses a wide sweep of the North Pacific. No other North American spaceport offers equally unrestricted launch horizons. Further, because of its unique location, KLC is the only U.S. facility that can launch high inclination (63.4°) missions without land over-flight. Low inclination launches support equatorial

³ "2000 Reusable Launch Vehicle Programs and Concepts," Associate Administrator for Commercial Space Transportation (AST), Federal Aviation Administration, January 2000.

orbits (where the spacecraft orbits Earth at or near the equator). High inclination launches support polar orbits (where the spacecraft orbits Earth over the north and south poles). Polar orbits are possible from spaceports in North America other than KLC; however, energy consuming in-flight dog-leg directional adjustments are required.

KLC's principal competition for polar launches is Spaceport Systems International, located on Vandenberg Air Force Base. Vandenberg's advantages over KLC include better access to a well-developed and relatively close service and supply network. Vandenberg's disadvantages relative to KLC, among other things (described below) include much narrower launch azimuths. At Vandenberg, most launch azimuths range from 168 to 220 degrees, with no over-flight of populated areas.

Other facilities, such as the New Mexico Commercial Spaceport (now under development), are not competitive with KLC because of limited launch azimuths and requirements that jettisoned boosters land within very narrow areas. Major launch facilities such as Cape Canaveral in Florida and the Wallops Flight Facility in Virginia, can only offer polar and sun-synchronous orbits with costly and payload-limiting in-flight azimuth maneuvers.

Though KLC has certain transportation cost and logistics challenges related to its location, industry representatives point to operational advantages over Vandenberg. Vandenberg is a large and busy military facility, sometimes presenting significant bureaucratic challenges for securing launch dates and range clearances, as well as in addressing environmental issues unique to the area. These challenges can affect launch costs, as can delays in launch schedules. Launch delays among other users of the launch facility can have a domino effect on the schedules of following launches. KLC offers launch customers more scheduling certainty and therefore greater cost control.

The Rapid Launch/Medium Lift Project

Alaska Aerospace Corporation's (AAC) Rapid Launch/Medium Lift project includes construction of a new launch pad, vehicle processing facility, and rocket motor storage facility at KLC. This rapid launch capability would make possible the launch of small payloads (3,800 lbs.) into orbit with 24 hours of notification, making KLC the only rapid launch facility in North America. These facilities would offer AAC and KLC customers a range of benefits, including:

- Lower overhead costs per launch
- More than doubling KLC launch capacity
- Concurrent (multiple customer) launch capacity.

The first phase of the rocket motor storage facility is now under construction. The new launch pad, Launch Pad 3, and the Vehicle Processing facility could be fully operational by summer of 2012 (24 to 30 months from construction start).

Rapid launch capacity is expected to grow increasingly important for a number of national security, humanitarian, and commercial reasons. In general, rapid launch capacity would provide for quick replacement of damaged or aging satellites. It would also make possible quick placement of new satellites over areas of peace-keeping significance, or over areas where a natural disaster has produced urgent, enhanced communications needs (such as 24-hour surveillance or sat-phone coverage). Sudden shifts in foreign political or military stability can generate need for prompt satellite placement or replacement. In 2007, China destroyed one of its own satellites with a ground-based missile launch, demonstrating to the world that it has the capacity to destroy satellites in areas of space that are critical to global stability and security. Commercial communications satellites are vulnerable to mechanical failure or damage by the ever-increasing volume of "space junk" in orbit around Earth. Prompt replacement of a damaged satellite can be critical in terms of maintaining customer service. Currently, a period of months (or even years) is required to prepare for and execute a rocket launch to replace a damaged communications or data-gathering satellite. As North America's only rapid launch facility, KLC would be well positioned to serve this growing need for prompt satellite deployment or redeployment.

More specifically, development of rapid launch capability at KLC would position Alaska well to play a key role in the Department of Defense's new Operationally Responsive Space (ORS)

initiative. ORS will place greater national security reliance on the rapid launch of small satellites on small launch vehicles. The initiative will provide space-based capabilities needed to meet a broad range of U.S.



Proposed Vehicle Processing Facility and Launch Pad 3

diplomatic, information, military, and economic needs.⁴ ORS is a very new DOD effort that will focus on improving how the U.S. develops, acquires, fields and employs space capabilities more affordably and in shortened timeframes. ORS's aim is to provide rapid launch capabilities (launch vehicles, launch infrastructure, and associated launch support) exactly of the sort proposed for KLC.

In summary, the U.S. government and commercial market within which KLC is most competitive, the small orbital launch vehicle market (less than 5,000 lbs), was estimated in 2005 to average about 9 to 11 launches annually for the 2010 to 2020 time frame⁵



AAC's Rapid Launch/Medium Lift project would also make possible the launch of heavier rockets. Medium lift includes 12,000 to 20,000 pound payloads. With medium lift rocket capacity, KLC would be able to launch rockets carrying payloads three to four times heavier than is now possible from the Kodiak space port. Medium lift capacity at KLC would broaden the spaceport's market reach. Medium lift rockets fulfill a variety of civil, commercial and national defense satellite launch needs. The majority of the country's future medium lift launch requirements will be on the West Coast, either at Vandenberg or KLC. The future medium lift market will include resupply of the International Space Station (ISS). KLC is not well situated for ISS resupply launches (a fuel intensive left turn would be required to achieve the proper orbit). However, for the reasons described previously, KLC may be an attractive launch site (relative to Vandenberg) for other medium lift launches.

⁴ "A Plan for Operational Responsive Space, A Report to Congressional Defense Committees" Department of Defense, Primary Office for Coordination: National Security Space Office (NSSO), April 17, 2007.

⁵ "New Mexico Commercial Spaceport Economic Impact Study," prepared by Futron Corporation for the State of New Mexico Economic Development Corporation, Dec. 30, 2005

Economic Benefits of the Rapid Launch/ Medium Lift Project

There are a variety of potential economic benefits associated with development of rapid launch/medium lift capabilities at the Kodiak Launch Complex. These include:

- Temporary employment, payroll and business revenue associated with construction of rapid launch/medium lift facilities.
- Long-term (permanent) employment, payroll and business revenue in Alaska associated with an increase in launch activity. This includes additional direct and indirect economic activity in Anchorage related to an increase in launch activity at KLC.
- Inter-industry linkages related to a growing Alaska aerospace industry.

An assessment of these potential economic benefits is provided below. This chapter begins with an overview of the national economic benefits of the space transportation industry, based on research conducted by the Federal Aviation Administration. Next is a summary of the local and statewide economic effects of AAC operations, drawn primarily from a comprehensive impact study conducted in January 2009.

National Perspective on Space Industry Economic Benefits

The U.S. space industry is a diverse and complex blend of commercial, national defense, and research activities. The Federal Aviation Administration Office of Commercial Space Transportation conducted a study of the national economic impacts of commercial space transportation in 2006. The FAA study examined only the impact of commercial launches, including internationally competed launch events and/or any launches licensed by FAA under the Commercial Space Launch Act.⁶ Internationally competed launches are those launch opportunities available in principle to competitors in the international launch services market. The commercial space industry may include launch of government payloads on commercial vehicles (depending on if the launch was an internationally competed event). The commercial space transportation industry is composed of several sectors, including launch vehicle manufacturing and services, satellite manufacturing, ground equipment manufacturing, satellite services (the largest sector), remote sensing, and distribution industries.

In 2006, commercial space transportation and related industries account for \$139 billion in economic activity in the U.S., including \$36 billion in earnings and 729,000 jobs.⁷ According to the FAA study, the industry has been growing rapidly. In 2004, space transportation and related activity accounted for \$98 billion in

⁶ The commercial space industry does not include all space transportation-related activity. In 2008, there were 69 launches worldwide. Twenty-eight (28) of those launches were considered commercial launches.

⁷ *The Economic Impact of Commercial Space Transportation on the U.S. Economy*, April 2008. Federal Aviation Administration, U.S. Department of Transportation.

economic activity, 550,000 jobs, and \$25 billion in earnings. These measures of economic activity include all direct, indirect and induced impacts related to commercial space transportation in the U.S.

In terms of national economic impact, satellite services account for the largest component of the commercial space industry. Satellite services include direct-to-home (DTH) television services (account for about 80 percent of the satellite services sector), satellite transponder leasing, digital audio radio service (DARS such as Sirius Radio), and VSAT services.⁸

AAC is in the launch vehicle manufacturing and services sector, which includes launch services such as those offered at KLC. It should be noted that most of the economic impact of past KLC launch activity would not be captured in the FAA analysis because MDA and other military launches are not internationally competed. In addition to the economic benefits linked to MDA and other military launch activity, development of rapid launch/medium lift capability at KLC would place AAC in a better position to draw to Alaska some of the \$139 billion in annual economic activity associated with commercial launch activity.

Globally, the FAA anticipates that 468 satellites will be commercially launched over the next 10 years on 267 launch vehicles (some launch vehicles carry more than one satellite). This includes 110 non-geosynchronous orbit launches, such as the elliptical orbits supported by KLC.⁹

Current Economic Benefits of AAC

A study conducted by Northern Economics for Alaska Aerospace Corporation found in fiscal year 2008 the economic contribution to the Alaska economy from AAC operations and projects totaled \$28.7 million in direct and indirect spending, 235 jobs, and \$12.5 million in labor income (payroll).¹⁰ A total of 260 Alaska firms were among the businesses that provided goods and services to AAC in FY 2008.

Direct economic impacts of AAC operations included 38 employees on the AAC payroll. Direct employment also included 30 full-time equivalent subcontractor positions.

Most of the economic impact of AAC operations and projects occurred in the Kodiak area, including \$17.8 million in local spending, 155 total (direct and indirect) jobs, and \$7.7 million in annual labor income. The analysis indicates that AAC directly or indirectly accounted for 11 percent of the Kodiak economy in 2008. AAC-related employment and labor income impacts in Kodiak included temporary construction jobs for the Pasagshak Highway upgrade project, which improved access to KLC. Payroll earned by the 21 AAC employees located in Kodiak averaged \$6,274 per month in FY 2008, more than double the Kodiak economy-wide monthly average of \$3,111.¹¹

⁸ Very small aperture terminal (VSAT) is a two-way satellite ground station with a dish antenna smaller than 3 meters in diameter. VSATs access satellites in geosynchronous orbit to relay data from small remote earth stations (terminals) to other terminals or hubs. VSATs are most commonly used to transmit narrow band data (including point of sale transactions such as credit card data) or broadband data (for satellite internet access, voice over internet, or video).

⁹ *2009 Commercial Space Transportation Forecasts*, FAA Commercial Space Transportation (AST) and the Commercial Space Transportation Advisory Committee (COMSTAC), May 2009.

¹⁰ *The Economic Benefits of the Alaska Aerospace Development Corporation, FY 2008*. Prepared for the Alaska Aerospace Corporation, January 2009, by Northern Economics.

¹¹ 2008 Quarterly Census of Employment and Wages, Alaska Department of Labor and Workforce Development.

In Anchorage, where AAC is headquartered, economic benefits included \$7.1 million in total spending, 55 jobs and \$3.5 million in labor income. AAC purchased goods and services from 102 Anchorage area businesses in FY 2008. AAC directly employed 17 workers in Anchorage in 2008.

Infrastructure development supported by AAC has had an array of benefits for the community of Kodiak. Improvement of the Pasagshak Highway is one example. Another example is the fiber optic connection between the mainland and KLC, developed through an agreement with Kodiak Kenai Cable Company. As a result of this fiber optic connection, the community of Kodiak (along with communities on the Kenai Peninsula) has access to much faster and more reliable telecommunications services.

Return on Investment

As Alaska considers additional public investment in spaceport infrastructure, it is useful to consider the return of previous investments. To date, the State of Alaska has invested \$23 million in AAC and the Kodiak Launch Complex. From that investment (including an initial investment of \$15.6 million), a total of \$233 million in accumulated direct economic activity has been created in Alaska over the past 15 years. This includes \$94 million in accumulated launch revenues and \$139 million in total capital investments funded by NASA and the U.S. military. If all of the indirect and induced economic impacts were included, the total return on the State's investment in AAC would likely be 50 percent greater than the direct return of \$233 million.

Near-term, the economic return on Alaska's investment in AAC will continue. In 2008, AAC signed a three-year contract with the U.S. Missile Defense Agency and signed two launch contracts with the U.S. Air Force for launches in 2010.

The economic return on future investment in Alaska's aerospace industry is of course uncertain. Federal spending is essential. Funding of the U.S. Missile Defense Agency is subject to annual appropriation. The proposed \$7.8 billion MDA budget for FY 2010 is well below the appropriated \$9.0 billion MDA budget for FY 2009.¹² Still, investment in space defense technology is likely to be a national defense priority for the foreseeable future.

While it is not possible to predict with certainty that investment in rapid launch/medium lift facilities would generate a return on investment as Alaska's initial investment in AAC, it is clear that sustaining or enhancing Alaska's competitive position in the U.S. and global aerospace industry will require additional investment.

Benefits of Rapid Launch/Heavy Lift Capabilities at KLC

Construction Phase Economic Benefits

Kodiak would realize substantial short-term economic benefits associated with the construction and installation of rapid launch and medium lift facilities. According to AAC, an investment of approximately \$80 million will be required to fully develop KLC for rapid launch and medium lift services. About half of that total, \$40 million, would be spent on materials and components manufactured (or fabricated) outside of Alaska. The other half would be spent with Alaska contractors over a construction period of two to three years

¹² http://www.mda.mil/news/budget_information.html

(about three construction seasons). According to IMPLAN, a regional input-output model that predicts indirect and induced economic impacts of industrial activity, \$40 million in construction spending in Kodiak would result in a total of approximately \$60 million in direct, indirect, and induced economic activity in Alaska. This statewide economic impact would include an annual average of 130 construction and support sector jobs over the three-year construction period and a total of \$24 million in payroll (about \$8 million annually).

The amount of that activity impacting the Kodiak economy would depend on the degree to which local contractors are successful in securing project-related contracts or subcontracts. If it is assumed that Kodiak-based construction companies are awarded \$30 million in construction contracts (it is likely that some specialty contractors would come from the Anchorage area), the total local impact would be approximately \$40 million, based on IMPLAN multipliers. This impact would include the annual equivalent of 80 direct and indirect jobs over the two- to three-year construction phase and \$15 million in total payroll (\$5 million annually). It is important to note that these are preliminary calculations and more detailed project planning would be required to develop more precise estimates.

Long-term Economic Benefits from Increased Launch Activity

The long-term economic benefits associated with development of rapid launch/heavy lift capabilities will of course depend on the level of additional launch activity at KLC. It is outside the scope of this study to comprehensively assess the national and global demand for Kodiak launch services. The market is highly complex, competitive, and evolving, and a function of a broad range of political, economic, national security and even environmental forces. AAC officials estimate that with fully developed rapid launch and medium lift capabilities, launch activity could increase from its current level of about one launch per year to as many as four to six launches per year. With the necessary investment KLC would become North America's only rapid launch-capable spaceport. That, coupled with KLC's unique geographic and operational advantages, suggest an increase in launch activity is a reasonable expectation. However, reaching a level of activity of four to six launches per year would be a long-term goal, perhaps achievable within 10 to 15 years, particularly depending on the Department of Defense's progress with its Operational Responsive Space initiative.

The employment impacts of a several-fold increase in launch activity would generally be proportional. A typical launch campaign requires anywhere from 50 to as many as 100 people, temporarily, during a 6-week launch window. Launch campaign employment depends on the requirements of the parties engaged in the launch project, potentially including the owners (or their representatives) of the rocket and its payload, manufacturers of the rocket and its various components (motors, rocket stages, navigation instrumentation, etc.), as well as launch facility personnel. The number of people required to support a launch is substantial and includes a variety of engineers, technicians and specialists in communications, safety and security, meteorology, and other areas of expertise.

With a launch frequency of four to six per year, AAC's direct employment in Kodiak could increase modestly from the 21 full-time year round workers now employed at KLC. AAC's existing crew has the capacity to handle increased launch activity. However, there would be an increase in local employment among the businesses that provide contracted services to KLC. AAC contracts for a range of technical and non-technical services. Major high-tech firms such as Honeywell and ITT Corporation are among the subcontractors that

provide specialized personnel and services at KLC during launch windows. (Several subcontract firms also have a small number of staff dedicated to KLC during non-launch periods, as well as during the launch periods.) In 2008, AAC had significant technical/professional, administrative and other service subcontracts with 12 firms, totaling \$6.1 million. Approximately half of these firms are high-tech or otherwise specialized firms without a significant permanent presence in Alaska. As a result, much of the economic value of these subcontracts leaks from the state's economy. With an increase in launch activity, these firms would be more likely to establish a more significant year-round presence in Alaska.

The potential increase in permanent employment in Kodiak (and Anchorage) by what has been the non-resident component of launch campaign personnel is an important aspect of the benefits of rapid launch/medium lift capacity at KLC. At current levels of launch activity, less than half of all launch campaign personnel are Alaska residents. However, as launch activity increases, the economic and logistical efficiency of basing personnel in Alaska improves. Rocket owners, manufacturers, and suppliers of related mechanical and electrical components might choose to base personnel in Kodiak, or perhaps Anchorage. It is not possible to predict, with any degree of certainty, which businesses might choose to establish a more permanent presence in Alaska, when they might do so, and the number of employees involved. However, at a launch rate of four to six per year, with typical launch windows of about six weeks, the advantages of a permanent local presence are obvious.

In considering the likelihood of aerospace businesses establishing a presence in the state, it is worth noting there are a few key players in the global space industry that are already working in Alaska (though currently without a full-time employment presence in the state). For example, Orbital Sciences Corporation, which will be launching two satellites on two separate missions from KLC in 2010, is one of the country's leaders in small to medium class rocket and satellite systems. Orbital has previously launched three rockets from KLC, including the first launch from the newly construction facility in 1998. Orbital has 3,600 employees in five locations in the U.S.

Another prominent player in the space industry is ATK, manufacturer of 85 percent of the world's solid rocket propulsion systems. ATK propulsion systems have supported the majority of launches from KLC. Additionally, ATK propulsion systems are also part of the missile defense system assets deployed at Ft. Greely. ATK Space Systems has a degree of decentralization in its workforce, with 6,400 employees based in 15 different locations in six states.

To the extent that Orbital, ATK and other key space industry participants see an increase in their launch activity in Alaska, they will consider a variety of internal and external factors to determine if establishing a full-time presence in Alaska is in their corporate best interest.

At an activity level of four to six launches per year, direct permanent employment in Alaska in support of those launches would total the annual equivalent of approximately 150 jobs. To place this in perspective, in 2008, AAC directly employed 38 workers and provided jobs for another 30 employees through services contracts. There would still be a spike in activity around launch windows, but as is the case today, this activity would be driven by nonresidents in Alaska (in Kodiak specifically) during launch windows of a few weeks to three months.

Not all of the 150 jobs would be filled by Alaska residents. Initially, the most highly-skilled positions would be most likely be filled by nonresidents; Alaska does not currently have the necessary highly skilled, highly specialized professional and technical people in its labor force. However, over time these workers would establish residency in Alaska. Temporary, nonresident workers would continue to play a significant role in the Alaska space industry, given that not all of the businesses and government/military personnel connected to a rocket launch will have a permanent presence in Alaska. It should be noted that the Alaska economy overall is dependent on non-resident labor. About 20 percent of the state's labor force is nonresident.¹³

The mix of exiting and future jobs in Alaska's space industry workforce ranges from highly educated and skilled engineers to support clerical and administrative staff. Overall, wages are and will continue to be higher than the Alaska average. A space industry average annual wage of approximately \$75,000 is assumed for purposes of calculating total payroll and related economic impacts. This annual salary is the 2008 average for Alaska's architectural and engineering services sector.¹⁴ This average is also consistent annual salaries currently paid to AAC's Kodiak workforce. At that average salary, direct annual payroll in Alaska related to Kodiak launch activities would be about \$11 million.

The indirect and induced employment and payroll impact of increased launch activity in Alaska would depend on a number of factors, including the type and total value of goods and services purchased from Alaska businesses in support of launch operations. It also depends on the residency of the labor force, wages paid to the labor, and ultimately how much of the payroll dollars earned in Alaska are spent within the state. Employment multipliers in the relevant sectors of Alaska's economy range from 1.56 in the engineering and related services sector to 1.68 in the management, scientific and technical consulting sector. Based on the average of those two multipliers, the total permanent employment impact of the rapid launch/medium lift project would be approximately 250 jobs, including direct, indirect, and induced employment. Similarly, direct, indirect, and induced payroll would total approximately \$15 million annually.

It is useful to consider where future space industry-related employment will be based. Obviously Kodiak would see some of the new direct jobs associated with rapid launch/medium lift development. However, Anchorage could also expect to see some (perhaps most) of the new jobs associated with an expanded space industry in Alaska. Initially, some of the most skilled positions would require recruitment (or relocation) from across the country. Businesses looking to establish a presence and employ people in Alaska, in support of Kodiak launches, will consider a number of logistical, cost and quality of life factors in determining where to base employees. Proximity to Alaska headquarters for engineering, technical and other professional service firms, access to varied arts, cultural and entertainment opportunities, school selections, and a range of other factors work in Anchorage's favor in the regard. On the other hand, the community of Kodiak's immediate proximity to the launch complex will offer necessary advantages. Certainly services now provided by Kodiak business, such as security services, would be in greater demand with an increase in launch activity. In any case, while it is not possible to predict with any certainty where new space industry jobs in Alaska would be based, it is certain that both Anchorage and Kodiak could expect to see new jobs and related economic activity.

¹³ "Nonresidents Working in Alaska, 2007," Alaska Department of Labor and Workforce Development, 2008.

¹⁴ 2008 Quarterly Census of Employment & Wages, Alaska Department of Labor and Workforce Development.

Other Research on the Economic Impact of Launch Facility Operations

Research conducted in other areas of the country provides some guidance on the expected economic impacts of additional rocket launch operations in Alaska. For example, the Environmental Impact Statement (EIS) prepared for construction and operation of Titan IV/Centaur Launch Complex on South Vandenberg Air Force Base for launching the Titan IV/Centaur space vehicle indicated that launch facility operations in support of this particular program would create 400 jobs. Titan IV/Centaur project was intended to provide timely and reliable medium-class (10,000 pound) launch of critical Department of Defense satellites into highly inclined and polar orbits.¹⁵

The Draft EIS for the Spaceport America commercial launch site includes analysis of the economic effect of constructing and operating a spaceport in Sierra County, New Mexico. The New Mexico Space Authority (NMSA) is proposing to operate the site for horizontal and vertical launches of suborbital launch vehicles carrying space flight participants, scientific experiments, or other payloads. Most of the economic impact of the facility is expected to be associated with providing services to space tourists and other visitors to the spaceport.¹⁶ However, the study found that launch operations alone would, over about a five-year ramp-up period, generate total economic activity of \$27 million annually, including \$6 million in annual payroll and approximately 200 direct and indirect jobs. This economic analysis may have limited applicability to the KLC expansion because of the large number of sub-orbital launches anticipated for the Spaceport America facility, but it does provide an order of magnitude estimate of the on-site employment requirements of a fully utilized launch facility in a relatively rural area.

Space Industry Cluster Development in Alaska

An interesting aspect of this analysis is the potential inter-industry linkages related to a growing Alaska space industry. All of the various businesses and organizations with actual or potential interconnections with Alaska's space industry can collectively be termed an industry "cluster." Alaska's space industry cluster is currently small and far from fully developed. A four-fold increase in launch activity at KLC, and resulting support business development in Alaska, could substantially enhance Alaska's space industry cluster, bringing a variety of attendant economic and other benefits.

It is not possible to predict where and how all potential space industry linkages might form in Alaska, but elsewhere in the world such linkages have extended into a variety of engineering and technical sectors, university research and education, and travel and tourism. In this section, some of these potential linkages are described.

UNIVERSITY RESEARCH

University research and higher education in Alaska are already connected to the space industry through the Alaska Space Grant Program (ASGP). ASGP was established at the University of Alaska Fairbanks in 1991 under a grant from NASA's National Space Grant College and Fellowship Program. ASGP is a consortium of

¹⁵ Volume III, Final Environmental Impact Statement, Construction and Operations of Titan IV/Centaur Launch Complex, Vandenberg Air Force Base, August 1990.

¹⁶ Draft Environmental Impact Statement for the Spaceport America Commercial Launch Site, Sierra County, New Mexico. Federal Aviation Administration, June 2008.

universities and nonprofit organizations that sponsor a range of programs to enhance teaching, research, and educational outreach within aerospace and earth science-related disciplines in Alaska.

The Poker Flat Research Range, located about 30 miles northeast of Fairbanks, is owned and operated by the University of Alaska's Geophysical Institute. Poker Flats is the only nonfederal, university owned and operated range in the world and the only high-latitude, auroral-zone rocket launching facility in the U.S. Poker Flat operations are funded through contracts with NASA. Past funding sources have also included the Defense Nuclear Agency, the U.S. Air Force Geophysics Laboratory, the National Science Foundation, and the National Oceanic and Atmospheric Administration (NOAA). Poker Flat supports the launch of sounding rockets for a variety of scientific instruments designed to study the arctic atmosphere and ionosphere.¹⁷ Increased launch activity at KLC for non-military purposes could provide a broader platform for enhancing Alaska's already strong university connection to the space industry by providing new research and development opportunities as well as opportunities for launch of student-constructed satellites. UA students in engineering, physics and other fields could have enhanced access to instate internship and employment opportunities, with increased Kodiak launch activity.

NATIONAL DEFENSE AND MILITARY RESEARCH AND DEVELOPMENT

The military is a critical component of the Alaska economy, with \$3.6 billion in spending in 2008 and 27,400 Alaska-based personnel. Launch activities at Kodiak have generated a small part of that economic contribution, and rapid launch capability development (especially that associated with the Department of Defense's Operational Responsive Space initiative) at KLC could significantly increase that contribution. However, while very little information is available to the public about military research and development (R&D) in Alaska (other than that related to missile defense) it is possible that with a rapid launch commitment from the military in Kodiak, the state could achieve a critical mass in terms of space-related and other military R&D. Many of the firms engaged in the rocket launch business, Orbital, ATK, Lockheed Martin, Boeing and others are also involved in a broad range of military product development and systems research projects. A growing presence in the space industry, coupled with Alaska's very strong military presence (especially Air Force), could result in a new level of high-tech, military-related economic activity in Alaska.

TRAVEL AND TOURISM

Travel and tourism related to rocket launch activity is a significant and growing source of economic activity in Lower 48 spaceports. Travel to spaceports, either by people officially involved in the launch (contractors, owners, etc.), or by spectators, creates economic benefits for transportation providers, lodging establishments, restaurants, and other businesses that provide services to travelers. Official travel to Kodiak would certainly increase along with increased launch activity at KLC. Though Alaska hosts approximately 1.7 million nonresident visitors annually, spectator travel to Kodiak for launch viewing is not likely to become an important source of economic activity. Rapid launches by definition would largely be short-notice events, not conducive to advance planning for resident or nonresident travel to Kodiak to witness launches. Medium lift launches, however, would draw visitor to Kodiak. Medium lift launches require relatively long planning windows and therefore could provide advance-planning opportunities for interested spectators.

¹⁷ <http://spacegrant.alaska.edu/about>

PROFESSIONAL/TECHNICAL SERVICES

Economic development professionals point to Alaska's need to diversify its natural resource dependent economy to include more knowledge-based industry activity. The term "knowledge-based industries" refers to industries that are human capital intensive and often technology intensive relative to other industries. Alaska (Anchorage in particular) has apparently well-developed engineering, computer systems design, sciences, and technology consulting sectors. Together these sectors accounted for 8,600 jobs in Alaska in 2008.¹⁸ Much of Alaska's development in these areas has been related to the oil industry. In any case, this base of engineering, technology and science knowledge could have mutually beneficial linkages to a growing space industry presence in Alaska. With the growth of the space industry presence in Alaska, engineering and technical services companies already active in Alaska would have a new market for their services. Also as a result of these linkages, greater cross-industry transfer of systems and expertise is possible. Finally, buyers (from a range of industries) of professional engineering and technical services can have access to a broader and deeper array of expertise than would be the case without an in-state space industry. In summary, growth in Alaska's space industry, such as that possible with the rapid launch and medium lift project, would enhance that knowledge-based component of the state's economy.

¹⁸ Includes employment in the following industry sectors: Architectural and Engineering Services; Computer Systems Design; Management, Scientific and Technical Consulting; and Scientific Research Development. Source: Alaska Department of Labor and Workforce Development 2008 Quarterly Census of Employment & Wages.