



Unmanned Aircraft Systems: An Economic Development Strategy for Alaska



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Acronyms and Abbreviations

AAC	Alaska Aerospace Corporation
ACTD	Advanced Concept Technology Demonstration
ACUASI	Alaska Center for Unmanned Aircraft Systems Integration
ADSB	Automatic Dependent Surveillance-Broadcast
AFB	Air Force Base
AIDEA	Alaska Industrial Development and Export Authority
AK ANG	Alaska Air National Guard
AMOC	Alternate Method of Compliance
ATTREX	Airborne Tropical Tropo-pause Experiment
AUVSI	Association for Unmanned Vehicle Systems International
AVAPS	Advanced Vertical Atmospheric Profiling System
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BP	British Petroleum
C2	Command and Control
CAD/CAM	Computer-aided Design/Computer-aided Manufacturing
CARVE	Carbon in Arctic Reservoirs Vulnerability Experiment
CBP	Customs and Border Protection
CFR	Code of Federal Regulations
CNC	Computer Numerical Control
COA	Certificate of Waiver/Authorization
CONOPS	Concept of Operations
CPB	Customs and Border Protection
CSAR	Combat Search and Rescue
CTA	Continental Control Area
DCCED	Department of Commerce, Community and Economic Development, State of Alaska

DETR	Department of Employment, Training and Rehabilitation, State of Nevada
DHS	Department of Homeland Security
DoD	Department of Defense
DOI	Department of Interior
DMVA	Department of Military and Veterans Affairs, State of Alaska
DOT&PF	Department of Transportation and Public Facilities, State of Alaska
EDCO	Economic Development for Central Oregon
EO	Electro-optical
EXCOM	UAS Executive Committee
FAA	Federal Aviation Administration
FEDC	Fairbanks Economic Development Corporation
FEMA	Federal Emergency Management Agency
FIR	Flight Information Region
FMRA	FAA Modernization and Reform Act of 2012
GDP	Gross Domestic Product
GOED	Governor's Office of Economic Development, State of Nevada
GWOT	Global War on Terrorism
HAMSR	High-Altitude MMIC Sounding Radiometer (MMIC also an acronym)
HF	High Frequency
HIRAD	Hurricane Imaging Radiometer
HIWRAP	High-Altitude Imaging Wind and Rain Airborne Profiler
HS3	Hurricane and Severe Storm Sentinel
ICAO	International Civil Aviation Organization
IR	Infra-red
ISR	Intelligence Surveillance and Reconnaissance
JPARC	Joint Pacific Alaska Range Complex
LTFUAS	Legislative Task Force on Unmanned Aerial Systems (Alaska)
MAAP	Mid-Atlantic Aviation Partnership

MIZOPEX	Marginal Ice Zone Observations and Processes Experiment
MODIS	Moderate Resolution Imaging Spectroradiometer
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NGA	National Geospatial-Intelligence Agency
NIAS	Nevada Institute for Autonomous Systems
NIC	Nanook Innovation Corporation
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NSSI	North Slope Science Initiative
NTV	Nanook Tech Ventures
OAM	Office of Air and Marine
OCS	Outer Continental Shelf
OEM	Original Equipment Manufacturer
OIPC	Office of Intellectual Property and Commercialization (UAF)
OR-UAS	Oregon Unmanned Aerial Systems Business Enterprise
OSU	Oregon State University
PPUTRC	Pan-Pacific UAS Test Range Complex
PUR	Pendleton UAS Range
RCC	Rescue Coordination Center
R&D	Research & Development
ROW	Rights-of-Way
RT&D	Research and Technical Development
RDT&E	Research, Development, Testing and Evaluation
SAC	Special Airworthiness Certificate
SAREX	Search and Rescue Exercise
S-HIS	Scanning High-resolution Interferometer Sounder
SME	Subject Matter Expert

SSS	Sea Surface Salinity
SST	Sea Surface Temperature
TAMCC	Texas A&M Corpus Christi
TEES	Texas A&M Engineering Experiment Station
UA	University of Alaska
UAA	University of Alaska Anchorage
UAF	University Alaska Fairbanks
UAF-GI	University of Alaska Fairbanks Geophysical Institute
UAS	Unmanned Aerial Systems
UAS	University of Alaska Southeast (for purposes of this document no acronym will be used)
UAV	Unmanned Aerial Vehicle
USAF	US Air Force
USDA	US Department of Agriculture
USFS	US Forest Service
USGS	US Geological Survey
UNLV	University of Nevada Las Vegas
UTARI	University of Texas at Arlington Research Institute
VaCAS	Virginia Center for Autonomous Systems
VC	Venture Capital
WISPAR	Winter Storms and Pacific Atmospheric Rivers

Purpose

The State of Alaska Department of Commerce, Community, and Economic Development, Division of Economic Development, and the University of Alaska Center for Economic Development have developed this Unmanned Aircraft Systems (UAS) strategy document to guide the future expansion of the UAS-industry in Alaska.

The Division of Economic Development's primary functions are research, business assistance, promotion, and development finance. These functions have influenced the focus of this study as the state hopes to leverage its existing competencies to develop UAS related business opportunities.

This strategy document aims to advance the expansion of what is already an excellent economic opportunity for the state of Alaska. It focuses on growing related UAS industry sectors, advancing technologies in aerospace and aviation, and identifying opportunities for the Alaska workforce of the future.

Key long-term objectives related to the advancement of the UAS industry include:

1. Improve Alaska's unmanned system and aerospace industries business climate
2. Grow the UAS industry sector by encouraging private investment and job creation
3. Attract UAS sector anchor firms to Alaska
4. Promote UAS and aerospace research and development
5. Advance UAS and STEM education
6. Market and brand Alaska's UAS industry
7. Increase public sector education and engagement
8. Engage the FAA to produce a favorable regulatory framework for UAS operations.

The opportunities for Alaska's UAS sector are statewide. Alaska's existing geographic and technical assets, if developed in a strategic and intentional way, greatly increase the likelihood of the UAS industry resulting in economic opportunities and job creation for communities across the state.

As with any strategy document, this initial plan hopes to capture current thinking and data to frame the development of a strategy. This document is intended to be a living and changing plan, and should be regularly revised and updated to reflect technological, political and policy changes in both the public and private sectors.

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Executive Summary

Unmanned aerial systems (UAS) are positioned to revolutionize the field of commercial aviation. This technology has already transformed the defense market and will soon have a similar impact in a variety of civilian industries. These devices can perform a number of tasks ranging from wildlife observation to search and rescue and pipeline inspection effectively, efficiently, and safely. With global UAS expenditures of \$5.2 billion in 2013¹, industry analysts expect the market to more than double in the next decade, with a total value of \$89 billion over the whole period. As an early leader in the testing and development of UAS regulations and applications, Alaska has the potential to benefit economically from this emerging sector. It can increase the benefits it reaps by implementing investment strategies that encourage growth, innovation, and job creation.

Alaska offers unique advantages for the development of this new industry. First and foremost, the state has vast airspace available for testing UAS. While the Federal Aviation Administration (FAA) currently prohibits operating UAS in most civilian airspace, Alaska is a partner (with Hawaii and Oregon) in one of six FAA-designated test ranges across the country (see map below). Achieving this status is the culmination of a decade of path breaking research on UAS applications at the University of Alaska Fairbanks. Another regulatory advantage is the existence of the Arctic Airspace, a specially designated area over most of the Bering, Chukchi, and Beaufort Seas that will permit extensive UAS testing and some commercial operations. On the geographic front, Alaska provides a wide variety of landscapes and weather conditions for the testing and evaluation of aircraft over an immense area. Lastly, with the longstanding presence of resource development industries, military bases, civilian federal agencies, and other large actors, the state is home to a sizable potential market for UAS services.



Alaska test ranges, where FAA permits UAS testing

¹ "Teal Group Predicts Worldwide UAV Market Will Total \$89 Billion in Its 2013 UAV Market Profile and Forecast" <http://tealgroup.com/index.php/about-teal-group-corporation/press-releases/94-2013-uav-press-release>

Despite these strengths, other states and nations see economic opportunities in the UAS industry as well. The intense competition requires Alaska to develop a competitive strategy that coordinates the efforts of numerous stakeholders within government, the University of Alaska system, private industry, and others. By 2017, the FAA will implement a regulatory framework that integrates UAS into the national airspace system (NAS), opening the skies to commercial UAS use and negating some of Alaska's current advantages. Most other states feature lower business costs and larger available workforces, as well as established incentive programs to attract private investment. Capturing the economic benefit of a UAS industry in Alaska is thus a time-sensitive undertaking that requires strategic action.

Recommendations

A comprehensive strategy to grow and sustain a viable UAS industry for Alaska hinges on four major elements: business climate, innovation and entrepreneurship, workforce, and strategic partnerships.

Create a Strong UAS Business Climate

The business climate for UAS includes such elements as critical infrastructure, tax policies and regulatory framework. Any strategies deployed to minimize taxes, finance infrastructure, as well as minimize the cost of doing business in Alaska will improve the overall business climate. Specific recommendations include:

- **Strategically incentivize UAS investment to attract anchor firms.** Nationwide, most states and regions offer financial incentives (often in the form of tax credits or abatements) to attract businesses looking to expand or relocate. Alaska offers few incentives comparable to other states, but should consider them to offset the costs of doing business in the state. A state R&D tax credit, for instance, could provide businesses with corporate income tax relief.
- **Infrastructure investments.** Alaska must invest in critical infrastructure to support the continued development of the industry. This may include facilities, special use roads, airfields, or training centers. Infrastructure investments may be financed via public-private partnerships or organizations like the Alaska Industrial Development Export Authority (AIDEA).
- **A coordinated, branded marketing effort.** Several states in competition with Alaska for UAS investment feature marketing efforts to attract investment in targeted industries, such as "Diversify Nevada." Such an effort would include a team to recruit companies and serve as business liaisons. Clearly presented financial incentives are an expected component.
- **Clear communication of the state's assets.** The state offers more airspace for UAS testing than any other, a long history with defense and aviation related industry, deeply rooted UAS expertise, and nationally-renowned aviation training programs. With a large and diverse landmass, Alaska is an excellent laboratory for testing UAS. These and other strengths need to be communicated clearly and effectively.
- **Business retention and expansion (BRE).** The State of Alaska DCCED has successfully launched a BRE initiative to identify the needs of the business community in the state, and specific steps that can be taken to assist them. An aviation and UAS-specific BRE survey and engagement

could yield valuable information to encourage expansion of the industry.

- **State procurement of UAS services.** Where possible, state entities should consider utilizing UAS services in place of manned aircraft. This would be especially applicable for the Department of Natural Resources (DNR) or the Department of Environmental Conservation (DEC). In this way the state can promote UAS industry development while also realizing the greater efficiency and effectiveness of UAS.

Foster Innovation and Entrepreneurship

Alaska was an early leader in testing and evaluating UAS and thus has R&D capabilities within the University of Alaska system. The state and the university (along with other private sector stakeholders) must encourage spillovers of information that result in the commercialization of new innovations. This can be accomplished through:

- **Targeted R&D efforts.** The University of Alaska system is well-suited to conduct R&D to further develop specific UAS applications, such as wildlife monitoring, search and rescue, or remote infrastructure inspection. This could be done with a mix of public and private funds, with interested corporations sponsoring some of the R&D efforts. Public funding should go toward supporting centers of innovation to ensure the commercialization of research into viable products that will advance the industry. Several states have established technology funds for this purpose.
- **Development of a university research or technology park.** This is a special type of real estate development that integrates corporate R&D facilities into an area typically adjacent or in close proximity to a university campus. Research parks need to be developed cautiously. A key success factor is establishing a strong collaborative relationship between the university and industry partners. The corporations gain access to university facilities and brainpower, the ability to recruit top graduates, and to sponsor targeted research. A business incubator or accelerator (a structured program to nurture early stage businesses) could be integrated into a research park, with an emphasis on aviation and UAS related firms.
- **Availability of early stage capital.** With the advent of the 49th State Angel Fund in Anchorage (and its spinoffs) and venture funds at UAA and UAF, the state has the capital availability to support high growth ventures. In addition to the Angel Fund, the state should consider other financing programs designed to provide early-stage capital to the state's most promising entrepreneurs. These different funding sources must be aligned to better maximize their full potential and ensure that access to capital is achieved across Alaska.

Cultivate a Talented Workforce

The availability of skilled and semi-skilled workers has always been a challenge for Alaska's industrial development. A thriving UAS industry, however, requires a specialized workforce capable of piloting the vehicles as well as tending to the operational systems. A variety of ancillary services ranging from accounting to construction will also be necessary. The training and education needs can be met through:

- **Specialized coursework in UAS-related fields.** Both UAA and UAF offer aviation training

programs leading to degrees and certificates, including one course specific to UAS. Through the addition of UAS-related classes and even developing a certificate program targeted towards UAS, Alaska will be better poised as a training leader in unmanned aviation, as well as benefit from the attraction and growth of a specialized workforce. Complementary coursework and certificates for technicians in fields like remote imaging and electronic systems is also needed.

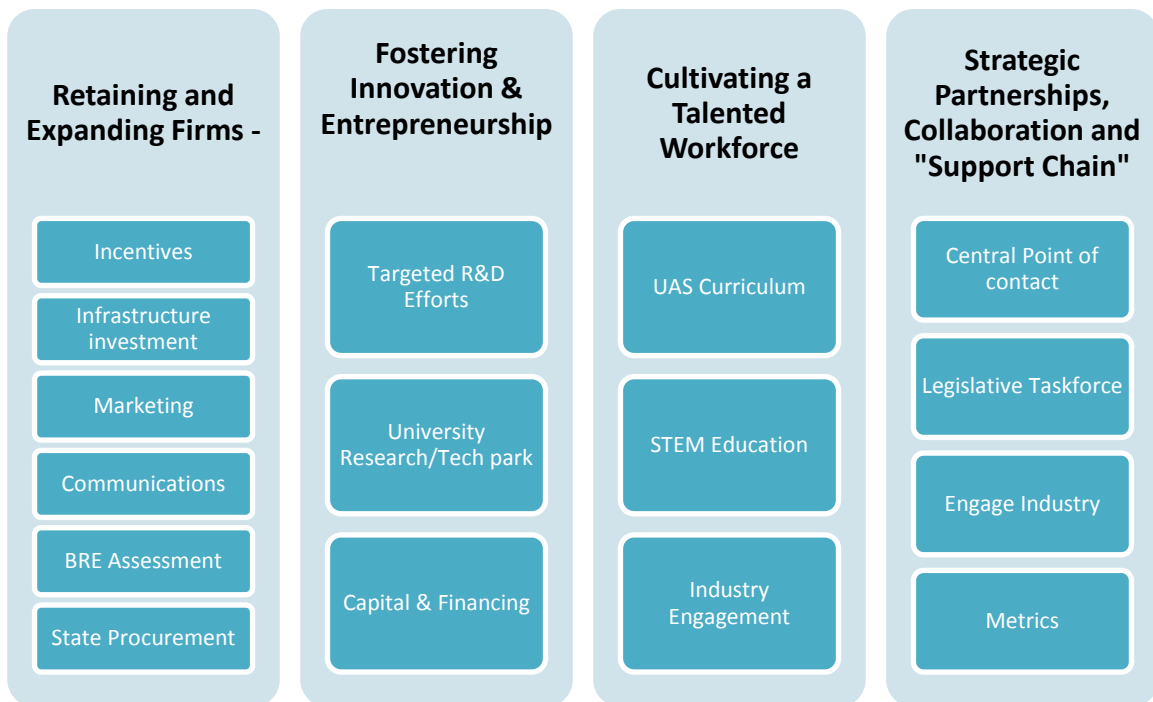
- **Invest in STEM education at all levels.** Activities could range from supporting youth robotics programs, expansion of the Alaska Native Science and Engineering Program or support for new engineering faculty and students to ensure Alaska has a highly qualified workforce. Post-graduate education in advanced engineering disciplines will also help develop a specialized workforce. Funding is necessary for the marketing and promotion of materials dedicated to how to build a career in aviation related industries.
- **Engage industry in determining needs and partnering to fund programming.** Establish employer-driven, standardized core curriculum for post-secondary students. Provide tax incentives for specialized training programs funded by employers.

Improving Strategic Partnerships and Collaboration

Contributors to the development of the UAS strategy plan spoke to the importance of improved alignment between government, higher education institutes, and private industry to maximize the potential for successful industry development. The following strategies are recommended to improve collaboration:

- **Formalize the UAS Interest Group or create an office as a central point of contact to coordinate efforts related to UAS.** This office might initially coordinate the efforts of the major stakeholder groups to ensure that strategies are inclusive yet disciplined. It might also serve as a point of contact for private industry.
- **Continue and expand the legislative task force.** This body works to ensure policies and workforce training needs are adequately funded and aligned with industry needs. It should also make legislative recommendations on the development of incentive programs.
- **Engage industry leadership.** Promoting a dialogue with industry leaders will help ensure that public sector activities are productive and meaningful. An industry association could help advocate for policies that encourage targeted and necessary investment.
- **Metrics.** Develop outcome-based metrics to measure the effectiveness and impacts of incentives developed to support the UAS industry to continuously improve and target incentives.

These strategies would position Alaska to compete as the UAS industry and related sectors evolve in the global marketplace. Alaska is in the enviable position of having several strong assets as it relates to leading in the UAS industry. Alaska must make a conscious decision to act in a strategic, orchestrated and sustained way in order to stand out from competing regions across the globe.



The four major components of a UAS-centered economic development strategy for Alaska

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1. UAS Industry Background

Experiments with pilotless aircraft began at the end of World War I. These earlier aircraft were known as “aerial torpedoes” and “flying bombs” and used on an experimental or small-scale basis. Not unlike the manned aviation industry, the maturity of unmanned aircraft has sprung from military and special operations to civilian applications. These began with search and rescue before moving to non-military security, firefighting, pipeline surveillance, and agricultural applications. As the civilian industry has matured in recent years, the terminology has also evolved from “drones” to unmanned aerial vehicles (UAVs) to the now widely accepted term unmanned aircraft systems (UAS).

National UAS Background

Used sparingly in previous military operations prior to the Global War on Terrorism, UAS are now making national headlines as they are used in supporting roles for both military and commercial efforts normally reserved for manned aircraft or satellites. For the past two decades, the Department of Defense (DoD) has driven the aerospace and defense industries to rapidly advance UAS related technologies with greater capabilities in the vehicles themselves as well as imaging technology. By 2009, the US Air Force (USAF) began to train more UAS pilots than manned fighter and bomber pilots.² Today, one-third of the USAF aircraft fleet is unmanned, and the US Army flew approximately 1 million UAS hours in 2010 alone. While the US reduces its presence in Iraq and Afghanistan, the number of UAS needed to US support military activity has remained relatively constant, as DoD operations expand into Africa, the Philippines, and South America, and are incorporated into US and NATO maritime realms.

A note on terminology: drone, UAV, or UAS?

While unmanned aircraft are frequently referred to as “drones,” unmanned aerial vehicle (UAV) is the established industry term. A UAV is defined by the *Dictionary of Military and Associated Terms* as a “powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload, or both.” “Unmanned aircraft system” (UAS) describes not just the unmanned aircraft itself but all the other necessary components and infrastructure, such as the control system or ground control station, navigational equipment, communication control link or data link and ground-based pilot. For the remainder of this document, UAS will be the most frequently used term.

UAS come in a variety of sizes and configurations, ranging from those as small as an insect to as large as a commercial airliner. According to available research, small (under 55lbs) UAS constituted the vast majority of platforms in operation between 2005 and 2011 while strategic (larger) UAS included some of the most versatile; typically operating up to 65,000 feet in altitude, with a maximum endurance (time in

² Air Force Times <http://www.airforcetimes.com/article/20090616/NEWS/906160319/More-training-UAVs-than-bombers-fighters>

the sky) of more than 20 hours. The US Air Force categorizes UAS in five tiers, which will be referred to throughout this document. These include:

- Tier N/A : Small/Micro, low altitude
- Tier 1: Low altitude, long endurance
- Tier 2: Medium altitude, long endurance
- Tier 2+: High altitude, long endurance conventional
- Tier 3: High altitude, long endurance low-observable

The success of US DoD applications for UAS has driven demand from other national governments to incorporate the technology into their own militaries. This is fueling a rapid growth in the international defense-related UAS marketplace.

In parallel, there is a growing understanding of non-military UAS capabilities and applications throughout civilian marketplaces to address “dull, dirty, and dangerous” or otherwise complicated tasks. UAS operations in the National Airspace System (NAS) has been primarily limited by the Federal Aviation Administration (FAA) to missions focused on public interest such as disaster relief, wildfire control, law enforcement, search and rescue, or related functions. Teal Group Corporation (a consultancy) reports indicate *the primary challenges holding back commercial development are the lack of access to airspace for UAS research and development, as well as restrictive export control regulations for US manufacturers to other countries with more flexible airspace restrictions.*

Figure 1: Uses for UAS Technology

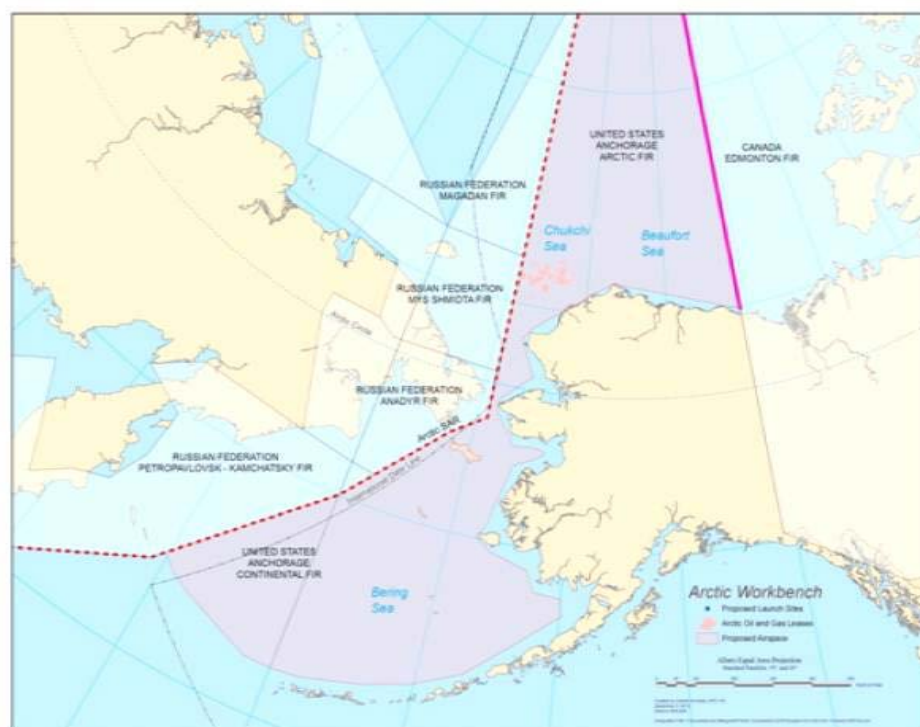
Non-Military UAS Applications	
Airworthiness Certification	Provision of non-military Services
Border surveillance	Damage surveying
Suspect tracking	Aerial photography
Traffic monitoring	Wildlife monitoring
Disaster response/relief	Pipe/power line surveillance
Damage assessment	Agricultural applications
Atmospheric/weather research	Communications/broadcast
Critical infrastructure monitoring	Movie production
Aerial news coverage	Flood mapping
Mail/freight transport	Real estate mapping
Mining	Sports event coverage

Given increasing demand for use of UAS in domestic airspace, the FAA has taken initial steps to safely integrate UAS into the NAS, the largest, most complex air traffic system in the world. In the FAA Modernization and Reform Act of 2012 (FMRA), Congress directed the FAA to establish six “test ranges” to assist in developing the policies, procedures, and technologies required to integrate UAS into the NAS. In selecting the test ranges, the legislation mandated that the FAA, in consultation with the National

Aeronautics and Space Administration (NASA) and the DoD, consider geographic diversity, climatic diversity, location of ground infrastructure and research needs in choosing the ranges.

Most significant, the airspace encompassing Alaska's Arctic was given special consideration in the FMRA. Alaska was designated to be first in allowing commercial UAS. **In recognition of Alaska's role in UAS development, the act also established the Arctic Airspace, a unique region located off the coast of Alaska north of the Aleutians over the Bering, Chukchi, and Beaufort Seas up to at least 2000 feet, for 24-hour access by all types and users of UAS, with launch and recovery from selected coastal locations without the need for special permissions or waivers (see map below).³**

Figure 2: Arctic Airspace



In 2013 the first commercial offshore UAS flights in the US were conducted about 50 miles northwest of Wainwright in the Chukchi Sea. Conoco Phillips, Insitu, and Olgoonik Fairweather conducted two commercial Scan Eagle flights from the R/V Westward Wind to investigate the viability of using UAS to conduct marine mammal surveys and ice reconnaissance. In the summer of 2014 BP and AeroVironment, Inc. conducted the first terrestrial UAS operations near Deadhorse, the center for Alaska's North Slope oil production. The UAS industry had partnered with Alaska operators to conduct these historic flights and have scheduled many more promising operations to highlight the effectiveness of the technology.

³ The FAA is currently in the process of designating the Arctic Airspace, and as such the map reflects proposed areas.

The six FAA test ranges were announced in December 2013 and began operations in January 2014, initiating airspace access for researchers, government agencies, and industry towards assisting in the assimilation of requirements for integration of UAS into the NAS. The test range selection established range operators in Alaska, Nevada, New York, North Dakota, Texas and Virginia. While the selection of test ranges does not provide wide-scale access to national airspace for commercial and civil purposes, the operational data collected will provide the FAA an opportunity to develop regulations for future commercial and civil uses in the NAS.⁴

National UAS Economic Impact

UAS will likely become the most dynamic growth sector of the world aerospace industry this decade. UAS in civilian use are expected to become a multi-billion dollar industry while opening new opportunities in scientific research and student education. The Teal Group Corporation, in its 2013 Small UAS (SUAS) Market Profile and Forecast, estimated that the global UAS market could be worth up to \$89 billion over the next decade, and the US is expected to account for almost two-thirds of the world's research and development (R&D) investment in the field.⁵ The same study predicts that the UAS demand worldwide for R&D, testing, and procurement rising from \$6.6 billion in 2013 to \$11.4 billion in 2022. Teal expects the US share of R&D to account for 62% of worldwide spending. In short, the development and manufacture of UAS for use by public entities and commercial users is expected to grow in the coming years despite numerous regulatory and technical issues which remain to be addressed.

A number of US and international firms currently manufacture UAS for military and civil government operations. Depending on the mission, unmanned aircraft are typically equipped with payloads that provide multiple capabilities, including reconnaissance (surveillance and intelligence gathering) and in some cases attack capabilities. All UAS require a ground control component and a communications link to the unmanned aircraft. According to Forecast International, unmanned air vehicles will account for 46% of UAS spending, payloads for 38%, and ground control equipment for 16% during the next decade. US manufacturers with the largest share of the global UAS market are listed below.⁶

Figure 3: Global UAS Market Share (manufacturing)

Company	Global Market Share
General Atomics	20.4%
Northrop Grumman	18.9%
Boeing	1.5%
AAI	1.2%

⁴ FAA UAS Fact Sheet - http://www.faa.gov/news/fact_sheets/news_story.cfm?newsid=15575

⁵ World Unmanned Aerial Vehicle Systems. 2011 Market Profile and Forecast, The Teal Group Corporation, 2011.

⁶ Graham Warwick and Larry Dickerson, "Cooling Down? Export and civil unmanned aircraft demand will grow, but mainstay military markets may slow." Aviation Week & Space Technology, December 31, 2012 p. 84

The Association for Unmanned Vehicle Systems International (AUVSI) estimates that by 2029 more than 23,000 UAS jobs could be created in the US as the result of UAS integration into the NAS. New jobs will not only result with this industry growth, but also expand into academia, federal government agencies, and the civilian/commercial UAS support community. These new positions could translate into more than \$1.6 billion in wages over the next 15 years. These jobs will emerge from the manufacturing sector, as well as pilots and operators, data analysts, maintenance personnel, range and air traffic control management and consultants will also result. Universities are already developing new curriculum targeted for these future positions and in preparation for related workforce training. Operator certification and maintenance programs are being created due to student demand. In a few instances, four-year professional degrees as well as advanced degrees are offered.

Secondary employment will also be created in ancillary markets by the increased demand for UAS. For instance, sensor manufacturers, avionics providers, software developers, and composite manufacturers will add manufacturing and engineering personnel. Companies are also anticipating adding support staff such as accountants, sales associates, managers, human resources specialists, insurers, and administrators to ensure business efficiency. Regions with a large UAS manufacturing or R&D presence will experience employment growth across numerous employment sectors as spillover effects materialize.

An additional opportunity area—and perhaps the most relevant to Alaska—is an emerging market for UAS services. Large resource development companies and civilian government agencies are already exhibiting demand for a variety of imaging, mapping, and other services (Chapter 3 will describe several examples). The ability to operate UAS fleets and analyze data collected from unmanned aircraft will likely become a profitable business opportunity.

Alaska UAS Background

Within Alaska, the current breadth of applications for UAS is expansive. Several factors drive the use of UAS, including Alaska's vast size, abundance of natural resources, limited road access (and therefore remoteness), and extreme weather and terrain. These realities, coupled with the fact that Alaska has a strong aviation-centric orientation (with six times more pilots per capita than the rest of the nation) has made the leap to UAS technologies a natural fit. UAS are already utilized to support a wide array of activities such as conducting scientific research and environmental monitoring by NASA and the National Oceanic and Atmospheric Administration (NOAA), oil spill mapping (response/environmental cleanup), weather forecasting, wildlife monitoring and counts, atmospheric sampling during wildfires, power line inspections, air quality monitoring and examination of sea ice build ups. Further applications tried in Alaska include: whale observing, cadastral mapping, maritime navigation support, industrial plant and pipeline monitoring, oil and gas flare stack maintenance, and environmental cleanup response.⁷ Furthermore, the opening of the Northwest Passage to shipping and therefore the additional burden of providing potential assistance to those vessels as well as related port developments lend themselves to use of UAS

⁷ Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) presentations and interviews

technologies. As evidenced by these examples, aviators, researchers, and industry are collaborating closely to use unmanned aircraft for missions previously requiring manned aircraft at higher cost, greater risk, and with fewer capabilities.

Throughout these initiatives, the Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) at the University of Alaska Fairbanks within the Geophysical Institute has been instrumental in developing a world-class program and successfully securing one of the six FAA test ranges to further this capacity. ACUASI was formally established in December 2012 by the University of Alaska Board of Regents to advance the study of UAS capabilities. The program's roots reach back to 2001, and over the years it has expanded its scope, obtained more advanced equipment, and increased the variety and complexity of research executed. The mission of ACUASI is to serve as a research center for small, unmanned aircraft systems providing integration of unique payloads and supporting pathfinder missions within the government and scientific communities, with special emphasis on the Arctic region. ACUASI has worked on UAS projects all across the world, including projects in Iceland, Chile, and South Africa. For instance, ACUASI led a trip to South Africa in which they deployed UAS technology in an effort to find rhinoceros and elephant poachers. In recognition of the important role of UAS in Alaska, the Legislature appropriated \$5 million from the state Capital Budget in 2012 to the UAF for the specific purpose of "Research and Development of Unmanned Aerial Systems" and to support the development of sustainable high-tech industry in Alaska.

Who can legally operate UAS?

Until the FAA fully integrates UAS into the National Airspace System, unmanned aircraft may only operate under certain highly controlled circumstances. Under current FAA rules, there are three types of UAS that can be operated: civil UAS, public UAS, and model aircraft. Flying Civil UAS requires a Special Airworthiness Certificate to be issued for experimental purposes, such as R&D. UAS may not be used to transport people or property for hire. Public UAS requires a Certificate of Airworthiness (COA) that may be issued to a public entity to carry out a public purpose, such as law enforcement or search and rescue. Model aircraft are those operated by hobbyists at 400 feet or less, within sight of the operator.

In 2012, ACUASI began collaborating with Oregon State University, the University of Hawaii, and several industry and government entities to propose a Pan-Pacific UAS Test Range Complex (PPUTRC). The PPUTRC, led by ACUASI, proposed test range research targeted towards the development of standards for UAS categories, state monitoring and navigation, and safety standards for UAS operations. **In December 2013 the FAA announced that PPUTRC was successful in its bid and was initially awarded approval for 9 of its 13 proposed test ranges located in Alaska, Hawaii, and Oregon.** Of the 13 proposed ranges, six ranges are in Alaska (Denali, Kodiak, North Slope, Oliktok Corridor, Poker Flat, and Wainwright Corridor), three ranges are in Hawaii, and three ranges are in Oregon. Since designation, the FAA has opened the opportunity for PPUTRC to propose additional locations, and several have already been approved. In late 2014, ACUASI entered into an agreement to expand testing operations to Iceland,

for instance. The FAA test range designation runs through February 2017 in accordance with the FMRA. However, the FAA has stated that it expects to grant an extension, and after expiration will view the test sites as continuing operations to support long-term testing of new design UAS and supporting systems. Another issue of strategic importance is that the FAA test range designation comes with no fiscal support to complete the efforts in support of the FAA.

Figure 4: Alaska, Hawaii, and Oregon, the three states that form the Pan-Pacific UAS Test Range Complex (PPUTRC).



While this strategy plan focus is UAS related activities, it is important to also acknowledge the fact that the University of Alaska Fairbanks via its School of Fisheries and Ocean Sciences is also developing expertise with Marine Autonomous Underwater Vehicles (AUV). The AUV program is very symbiotic and complimentary to the other work the University of Alaska system is engaged with relating to UAS and may ultimately lead to some crossover research, innovation and commercialization opportunities. At a later update this strategy document may want to incorporate AUV strategies for the emerging AUV sector.

Strategic Considerations

As the nation races to transition UAS from military to civil and scientific applications, an enormous opportunity exists for Alaska to participate in the development of this industry and benefit from the associated economic development and therefore jobs that will result. As already presented, Alaska has some clear advantages or assets to leverage when considering UAS industry expansion including:

- Access to comparatively vast airspace for UAS research and development;
- Location includes Arctic Airspace, a unique region located off the coast of Alaska north of the Aleutians over the Bering, Chukchi, and Beaufort seas;
- Aviation-centric orientation;
- Engaged university, the Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) at the University of Alaska Fairbanks within the Geophysical Institute has focused on UAS since 2001;
- FAA test range – the Pan-Pacific UAS Test Range Complex was awarded multiple test ranges located in Alaska, Hawaii, and Oregon.

While Alaska's position is enviable by other states, unless Alaska strategically grows its current opportunities from a nascent occurrence to an established industry, the potential value will never be realized. Over the next few years Alaska must transition from being a lead test range to an expanding center for UAS-related industries. Currently all focus is on conducting missions and collecting the data the FAA needs to implement rules for the civil and commercial use of UAS. Simultaneously, more formal efforts to support the application of current UAS capabilities and development of new technologies and the advancement of uses for UAS are necessary. Other states with fewer strategic assets and even in some instances lacking a "test range" designation are ramping up to further expand their presence.

Alaska has a unique opportunity to tap distinctive expertise and develop a new industry for the state, one that leverages its global position and unique competencies. Alaska has the potential to market and position itself as the best place in not only the country but also the world to work out the issues of integrating the emerging UAS systems into the NAS, as well as commercializing technologies into private sector uses. The challenge Alaska faces is how best to link and align these assets to grow a prospering new industry that moves all stakeholders in a shared direction with common overarching objectives.

2. Alaska's UAS-Anchor Assets

Alaska possesses many key anchor assets which, if coordinated properly, can help the state to develop a thriving and integrated UAS industry. These assets come from a broad spectrum of organizations, including the University of Alaska, the US military, and several public sector stakeholder groups which have formed in response to the development of UAS within Alaska. The key moving forward will be to properly align the efforts of these diverse organizations as they work toward the common goal of building a strong UAS industry within Alaska.

University of Alaska

One of Alaska's key assets in developing its Unmanned Aerial Systems industry is the University of Alaska system. The University of Alaska Fairbanks (UAF) and the University of Alaska Anchorage (UAA) both possess a number of core competencies that position them well in supporting the development of a UAS industry within the state. The two universities have significant experience in aviation, aviation maintenance, aerospace, and unmanned systems. In addition to offering coursework each possesses state-of-the-art facilities and training equipment. Through the Alaska Center for Unmanned Aircraft Systems Integration (ACUASI), the university system has even emerged as an early leader in testing and evaluating UAS.

Moreover, the University of Alaska system is committed to economic development and industry partnerships. The Shaping Alaska's Future Initiative is UA's commitment to continuous improvement and innovation. Relevant themes of the initiative include: Productive Partnerships with Public Entities and Private Industry; R&D to Enhance Alaska's Communities and Growth; and Accountability to the People of Alaska. Through these initiatives the UA system is working to modernize, streamline and improve by investing in areas of real need and eliminating areas of barrier. The following table outlines the major assets of both UAF and UAA in terms of their collective coursework, facilities, and other attributes. This chapter also reviews Alaska's other anchor assets such as its UAS Interest Group, military presence, aviation/aerospace competencies, and arctic location.

Figure 5: University System Anchor Assets

Entity	Asset	Details
University of Alaska Fairbanks	Alaska Center for Unmanned Aerial Systems Integration (ACUASI)	A nationwide leader in the testing of UAS applications; one of the first centers of its kind and the lead entity in the Pan Pacific Test Range Complex
	Poker Flats Research Range	Largest land-based research rocket range in the world. Also Alaska's first UAS test site.
	Office of Intellectual Property and Commercialization (OIPC)	Leases university-owned patents to businesses. Also manages Nanook Tech Ventures spinoff, a venture capital fund.

	Aviation Program	Possesses large hangar and degree or certificate programs in aviation, airframe, and power plant maintenance.
University of Alaska Anchorage	Office of Technology Commercialization	Leases university-owned patents to businesses. Also manages Seawolf Venture Fund.
	Aviation Program	One of nation's top ranked aviation programs, with programs in air traffic control, professional piloting, aviation technology, and aviation administration. Under Center of Excellence designation, performed aviation safety research with other top aviation schools.
	Business Enterprise Institute	Hosts Center for Economic Development, Alaska Small Business Development Center and other entities. Serves as a bridge between academia and private industry.

University of Alaska Fairbanks

Leading the charge for the development of an unmanned aerial systems industry in Alaska is University of Alaska Fairbanks (UAF). The university is the official host of the Pan Pacific UAS Test Range Complex, and has a long history of working with UAS technology. In fact, UAF was one of the first universities in the country to begin working with unmanned systems. UAF took on a leadership role in establishing ACUASI, the only center of its kind in Alaska, and one of only a small number nationwide. ACUASI began its operations as early as 2001, when it began looking into UAS technology and potential applications. Since then, the center has conducted associated research and flight missions with the aid of UAS technology in a variety of areas including: sea ice, fish and wildlife observations, firefighting, environmental cleanup, and climate research. ACUASI has conducted significant UAS-related research in Alaska, across the nation as well as internationally.

Another UAF asset is its Poker Flat Research Range, which serves as one of the state's six test ranges through the FAA test range selection. The Poker Flat Research Range is one of the most advanced ranges of its kind in the country, and even globally. The range is the single largest land-based rocket range in the world, and is the only high-latitude rocket range in the United States. The range first began its testing of UAS in 2004, and has scaled up its research activities since that time. The range is now home to more than two dozen UAS models, including everything from the 2.5 pound Aeryon Scout (the range's smallest UAS) to the 40 pound Insitu A-20, the range's largest. In addition to its core competencies directly related

to UAS technology and research, the range is also unique in being the only university-owned rocket range in the world. This is a distinct advantage that can only be found at UAF.



Poker Flat Research Range

UAF conducts approximately \$120 million per year in research. The Office of Intellectual Property and Commercialization (OIPC) leads the efforts to commercialize UAF research in direct support of business development and job creation. While OIPC develops and protects intellectual property for UAF, the separate nonprofit, Nanook Innovation Corporation (NIC) is charged with licensing new technologies to existing companies or creating startup companies through its subsidiary, Nanook Tech Ventures (NTV). In 2014 alone, 75 inventions were reported to OIPC, patent filings were up over 130% from FY13, 2 patents were granted, and 40 technologies were licensed through 6 licensing agreements from NIC to private companies. Royalties from NIC licenses are returned to the University to promote new innovation and development. Also in FY14, NTV created the startup company ArcticFire Development Corporation that will commercialize unmanned aircraft software.

UAF is also a core partner of the proposed FAA UAS Center of Excellence team being led by Mississippi State University. This team, called the Alliance for System Safety of UAS through Research Excellence (ASSURE) consists of eighteen of the world's leading research universities, and a hundred leading industry and government partners. ASSURE possesses the expertise, infrastructure and outstanding track record of success that the FAA Center of Excellence for Unmanned Aircraft Systems requires. In addition to UAF, members include Oregon State University, the University of Kansas, and Auburn University, among others. ASSURE members are core to three FAA UAS test sites, lead four FAA

research centers, have seven airfields and a 340 UAS fleet—24 more UAS than the USAF. If ASSURE is successful, each core University team member will receive a contract with the FAA to support UAS research in their individual areas of expertise. For Alaska this will include a focus on low altitude operations, efforts related to extreme climates, human factors, and pilot training and certification.

UAF's many resources and core competencies including its expertise in rocketry, unmanned aerial systems, technology transfer, and aviation maintenance make it a strong resource in developing an integrated UAS industry in Alaska.

University of Alaska Anchorage

The University of Alaska Anchorage (UAA) possesses many core competencies that allow it to play a significant role in the UAS industry. UAA is especially well known for its aviation programs, which are often regarded as among the best in the nation. UAA also supports a growing research portfolio, is expanding its technology transfer competencies, and has decades of experience supporting industry through addressing technical assistance needs. Offering education, providing industry technical assistance, engaging in public policy needs and research related to Unmanned Aerial Systems are natural extensions of UAA's already existing programming.

UAA's aviation students can obtain degrees in air traffic control, professional piloting, aviation maintenance technology, and aviation administration or choose to minor in aviation technology. The FAA ranked UAA's air traffic control program 3rd out of 31 certified Collegiate Training Initiative (CTI) schools. CTI schools are those designated by the FAA for meeting the specific requirements necessary to produce certified air traffic controllers for the agency. A state-of-the-art air traffic control simulator is a central asset of the program, with a full 360-degree interface, and is one of only a handful worldwide.

UAA's specialties in the aviation and aviation maintenance fields provide it with several core competencies that have clear applications in the UAS field. Seeing this potential opportunity, UAA has taken on a leadership role in developing curriculum around Unmanned Aerial Systems. Starting in the fall 2014 semester, UAA became the first school in the state of Alaska to offer a UAS class. The class, "Introduction to Unmanned Aircraft Systems", provides students with an overview of UAS technology. The course will inform students of present and future missions, as well as a detailed study of sensors and mission development. Further, the UAF ACUASI team helped develop the course.

Another program at UAA, the Business Enterprise Institute (BEI), links economic development programs across the UA system and supports businesses with technical assistance and the expansion of entrepreneurial capacities across Alaska. Providing economic development-related research and technical assistance, high-level professional education, small business development services and youth entrepreneurship programming, BEI serves as a bridge to expertise and talents throughout the UA system. BEI's programs, which include the Alaska Small Business Development Center and the Minority Business Development Agency, are becoming better versed in the needs and opportunities of UAS related business development and are willing and able to assist both existing and startup firms with their business

development needs. The UA Center for Economic Development also reports through BEI and provides technical assistance in the form of information, research data and know-how in evaluating, shaping and implementing specific projects and programs that promote economic development.

UAA's expertise in aviation and economic development, coupled with its leadership in establishing course offerings on UAS, position the university well to aid the coalition of organizations in helping to grow a UAS industry in Alaska.

Military⁸

The military represents an important sector of Alaska's overall economy, as military personnel routinely relocate to Alaska to receive specialized training. This strong influence on Alaska's economy is highlighted by the Department of Labor, which has pointed out that the military's influence on Alaska can be viewed as one of the state's leading exports, as troops positioned in Alaska bring new revenues to the state and thus provide large numbers of indirect jobs.

Beginning in 1993, the military presence in Alaska began declining from a peak of 30,800 personnel. The terrorist attacks of 2001 and the wars in Iraq and Afghanistan then led to a large influx of military to Alaska. While total troops fell to 17,631 in 2000, by 2009 the active duty count in Alaska climbed to 24,449. The vast majority of current UAS innovation and use is via the Army and Air Force, both of which have relatively large installations in Alaska.

According to the *Alaska Economic Trends* magazine, the military's economic reach includes a large civilian workforce as well. In 2012 Alaska had more than 7,000 defense-related civilian jobs with a payroll of \$452 million and average earnings of \$62,278. Civilians provide base support that ranges from highly technical skillsets to construction to retail workers in the commissaries. The Anchorage and Fairbanks areas are home to 90 percent of all Alaska-based uniformed military and their dependents.

The military has increasingly outsourced or sought private contracting opportunities. It is difficult to estimate, but in 2010 approximately \$2.2 billion in military contracts were awarded in Alaska. In 2009, Arctic Slope Regional Corporation topped the Alaska contractors list at \$151 million. These contracts include utilities, housing, security, specialized technical support, food services and janitorial services.

In 2009, defense spending in Alaska totaled \$44.9 billion, or about 10.77% of Alaska's total GDP. Procurement contracts account for approximately \$2.2 billion or 45% of total defense spending, with salaries and wages accounting for \$2.7 billion. On a national comparison, defense spending equated to \$6,999 on a per capita basis as compared to \$1,719 nationally.⁹

One strategy for Alaska is to work with the federal government through our Congressional Delegation to not only maintain, but grow our military presence in Alaska by expanding its current

⁸ Alaska Economic Trends, December 2013 – The Military and Alaska's Economy

⁹ Source: Impact of Defense Spending: State by State Analysis, Bloomberg Government Study November 17, 2011.

focus including UAS competencies and innovation. Similarly, targeting future defense spending toward UAS activities and capturing those dollars for Alaska will further strengthen the UAS industry's development. Alaska's strategic location and the opening of the Arctic call for expanded military and homeland security measures. While much work has already been placed here, it will be imperative to continue to deploy strategies that focus on military expansion, particularly including UAS-related business development strategies that involve federal investment.

Figure 6: Alaska's Military Anchor Assets

Entity	Asset	Details
US Army	Fort Richardson (now JBER)	Controls 62,000 acres, a helipad, and firing ranges. Located near Anchorage.
	Fort Greeley	Part of US missile defense system and home to Cold Regions Test Center for testing vehicles and weapons systems in cold climates. Located near Delta Junction in the state's Interior.
	Fort Wainwright	Long history as aviation testing center (Ladd Field). Possesses large airfield. Located near Fairbanks.
US Air Force	Eielson AFB	Home to F-16 fighters and a candidate to receive F-35 fighters. Currently hosts Gray Eagle. Located near Fairbanks.
	Elmendorf AFB (now JBER)	Home to F-22 fighter and part of the Pacific Command. Located near Anchorage
US Coast Guard	Bases and support operations throughout coastal regions	Assets include bases in Ketchikan and Kodiak, air stations in Sitka and Kodiak, and cutters stationed in 13 communities.

Other Anchor Assets

In addition to its university and military assets, the State of Alaska also possesses many other key anchor assets that will help support the development of a strong UAS industry within the state. These key assets include geographic and industry-related core competencies, as well as several public entities that have formed to help guide leadership on UAS and other aviation-related issues.

One of Alaska's key anchor assets within the public sector is the Alaska UAS Interest Group. The group

was formed in 2006 and has worked to bring together UAS industry members from both the public and private sectors. The interest group includes a broad cross section of entities, including the Department of Interior, US military, FAA, Department of Energy, and several UAS manufacturers. The interest group has an immediate goal of building a stronger network of Alaska UAS entities and projects, and a longer goal of positioning Alaska as the “go-to” UAS location and test range in the US for both commercial and military sectors.

Another key public sector asset for Alaska’s UAS industry is the formation of the FAA Arctic Team. The team was formed as a way to address the many changes occurring within the arctic. Increasing global temperatures have caused the melting of arctic sea ice. This rapid melting may provide an opportunity for the development of arctic shipping lanes, as well as a need for research into the changing climactic conditions of Alaska’s arctic.

Within the FAA Modernization and Reform Act of 2012, specific language was included to provide for the expanding use of UAS technology within the Arctic. This UAS expansion in the arctic will provide many wide-ranging benefits, including increased scientific research, environmental analysis, fisheries and marine mammal observations, oil and gas leasehold management and maritime route planning. According the act, the Secretary of Transportation must develop a plan to designate permanent areas in the Arctic where small UAS may operate 24 hours per day for research and commercial purposes. Having a specially-designated zone for UAS use within Alaska is perhaps one of its most important assets in attracting and developing a thriving UAS industry within the state.

Key stakeholder members of the FAA Arctic Team include:

- National Oceanic and Atmospheric Administration (NOAA)
- United States Coast Guard
- National Aeronautics and Space Administration
- Department of Energy
- Department of Interior
- UAS Executive Committee Senior Steering Group
- Department of State
- Arctic Council and its member states
- Cross Polar Working Group
- Marine Mammal Commission
- International Civil Aviation Organization (ICAO)
- State of Alaska

Figure 7: Alaska's Public Entity Anchor Assets

Entity	Asset	Details
Alaska UAS Interest Group	Participants include FAA, Department of Interior, DoD, Department of Energy, ACUASI, and private industry	Group exists to provide leadership and coordinate UAS related activities.
FAA Arctic Team	Various public entities including Department of State, Department of Energy, Coast Guard, NASA, State of Alaska, Arctic Council, and others.	A stakeholder group advising on policies related to Arctic aviation
Alaska Aerospace Corporation	Kodiak Launch Complex	The only high-latitude rocket launch complex in US.

Strategic Considerations

Alaska is well positioned to lead the nation in the integration of UAS into the NAS. Assets such as the University of Alaska, UAS Interest Group, Military, and its other public sector assets make Alaska well positioned to not only lead research and testing, but also lead in establishing a UAS education and business development system. As it relates to UAS education, there is great opportunity to design, test, and exhibit to FAA a proto-type UAS pilot certification program including:

- Degree or Certification Completion Standards
- Practical Test Questions
- Manual System (similar to Part 141)
- Integration of UAS into existing degree programs (i.e. engineering or business)

Similarly, ACUASI and the UAA Business Enterprise Institute are well positioned to align and become a stronger focal point for UAS industry development in support of leveraging the University of Alaska's other assets. Each of these programs is well versed in serving as the face of the university to public and private entities as well as to economic development organizations across Alaska. Each of these programs is also well situated to identify and secure additional sources of funding to support research, teaching expansion and business and economic development growth.

It is also recommended that the Alaska UAS interest group begin to develop plans to incubate into a more formal organization such as the Cascade Chapter of the Association of Unmanned Vehicle Systems International (AUVSI) representing the states of Oregon and Washington. The Cascade Chapter was established in 2009 with 25 members and is now the second largest chapter with just over 292 members in 2014. The Cascade Chapter has assisted with the formation of working groups to address specific areas of industry development including: programming, membership, finance, government and media relations, and education initiatives. Ultimately this form of organization encouraged the sharing of resources to allow for

the hiring of an executive director to promote and lead the industry working group. This level of organization has been significant in facilitating collaboration across industry, academia and government agencies. Supporting the transition of the UAS interest group towards becoming a standalone organization that has a sole purpose of linking and aligning industry members is recommended.

Figure 8: a UAS flight station



3. Alaska UAS Market Opportunities

One of Alaska's chief advantages in the development of a thriving UAS industry is the significant federal investment within the state. Many federal agencies have significant expenditures within Alaska due to the state's strong military presence, as well as the many natural resources under the federal government's control. As a whole, the state consistently ranks at or near the top nationally in federal expenditure per capita, which totaled \$17,762 in 2010. Of this figure, defense spending accounted for over \$7,000 in 2010, placing it second nationally. These federal funding sources drive a substantial portion of the state's economy, and will likely be instrumental in the success or failure of a UAS industry within Alaska.

The oil and gas sector is another large potential customer for UAS services. As mentioned in Chapter 1, both ConocoPhillips and BP, Alaska's two largest oil companies, have utilized UAS to monitor wildlife and sea ice conditions. Other oil and gas related applications include pipeline inspection and emergency response.

Many applications exist for the technology's implementation within the state, with broad research and data collection needs possible from many agencies at both the federal and state level. It is likely that this demand will be necessary to spur the growth of the UAS industry. The potential for substantial demand within the government sector presents Alaska with an opportunity to grow its UAS capabilities. Alaska will be able to grow this industry through the sizable government demand as a way to build its core competencies, allowing it to be ready to capture the private sector demand as it becomes available following the implementation of UAS into the NAS.

It is anticipated that much of the initial demand for UAS technology within the state will come from research activities. This will include research into UAS capabilities and testing, as well as activities carried out by UAS, such as volcano monitoring and wildlife management. If the demand for the technology is great enough, it may become large enough to support some level of UAS components manufacturing and maintenance, as well as the operation of UAS services for government or the private sector.

This chapter will provide an overview of the potential and existing demand for UAS services in Alaska, and includes a table that outlines the major likely customers for UAS technology.

Federal Market Demand

Likely one of the largest sources of market demand will continue to come from the federal side. Many federal agencies have unique demands currently serviced through UAS technology and could be expanded with Alaska in mind. **In order for Alaska to effectively serve the federal marketplace, it will be important to identify those areas in which the state is best suited to compete. This will require an honest and ongoing assessment of the state's core competencies, as well as an identification of its weaknesses.** By focusing its energy in a targeted manner on those markets in which it has the best opportunity to succeed, the state will allow itself maximum return on investment for any financial

investments made. Within the federal sector, two areas show the most promise: agencies with a research emphasis, and military. Each will be discussed in turn.

Civilian Agencies

Government agencies outside of the DoD have pioneered several UAS applications in Alaska (although NASA falls under DoD, it is discussed separately from other military agencies). Some specific examples highlight the utility of UAS technology in the state and suggest a variety of applications that can be built into viable business opportunities. For instance:

- In 2009, NOAA began using Scan Eagle UAS developed by Insitu, a subsidiary of Boeing, to monitor sea lions in the Aleutian Islands as well as volcanic ash in multiple locations.¹⁰ The Scan Eagle and Aeryon Scout UAS both equipped with infrared image sensors and cameras were used to locate hot spots within wildfire perimeters.
- The Scan Eagle was also used to combat fires including the Crazy Mountain Complex fire of 2009¹¹ and the Funny River fire of 2014.¹²
- In 2010, NASA and Northrop Grumman partnered to launch the Global Hawk Advanced Concept Technology Demonstrator under NASA operation. NASA's Global Hawk Pacific environmental science campaign took the Global Hawk on its longest flight from California over Alaska and the Arctic Ocean.¹³ In 2011, the Global Hawk was again used in Alaska to complete the Winter Storms and Pacific Atmospheric Rivers, or WISPAR research to explore atmospheric conditions and collect observations to improve weather forecasting.¹⁴
- In 2012, NASA also supported the Marginal Ice Zone Observations and Processes EXperiment (MIZOPEX) research, which was flown by UAF's Nanook version of the ScanEagle. The MIZOPEX mission collected data on ocean surface temperature and salinity by utilizing the unique capabilities of multiple UAS including the NASA SIERRA, Scan Eagle and a micro UAS.¹⁵

¹⁰ National Marine Mammal Laboratory - <http://www.afsc.noaa.gov/nmml/polar/research/uastests.php>

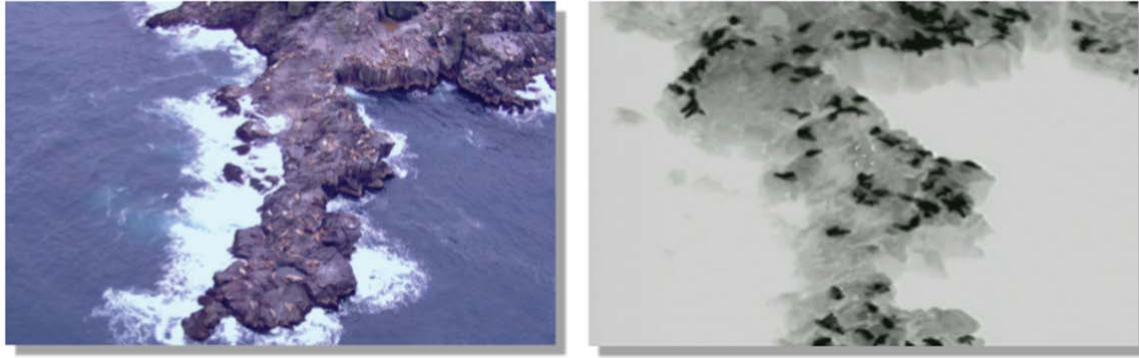
¹¹ Unmanned Aircraft Maps Alaskan Forest Wildfires - <https://www.youtube.com/watch?v=sYfOyriR-ws>

¹² UAF Geophysical Institute - <http://www.gi.alaska.edu/node/1826>

¹³ NASA's Global Hawk Aloft on 28-Hour Arctic Flight - http://www.nasa.gov/centers/dryden/status_reports/Global_Hawk_03_11_10.html#.VASkhPldUvw

¹⁴ NASA Global Hawk Complete Atmospheric Rivers Study - http://www.nasa.gov/centers/dryden/status_reports/global_hawk_03_10_11.html#.VASlwPldUvw

¹⁵ NASA Airborne Science Program - https://airbornescience.nasa.gov/content/Marginal_Ice_Zone_Observations_and_Processes_EXperiment_MIZOPEX



UAS paired with heat sensing technology is used to count Stellar Sea Lions in the Aleutians for NOAA (photo courtesy of ACUASI).

The most promising agencies with regard to UAS technology use in Alaska are those with a dedicated research purpose, such as NOAA, NASA, and US Geological Survey as well as those managing lands in the state, such as the National Park Service and US Forest Service.

US Department of Defense (DoD)

The DoD is charged with coordinating and supervising all agencies and functions of the government concerned directly with national security and the United States Armed Forces. Given the significant budget of the DoD, and historical activity within the industry, it is likely that the DoD will continue to be one of the largest buyers and operators of UAS technology in the coming years. The DoD will continue to require support from UAS platforms and services, particularly the platforms currently in use. It will also need significant airspace to test the technology across a variety of landscapes and conditions. Growing challenges around the world will drive the need for greater enhanced, long-range ISR (Intelligence, Surveillance, and Reconnaissance) capability while any troops on the ground will require light, flexible platforms and payloads.

The DoD currently utilizes a wide variety of platform and payloads to meet the needs of the Army, Air Force, Marines and Navy. The Army currently employs AAI's RQ-7 Shadow in Alaska for ISR, target acquisition and battle damage assessment. **In 2015 the army will expand its operations by adding the Grey Eagle platform to Ft Wainwright. The Army and USAF are both likely to base additional UAS units in Alaska, particularly as the Arctic generates geopolitical and commercial interest.**

State Government

While the bulk of overall demand for UAS technology has historically come from the federal level, an emerging market will be those agencies and organizations at the state level with similar or complimentary purposes as their federal counterparts. These agencies (i.e. Environmental Conservation, Fish and Game, Natural Resources, etc.) may potentially benefit from incorporation of UAS technology. **Given the state's mission and efforts already underway to support the development of an Alaska grown UAS industry, meeting the State of Alaska's own demands with the incorporation of UAS**

technology is a natural expectation. This strategy may prove an effective means to build core industry competencies, enable for testing of additional uses and ultimately position Alaska to better compete for increased market share out-of-state.

Opportunities may exist to support Alaska's Air National Guard, as well as the Alaska State Troopers and municipal police programs. Given Alaska's geographic challenges, permitting Alaska State Troopers the use of UAS may be beneficial in addressing agency needs as well as testing and further proving uses for the emerging technology. Agencies such as, the Alaska Department of Fish and Game, which often use manned aircraft to accomplish wildlife management activities, may find value in augmenting their services with UAS and thereby improve safety as well as overall information access.

Oil & Natural Gas Development

The security of pipeline infrastructure and emergency response support for oil spills directly affect US national security. Given the special importance placed on the security and proper operations of oil infrastructure, there may be several potential applications for UAS technology within the oil and gas industry. The oil and gas industry is responsible for much of Alaska's economic growth for 40 years.¹⁶ Oil revenues fund most state services including the education system, transportation infrastructure, public health, safety services, and many other programs throughout the state. Since statehood, Alaska has received \$164 billion in revenues from oil. An industry of this size brings the need for continued exploration, risk mitigation and security monitoring. For these reasons, Shell, Conoco Phillips, and others all await unrestricted utilization of UAS in the Arctic.

Currently, the oil companies utilize aerial technology throughout the course of their operations, including some early use of UAS. While the industry has not utilized UAS technology on a large scale it is expected to become a major customer for the technology once a regulatory framework is in place. State entities with a regulatory role in the oil and gas industry, such as the Departments of Environmental Conservation (CED) and Natural Resources (DNR) should work with the FAA to ensure their interests are represented.

Figure 9: BP Utilized Aeryon Scout for Pipeline Inspections Jun 2013 ¹⁷



¹⁶ State of Alaska Resource Development Council, website, <http://www.akrdc.org/issues/oilgas/overview.html>

¹⁷ Alaska Uses Drones to Inspect Oil and Gas Pipelines at a Fraction of the Cost, The Raw Story, June 7, 2013, <http://www.rawstory.com/rs/2013/06/07/alaska-uses-drones-to-inspect-oil-and-gas-pipelines-at-a-fraction-of-the-cost/>

Presently, oil companies have incorporated a variety of manned fixed wing and rotary platforms to collect data and monitor infrastructure. These firms have been early adopters and eagerly to experiment with varied UAS platforms. Current adoption seems restricted only by FAA regulations on their use.

International Market Demand

At present, the United States is the world's most important market for UAS technology. However, the limited availability of airspace for UAS limits market growth for the time being. Other countries are aggressively pursuing efforts to develop the technology for their own purposes, but are also eagerly awaiting the US and specifically the FAA's integration of UAS with manned aircraft. Nonetheless, the current efforts toward development of a UAS industry in Alaska will continue to attract potential international market opportunities, particularly in high-interest nations such as Canada and Japan. The Canadian military continues to research UAS uses and programs, and opportunities exist for synergistic missions across the scientific research and environmental monitoring communities. Further, opportunities exist to launch flight simulation and other UAS training programs to reposition the US and Alaska as leaders in this arena. As a result, the successful implementation of a UAS industry within Alaska will need to focus on domestic customers at the national and state level, while at the same time expanding research, training and other opportunities via international markets.

Strategic Consideration

As reviewed throughout this chapter, significant market opportunity exists across Alaska from federal, state and private sector stakeholders. Each of these entities has budget as well as clear reasons to deploy the use of UAS technologies to improve access to locations via a wide variety of missions. These industry players are already deriving mutual benefit from their proximity, shared needs and connections.

While already mentioned, it is important to emphasize that a more structured UAS interest group will provide many significant benefits to the advancement of the UAS industry sector in Alaska and spur on the ability of Alaska to compete in the global UAS economy. The more purposeful role of the UAS interest group will be to facilitate a stronger environment for success. The focus should be on expanding and growing the UAS industry very strategically beyond where it is today. The UAS interest group will need to act as the hub and in this role facilitate engaged and strategic conversations involving all stakeholders to improve production and sharing of information, logistics, workforce development and the identification of infrastructure needs. Alaska will need to compete with the rest of the nation and the world by staying abreast of innovations and leading advancements in business and workforce development.

As previously introduced, the Cascade Chapter of the Association of Unmanned Vehicle Systems International (AUVSI) representing the states of Oregon and Washington may be an industry group to emulate, at least initially. A significant outcome of the Cascade Chapter has been the collaboration of private sector leaders, elected officials, education leaders, and even interested non-governmental entities. Key has been the formation of working groups or initiative areas to address specific needs common to industry development including: deepening skills and talent; aligning innovation investments, accelerating

entrepreneurship, and raising global awareness of the industry. It is important to recognize that membership with the industry group is not enough to achieve industry expansion. A successful Alaska based industry group will need to use the platform to encourage the development of tighter relationships between industry stakeholders and then leveraging the relationships to drive forward shared actions, policies and programs for ultimate expansion of the industry. The challenge will be enabling the group to become organized to the point of being able to identify and then drive the implementation of effective strategies.

The State of Alaska and legislature can aid in the development of a stronger industry group through being open to and planning now for the development of tax and incentive policies, targeting education and training investments, research investments, regulatory streamlining, and encouraging greater access to seed and venture capital. Conversely, the existence of a strong industry group can advocate for UAS-friendly policies (such as those recommended in this report) within the Legislature. Further, the appointment of a special liaison to the interest group will likely be beneficial until the group can afford its own executive director. While the state—through DED or another entity—can help spur the creation of a strong industry group, but it must ultimately be led by the private sector.

Potential or Actual Customers for UAS Services

Market Segment	Customer	Current/Potential Usage	Other Information
Federal Government			
	Department of Defense	<ul style="list-style-type: none"> • Long range ISR(Intelligence, Surveillance, and Reconnaissance) • Target acquisition and battle damage assessment 	<ul style="list-style-type: none"> • US Army currently uses UAS for ISR in Alaska. • One of the largest current buyers of UAS technology.
	NASA	<ul style="list-style-type: none"> • Climate/weather research • Volcano research and remote thermal sensing • UAS traffic management research 	<ul style="list-style-type: none"> • NASA is looking at ways to integrate UAS into the NAS. Their Traffic Management Project is interested in testing in Alaska.
	NOAA/National Marine Fisheries Service	<ul style="list-style-type: none"> • Fisheries research/monitoring • Climate/weather research • Arctic sea ice monitoring • Oil spill surveys • Marine mammal surveys/monitoring 	<ul style="list-style-type: none"> • NOAA/NMFS have a strong Alaska footprint • NOAA currently uses UAS technology in their scientific research
	Department of Homeland Security	<ul style="list-style-type: none"> • UAS for Alaska/Canada border patrol • Drug trade monitoring 	<ul style="list-style-type: none"> • DHS currently uses UAS technology for border patrol with Mexico and Canada
	Bureau of Land Management	<ul style="list-style-type: none"> • Mineral and energy development • Land-use planning and monitoring • Fire management • Evaluation of stream & watershed enhancement projects • Water quality & habitat analysis • Climate change analysis • Management of fish and wildlife resources 	<ul style="list-style-type: none"> • BLM currently uses manned aviation with visual scanning/counting techniques. Not currently using UAS technology. • BLM currently manages 1/5 of Alaska's surface lands and wetland areas
	Bureau of Ocean Energy Management	<ul style="list-style-type: none"> • Oil & Gas site identification for land leasing • Resource evaluation and assessment • Geological data acquisition • Environmental stewardship • Regulations and guidance 	<ul style="list-style-type: none"> • BOEM uses collected data to create a database used for environmental and mammal health trend analysis. • BOEM does not currently utilize UAS technology • BOEM currently uses manned aircraft w/ visual counting techniques

National Park Service	<ul style="list-style-type: none"> • Fire and aviation management • Lands management • Personnel transport • Law enforcement • Information technology • Resource/wildlife management • Visitor protection (search and rescue) 	<ul style="list-style-type: none"> • Alaska is 60% of all land managed by NPS in the US • Currently using manned aircraft for visual monitoring and detection
US Geological Survey	<ul style="list-style-type: none"> • Climate change and land usage • Energy and minerals research • Environmental management • Natural hazard research 	<ul style="list-style-type: none"> • Incorporates UAS technology into many data collection methods • Although UAS technology is being utilized, most data collection is still generated through manned aircraft methods.
US Department of Agriculture	<ul style="list-style-type: none"> • Precision agriculture • Vegetation mapping • Terrain extraction/monitoring 	<ul style="list-style-type: none"> • USDA is currently experimenting with Tier I, small UAS for precision agriculture, vegetation mapping, and terrain extraction/monitoring
US Forest Service	<ul style="list-style-type: none"> • Land mapping • Forest management • Fire prevention/management 	<ul style="list-style-type: none"> • Serve as the premiere leader in wild land fire management operations, computer simulated fire management programs and sophisticated resource tracking systems. • Currently using UAS equipped with low-cost digital cameras to acquire thousands of images. • Using UAS technology to generate mosaics for the creation of vegetation maps of arid rangelands.
Federal Emergency Management Agency	<ul style="list-style-type: none"> • Disaster response • Disaster assessment • Search and rescue 	<ul style="list-style-type: none"> • FEMA currently uses manned aircraft, but does not has not yet incorporated UAS technology.
State/University		

Alaska Air National Guard	<ul style="list-style-type: none"> • Combat search and rescue • Arctic shipping lane management 	<ul style="list-style-type: none"> • Expressed interest in hiring UAS services on an “as-needed” basis • Currently utilizing manned aircraft for search and rescue • Could potentially be used to identify soft areas of sea ice to improve ice breaker success in Arctic shipping lanes.
Alaska State Troopers	<ul style="list-style-type: none"> • Emergency response • Search and rescue • Law enforcement 	<ul style="list-style-type: none"> • Not currently implementing UAS technology
Department of Fish and Game	<ul style="list-style-type: none"> • Wildlife monitoring/management • Fisheries data collection • Marine mammal detection 	<ul style="list-style-type: none"> • Currently utilizes sonar for collection of fish counts • Department not currently implementing UAS technology
Department of Natural Resources	<ul style="list-style-type: none"> • Lands mapping • Environmental studies and assessments 	<ul style="list-style-type: none"> • Not currently implementing UAS technology
University of Alaska	<ul style="list-style-type: none"> • UAS and other applied research • Student/workforce training (for UAS operations) 	<ul style="list-style-type: none"> • UAA offers a class specific to UAS technology • Potential to grow the university into a national leader in UAS training and research
Private Sector/Other		
Oil & Gas Industry	<ul style="list-style-type: none"> • Pipeline monitoring • Emergency spill response 	<ul style="list-style-type: none"> • Industry has utilized some UAS technology for pipeline monitoring • Industry currently uses manned technology for data collection and infrastructure monitoring
Alaska Native Corporations	<ul style="list-style-type: none"> • Trespass detection • Land surveying 	<ul style="list-style-type: none"> • Native Corporations hold roughly 13% of the state's land area which must be secured and surveyed periodically

4. Competing Locations

The Federal Aviation Administration (FAA) is responsible for the integration of UAS into the National Airspace System (NAS). This requires the development of standards and protocols (regulation, policy, procedures, guidance material, training requirements, etc.) for all aspects of operation of UAS. In furtherance of this charge, and amid mounting pressure to expedite the integration, the FAA Modernization and Reform Act of 2012 directed the FAA, in coordination with NASA and the DoD, to designate six test ranges to research the safety and other operational aspects of the technology. This testing will ultimately inform and assist the regulatory process.

As in Alaska, leaders in each of the states hosting a test range hope to develop strong, local UAS-related economic opportunities. In addition, several states without a test range also hope to capture economic benefits from a homegrown UAS sector. This chapter discusses each of the states that have been identified as potential competitors, including the assets they offer to the emerging industry.

FAA Test Range Locations

To accomplish safe integration of UAS into the NAS, the FAA needs to develop a specific regulatory framework as expeditiously as practical. These regulatory protocols will ultimately cover all aspects of UAS from aircraft design specification to pilot certification, and comprehensive operational standards. The selected test ranges will address the agency's overarching UAS research goals: (1) system safety and data gathering; (2) aircraft certification; (3) command and control link issues; (4) control station layout and certification; (5) ground and airborne sense-and-avoid; and (6) environmental impacts.

Key among the range selection criteria were geographic and climatic diversity. While individual ranges may be more suited to specific research areas than others, they are each free to expand research and testing activities into multiple UAS applications. Following a 10-month process, the FAA awarded six test ranges from a field of more than 25 applications representing 24 states. A total of 19 teams were not chosen; some of these unsuccessful teams have abandoned UAS plans and others have joined forces with designated test ranges. The six ranges selected by the FAA to carry out its research goals include the following:

- University of Alaska
- State of Nevada
- New York's Griffiss International Airport
- North Dakota Department of Commerce
- Texas A&M University
- Virginia Polytechnic Institute

What follows is a more comprehensive profile of each of the six FAA test ranges. Each is identified by the lead for the range with the goal of providing a format for understanding each of the range's specific capabilities with respect to the FAA's goal of integrating UAS into the NAS. Each of the ranges selected by

the FAA has a specific advantage or charge for the furtherance of UAS integration into the national airspace. Following the profiles a brief overview of non-FAA test range activity is also provided.

University of Alaska¹⁸

Lead Organization & Assets

The Pan-Pacific UAS Test Range Complex (PPUTRC) is the designation for this test range. The PPUTRC represents the largest of the FAA test ranges with 59 contributing partners as well as expansive geographic coverage. The PPUTRC spans seven climate zones, allowing UAS manufacturers and users to test their equipment in the Arctic, the tropics, and arid environments. The Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) oversees all operations for the test range and in this role represents the entire PPUTRC which includes test ranges in Alaska, Oregon and Hawaii.

The team proposed six test ranges in Alaska that included the Kodiak Range, Denali Range, Poker Flat, Oliktok Corridor, Wainwright Corridor, and the North Slope Range. Oregon proposed four ranges including Tillamook coastal, Warm Springs, Pendleton Range, and Juniper MOA. Lastly, Hawaii proposed three test sites at Humuula-R-3103, Makua-R-3109, and Maku-R-3110. After selection, the FAA initially approved a smaller set of ranges, but has since approved additional range locations.

Stakeholder Organizations

The University of Alaska (UA) leads the PPUTRC effort and has the most experience of any school in the country with regard to UAS technology. ACUASI was established in 2012 under the Geophysical Institute at UAF. The ACUASI team conducted UAS research for more than ten years prior to 2012 and has successfully managed more than 50 FAA Certificates of Authorization. Further, UA has strong pilot, air traffic control and mechanic training programs that directly align with UAS and range needs.

The PPUTRC represents a collaboration of academia, state agencies, Native organizations, private sector firms, economic development organizations and related stakeholder organizations. Oregon State University is the primary research lead for Oregon and University of Hawaii-Hilo is the primary research lead for Hawaii. These entities manage the ranges in their respective states, but both report to ACUASI as PPUTRC's lead organization.

The armed forces in Alaska represent a key stakeholder group. The RQ-7 Shadow is in use at Fort Richardson, Fort Greely/Allen Army Airfield, and Fort Wainwright/Ladd Army Airfield. The Army uses the unmanned Shadow for global reconnaissance, surveillance, and damage assessment. Fort Wainwright is also home to the RQ-11 Raven. These smaller, fixed wing systems can be hand launched, but have limited

¹⁸ <http://acuasi.alaska.edu/about>
<http://www.wired.com/2012/06/64-drone-bases-on-us-soil/>
http://higherlogicdownload.s3.amazonaws.com/AUVSI/656942e4-4448-41c3-877d-0c5f3ea40e63/UploadedImages/2013AprilSymposium/Pan-Pacific-UAS-Test-Site_OSU.pdf
http://www.faa.gov/uas/legislative_programs/test_sites/

range and endurance due to their small size. The Army is preparing to host the Grey Eagle system at Ft Wainwright starting in 2015. These expansion plans should have an impact on PPUTRC.

Economic impact

The AUVSI has projected the following economic growth from the UAS industry for Alaska:

Year	Direct Employment	Total Employment Impact	Total Direct Spending (\$M)	Total Economic Impact (\$M)	Total Taxes (\$K)	Percent Change Over Previous Year
2015	16	32	\$41.21	\$77.14	\$0	
2016	33	64	\$82.41	\$154.28	\$0	100.00%
2017	49	95	\$123.62	\$231.42	\$0	50.00%
2018	52	100	\$129.80	\$242.99	\$0	5.00%
2019	54	105	\$136.29	\$255.14	\$0	5.00%
2020	57	110	\$143.11	\$267.89	\$0	5.00%
2025	73	141	\$182.64	\$341.91	\$0	5.00%

Incentive Structure

Alaska is still maturing in its creation of incentives for business expansion and attraction. The Alaska Industrial Development and Export Authority (AIDEA) provides financing to a wide range of commercial facilities and assets in the state. AIDEA's financing options include loan participations, revenue bonds, equity investment, and asset purchase. The 49th State Angel Fund, run by the Municipality of Anchorage also makes venture capital available to firms operating in that city.

Oregon provides research tax credits for firms engaged in advanced computing and materials, environmental assessment, and electronic device technology. The state also offers property tax breaks for new or expanding facilities and the potential for an income tax holiday spanning multiple years.

Hawaii offers a range of programs aimed at the attraction and development of high-tech firms. Blue Startups is Hawaii's venture accelerator and also serves as the state's technology incubator. Key components of Blue Startups include seed funding, mentorship, access to business expertise, product testing, peer review, pitch development and introductions to investors. Two times a year, teams are selected to go through an intensive 12-week program, to kick-start their business. Businesses looking to make foreign sales can benefit from its foreign trade zone designation, reducing trade duties. Hawaii also hosts Mbloom, an incubator and early stage technology investment fund created as a public-private partnership.¹⁹

¹⁹ A Range of Choices", Dee Ann Divis, Inside Unmanned Systems, Spring 2014, <http://insideunmanned.epubxp.com/i/307674/0>

Each state exhibits a growing demand for incentives and programs to support business starts as well as to attract new innovative firms. States often align technical assistance providers and funds to sustain a start-up through the “valley of death,” or the critical years between initial investment and sustainable cash flow.

Nevada

Nevada is sparsely populated, not unlike Alaska, which makes it attractive for UAS testing. The state hosts a large military presence, including Nellis Air Force Base, Fallon Air Force Base, the Nellis Test and Training Range, and the Nevada National Security Site (NNSS). Also of interest, the federal government owns approximately 80% of the land in Nevada. Further, Creech Air Force Base is home to the premier UAS military support units. Creech personnel have logged more than 10 million hours of flight time in UAS platforms, training, experimental, and operational modes. Likely because of this, Nevada boasts the largest numbers of trained UAS pilots and sensor operators in the world.

Nevada has developed capabilities and infrastructure that may make it a strong competitor within the UAS industry. Many of the large UAS manufacturers, including Lockheed Martin, General Atomics, and Northrop Grumman, maintain operations within Nevada. Sierra Nevada Corporation, Arcata Associates, and Science Application International Corporation are other defense contractors located in Nevada. The University Nevada, Las Vegas, through the Desert Research Institute, is working to create a Center of Excellence, an incubator designed to aid in the commercialization of UAS technology. **Furthermore, the University of Nevada, Reno has worked to establish an engineering minor in unmanned technology, and is working on the construction of the Nevada Advanced Autonomous Systems Innovation Center, a Reno-based UAS research hub.**²⁰

New York – Griffiss International Airport

Griffiss International Airport is the official designee of the FAA test range. Griffiss is teamed with the Northeast UAS Airspace Integration Research Alliance (NUAIR), a New York nonprofit regional consortium of more than 50 private industry, academic institutions, and military entities working together to support the testing of UAS in New York and Massachusetts. Griffiss International Airport in Rome, New York (a former Air Force base) and Joint Base Cape Cod in Massachusetts serve as the two approved test ranges. The range received its certificate of authorization (COA) by the FAA on August 7th 2014 and had its first unmanned aircraft test operation in early November 2014 for Lockheed Martin.

Griffiss International is charged with the development of sense and avoidance capabilities to prevent collisions with other aircraft. The range’s specific UAS projects include detection of insects, weeds, diseases, crop characteristics, crop biomass and background soil characteristics. Research at the range will evaluate methods for scouting agricultural fields using different types of sensors. The range also expects to manage agricultural research flights from Joint Base Cape Cod in Massachusetts. Combined,

²⁰ A Range of Choices”, Dee Ann Divis, Inside Unmanned Systems, Spring 2014, <http://insideunmanned.epubxp.com/i/307674/0>
<http://www.unr.edu/autonomous-systems>

New York and Massachusetts offer more than 7,000 square miles of diverse airspace available for UAS testing.

North Dakota Department of Commerce

The FAA certified the Northern Plains UAS Test Site as the first range ready for operation in April, 2014. This range relies on various test sites in the Grand Forks area including Grand Sky, Grand Forks AFB, Carrington, and Sullys Hill Game Preserve. Grand Sky in Grand Forks County provides a 217 acre site for potential development, testing, training, sensor technology development, data analysis and management. The site is adjacent to Grand Forks AFB and thus provides access to runways for testing. To date, the state has invested over \$19 million to advance UAS research and development and is collaborating with organizations statewide to expand this emerging industry.

The University of North Dakota established the John D. Odegard School of Aerospace Sciences in the 1960's and more recently the Center for Unmanned Aircraft Systems. The Center leads the research, education and training for UAS. The UND offers a BS degree in Aeronautics with a major in Unmanned Aircraft System Operation. The university was the first in the nation to offer a focus area in unmanned aircraft systems. University researchers are also developing a ground-based radar system capable of detecting low-flying aircraft such as sailplanes and hot air balloons. North Dakota State University, located in Fargo, is a partner as well, with a "world-class" engineering department specializing in electronic and electrical engineering, including nano and micro-scale electronics²¹.

Texas A&M University

The Texas FAA test range will focus its efforts on applications involving coastal and ocean areas (tracking of marine mammals, environmental monitoring, and drill platform assessment). Texas also offers a one-of-a-kind testing area for UAS emergency response applications. "Disaster City" is a recreated urban training environment composed of simulated rubble where emergency response scenarios are executed for first responder personnel and technology insertion training²². The test range has developed a partnership with the University of Texas at Arlington Research Institute (UTARI) which is currently focusing on several facets of UAS research for commercial applications. UTARI is currently researching UAS command and control link operations, general system safety and data gathering, sense and avoid technology, both in air and on the ground, as well as aerial refueling possibilities.

Virginia Polytechnic University

Their primary goal as an FAA test range is to conduct individual and collaborative work with the FAA, as well as economic modeling and marketing for the commercial applications of UAS. Additionally, the group will focus on the research of failure mode testing as well as operational and technical risks specific to

²¹ "A Range of Choices", Dee Ann Divis, Inside Unmanned Systems, Spring 2014, <http://insideunmanned.epubxp.com/i/307674/0>

²² "A Range of Choices", Dee Ann Divis, Inside Unmanned Systems, Spring 2014, <http://insideunmanned.epubxp.com/i/307674/0>

UAS. MAAP has several sites that they use for test flights including the Kentland experimental air station in Blacksburg, VA. The range had its first flight on August 13th 2014 and is now fully operational.

MAAP is one of the largest UAS groups supporting the UAS integration into the NAS with ten universities, seven government departments, and dozens of industry and economic development firms as members of the core group. Since the universities and government agencies are spread out over the East Coast (primarily Virginia, Maryland and New Jersey), MAAP expands the Virginia Tech test range borders well beyond simply the state of Virginia.

Virginia Tech does much of its research through the Virginia Center for Autonomous Systems (VaCAS), where they have over a decade of experience working with UAS. The VaCAS UAS fleet is ever growing with systems constantly being built by students and faculty. One set of systems are the SPARROs which help build on failure rate versus cost research. These systems are relatively cheap to manufacture, but have sophisticated safe guards to accommodate failures. VaCAS has been performing this variety of research since 2009. Other areas of research are vehicle guidance and control, sensing and navigation advancement, mobility and actuation development, dynamic vehicle modelling and analysis, and overall vehicle design.

	Nevada	North Dakota	New York's (including Massachusetts)	Virginia (including Maryland and New Jersey)	Alaska (including Hawaii and Oregon)	Texas
Cost of Living	<ul style="list-style-type: none"> • CPI*** Oct. 2014: 241.650; • Inflation Oct. 2014 to Oct. 2013: 2.0% 	<ul style="list-style-type: none"> • CPI Oct. 2014: 225.793; • Inflation Oct. 2014 to Oct. 2013: 1.6% 	<ul style="list-style-type: none"> • CPI first half 2014: 260.5; • Inflation (12 month change): 1.3% 	<ul style="list-style-type: none"> • CPI Sep. 2014: 155.52; • Inflation Sep. 2014 to 2013: 1.3% 	<ul style="list-style-type: none"> • CPI first half 2014: 214.777; • Inflation (12 month change): 1.9% 	<ul style="list-style-type: none"> • CPI Oct. 2014: 214.791 • Inflation Oct. 2014 to 2013: 3.4%
Per Capita Personal Income****, 2013, \$	• \$39,235	• \$53,182	• \$54,462 (NY)	• \$48,838 (VA)	• \$50,150 (AK)	• \$43,862
Incentives	<ul style="list-style-type: none"> • No personal income, corporate income, unitary, warehouse, or franchise taxes. • Sales and use tax abatement, business tax abatement, personal property tax abatement; • Train Employees Now program; • Nevada's Catalyst Fund (expansion or relocation of businesses). • Knowledge Fund (promote research and technology commercialization). 	<ul style="list-style-type: none"> • State appropriated \$5 million for UAS development. • Abatements on income tax for up to 5 years, breaks on sales tax, investment tax credits, interest rate buy-downs and gap financing, property tax abatement • State programs for workforce training and interns positions financing (Job Training Assistance). • Research North Dakota for firms in support of R&D (up to \$300,000 in matching funds). • Agricultural Products Utilization Commission: 15 grants annually. 	<p>NY:</p> <ul style="list-style-type: none"> • 80 different technology incubators. • Income tax exemptions, sales tax exemption. • Grants to promote targeted industries like UAS. • The Essential New York Initiative. • Start-Up New York tax-free zones. <p>MA:</p> <ul style="list-style-type: none"> • Emerging Technology Fund (loans or loan participations for emerging firms up to \$1.5 million and loan guarantees of up to \$1.5 million). • State offers bridge financing to private sector businesses. 	<ul style="list-style-type: none"> • Virginia Economic Development Incentive Grant (for starting-up or moving to the state firms). • Governor's Agriculture and Forestry Industries Development Fund. • Virginia Investment Partnership Grant; • Virginia Enterprise Zone Program; • Technology Zone Program; • Virginia Jobs Investment Program; • Tax credit programs: corporate income tax credit, sale and use tax credits, and property tax credits; • Center for Innovative Technology. 	<p>AK:</p> <ul style="list-style-type: none"> • Small Business Loans of up to \$300,000. • AIDEA's financing options • 49th State Angel Fund financing <p>OR:</p> <ul style="list-style-type: none"> • research tax credits; • property tax breaks; <p>HI:</p> <ul style="list-style-type: none"> • Blue Startups tech. incubator; • Mbloom incubator; 	<ul style="list-style-type: none"> • State incentives: tax breaks, tax refunds, and expansion and relocation financing. • The Texas Emerging Technology Fund (\$485 million). • Texas Enterprise Fund (helps businesses to locate in Texas). • Workforce Development: Self Sufficiency Fund and Skills Development Fund.

	Nevada	North Dakota	New York's (including Massachusetts)	Virginia (including Maryland and New Jersey)	Alaska (including Hawaii and Oregon)	Texas
Available Aerospace	More than 30,000 square miles of airspace ²³	More than 13,000 square miles of airspace ²⁴	More than 7,000 square miles of diverse airspace (NY and MA together)	More than 2700 square miles of airspace ²⁵	More than 663,300 square miles of airspace ²⁶	11 test regions cover about 6,000 square miles across the state ²⁷
R&D personnel at higher education institutions	3,144	3,963	60,706 (NY), 39,089 (MA)	22,016 (VA), 38,204 (MD), 14,724 (NJ)	1,558 (AK), 5,086 (HI), 14,806 (OR)	57,529
R&D Expenditures (in thousands), FY 2012 (information on states leading the project)	Total: \$153,325 Federal –70.31%; State and Local – 3.09%; Institution Fund – 22.53%; Business –1.60%; Non-Profit –2.34%; Other –0.13%	Total: \$215,642 Federal –46.82%; State and Local – 24.78%; Institution Fund – 19.28%; Business –5.20%; Non-Profit –1.43%; Other –2.49%	Total: \$5,361,113 Federal –59.92%; State and Local – 5.26%; Institution Fund – 20.91%; Business –5.37%; Non-Profit –7.14%; Other –1.40%	Total \$1,379,440 Federal –55.61%; State and Local – 9.37%; Institution Fund – 25.54%; Business –3.94%; Non-Profit –5.06%; Other –0.46%	Total: \$181,983 Federal – 61.23%; State and Local – 5.23%; Institution Fund – 27.49%; Business – 3.51%; Non-Profit – 1.64%; Other – 0.91%	Total: \$4,651,322 Federal –46.71%; State and Local – 15.63%; Institution Fund – 21.18%; Business –6.52%; Non-Profit –8.95%; Other –1.01%
Number of Universities with R&D Activities (state and private)	3	2	66 (NY), 26(MA)	15 (VA), 13 (MD), 16 (NJ)	3 (AK), 3 (HI), 11 (OR)	47
Universities Involved in UAS Development Programs	<ul style="list-style-type: none"> University of Nevada; Reno (College of Engineering); College of Southern Nevada; 	<ul style="list-style-type: none"> University of North Dakota (John D. Odegard School of Aerospace Sciences, the Center for Unmanned Aircraft 	20 universities total, including: <ul style="list-style-type: none"> Rochester Institute of Technology; Massachusetts Institute of 	<ul style="list-style-type: none"> Virginia Polytechnic University (the Virginia Center for Autonomous Systems); Rutgers University; 	<ul style="list-style-type: none"> University of Fairbanks (the Pan-Pacific UAS Test Range Complex; 	<ul style="list-style-type: none"> Texas A&M University-College Station; Southwest Research Institute;

²³ <http://www.insidegnss.com/node/4143>

²⁴ <http://www.uasresearch.com/aboutus/projects.aspx>

²⁵ <http://www.navair.navy.mil/nawcad/index.cfm?fuseaction=home.download&id=744>

²⁶ <http://commerce.state.ak.us/dnn/portals/6/pub/unmannedaircraftsystems.pdf>

²⁷ http://www.theeagle.com/news/local/faa-names-texas-a-m-corpus-christi-as-drone-test/article_ac269367-7611-5d8c-a97e-c21d656c47f1.html

	Nevada	North Dakota	New York's (including Massachusetts)	Virginia (including Maryland and New Jersey)	Alaska (including Hawaii and Oregon)	Texas
	<ul style="list-style-type: none"> • Las Vegas Desert Research Institute 	Systems); <ul style="list-style-type: none"> • North Dakota State University 	Technology; <ul style="list-style-type: none"> • Boston University; • Cornell University; • Embry-Riddle Aeronautical University and others. 	<ul style="list-style-type: none"> • State University of New Jersey; • National Institute of Aerospace; • Liberty University; • New Jersey Institute of Technology; • Rowan University; • The Richard Stockton College of NJ; • Virginia State University 	Alaska Center for Unmanned Aircraft Systems Integration); <ul style="list-style-type: none"> • Oregon State University; • University of Hawaii-Hilo 	<ul style="list-style-type: none"> • University of Texas at Arlington Research Institute (UTARI)
Labor Pool	Total Civilian Labor Force Oct. 2014 (thousands): 1,368.4 Unemployment Rate Oct. 2014: 7.1%	Total Labor Force Oct. 2014 (thousands): 415.5 Unemployment Rate Oct. 2014: 2.8%	Total Labor Force Oct. 2014 (thousands): 9,539.7 Unemployment Rate Oct. 2014: 6.0%	Total Labor Force Oct. 2014 (thousands): 4,263 Unemployment Rate Oct. 2014: 5.3%	Total Labor Force Oct. 2014 (thousands): 364 Unemployment Rate Oct. 2014: 6.8%	Total Labor Force Oct. 2014 (thousands): 13,039.2 Unemployment Rate Oct. 2014: 5.1%
Share of labor employed in Industries supportive to UAS development, 2013	Manufacturing – 4.2% Information – 1.7% Science* - 11.2% Transportation** - 5.2%	Manufacturing – 7.1% Information – 1.4% Science* - 6.6% Transportation** - 5.4%	Manufacturing – 6.6% Information – 2.9% Science* - 11.7% Transportation** - 4.9%	Manufacturing – 7.2% Information – 2.1% Science* - 14.8% Transportation** - 4.1%	Manufacturing – 3.7% Information – 1.8% Science* - 9.4% Transportation** - 7.9%	Manufacturing – 9.3% Information – 1.8% Science* - 11.1% Transportation** - 5.2%

5. Market Development Considerations

Alaska's traditional industries, which include oil and gas extraction, mining, fishing and seafood processing, tourism and military operations, are part of complex ecosystems that developed gradually over time. Forestry and wood products form a declining industry while commentators point to logistics and international trade, advanced business services, specialized machinery and social services as emerging areas of opportunity. The current concentration on UAS activity has the potential to develop a strong economic base in Alaska, in part by leveraging a number of established industries of importance including military operations, and those oriented towards resource monitoring and extraction. A potential UAS industry also benefits from arctic or "cold climate" competencies as well as rocket launch expertise. The following provides an overview explaining how an industry focus might be established.

Anchor Tenant

The introduction of an anchor tenant to a region will in many cases spur or advance an industry's development.²⁸ An anchor tenant will attract other firms. These co-located businesses will then benefit from greater innovation and economic performance due to the sheer proximity, resulting workforce, and even from the drawing of symbiotic players like venture capital investors to an area.

Definition of Anchor Tenant: An anchor tenant is a large firm, often engaged in R&D, which can promote the development of an industry concentration, encouraging smaller firms to locate in close proximity. For the purposes of UAS development, the role of an anchor tenant may be filled by the oil and gas industry or military. While these do not meet the conventional definition, they may support UAS by serving as large customers. Alternatively, the UAS industry in Alaska may benefit more from the attraction of a firm that is drawn by the FAA test site designation and has a sincere interest in engaging in and even serving as the champion for the development of a UAS industry.

An anchor tenant is considered one of the central elements necessary for stronger industry formation and ultimate growth. Attracting an anchor tenant for industry development purposes is not a new idea. This strategy has been borrowed from commercial real estate development practices, particularly for retail or mall developments. The classic anchor tenant is a large department store associated with a shopping mall. These department stores typically have name recognition and are known for creating demand, and thus generate traffic for the overall retail development. In many cases, a retail developer won't pursue a site's development until an "anchor tenant" can be locked in for the site. As an initial step in encouraging growth of UAS industry in Alaska, an anchor tenant is an important component that may actually involve multiple tenants or the engagement of multiple key stakeholders. The attraction of a large or multiple smaller private sector firms is essential. Further, large public entities such as the University of

²⁸ Michael Porter, *Cluster and the New Economics of Competitions*, Harvard Business Review, Nov. – Dec. 1998

Alaska and other institutes of higher learning, public laboratories and/or public entities with interest such as the FAA, all serve critical tenant roles, but are not typically an anchor tenant due to the need to integrate private sector capital and market practices into the mix. Similarly, national public stakeholders that will positively influence the dynamics of the emerging industry are also worth attracting if they are not already present (i.e. Department of Defense or NASA). In addition, the military bases and oil and gas companies may play the role of anchor tenant by serving as large potential customers of UAS services. The state itself can act as an anchor tenant by becoming a purchaser of UAS services.

In reviewing aerospace development activity across decades of the aircraft industry's existence, it is common to find companies from other sectors that acted as "incubators" by dedicating part of their activity to aircraft production. Afterwards, based on their performance, some of these incubators converted themselves entirely to aircraft production, while others returned to their previous activity, and closed or split their aircraft production unit, which continued to develop in an independent way.

These aviation industry anchor tenants positively influenced the innovation activity of a region (i.e. increasing number of patents and number of entrepreneurial firms) as well as attracted other innovators and smaller firms working in the same or related industries. Other examples were noted in which the anchor tenants attracted specialized suppliers when relevant to the industry sector, or when firms believed proximity would benefit their entry into the nascent industry. Once co-located within a region, these firms then attracted skilled labor with specialized training. As a result, it is important to understand the factors that will influence the decision of an anchor tenant, including:

- A pool of potential entrepreneurs or startup talent;
- A workforce or qualified manpower capable of understanding the complexity and satisfying the Requirements of the emerging industry;
- Access to capital – including both private and public sources of funds; and
- Inputs to research and development as well as manufacturing.
 - Further, based on the study of aerospace anchor tenants a UAS anchor tenant will also seek:
- Strategic military and or federal player engagement if it is believed the government will have a strong involvement in the financing and supervision of the ultimate development of the industry.

To encourage the development of healthy industry linkages, It will be useful to build a collaborative regional strategy that emphasizes:

- Alignment of regional leaders in common direction and provides opportunity for collaboration;
- Promotion of skill and talent development as well as career advancement paths;
- Support for study tours, networking and learning exchanges;
- Direction of R&D funds and mobilizes capital to encourage UAS business starts; and
- Acceleration of a robust UAS related entrepreneurial ecosystem.

Incentive Structures

One of the most important aspects in attracting UAS industry investment or an anchor tenant to Alaska will be providing key incentive packages to private industry. Incentives are cash or cash equivalent forms of assistance provided to firms on a discretionary basis to attract or retain business operations. Popular incentives include property tax abatements, discretionary credits under the state's corporate income tax, low-interest financing, and even free land and buildings. Alaska is faced with a number of challenges that make business development and attraction difficult, particularly the high supply chain and labor costs when compared with other states. However, the state can offer many unique incentives that can help spur industry development within the state and create a more even and comparative business investment environment. (Please see appendix 3 for table summary of incentives.)

Given the many challenges that Alaska faces from a business attraction standpoint, the state already finds itself at a disadvantage compared to other test range locations. Alaska is not currently a major hub for defense contractors or aerospace manufacturing, like some competing test ranges are (Nevada, for example). These realities do not make it impossible to develop a thriving, successful, and integrated UAS industry within the state. They do, however, reduce the margin for error as the state moves forward with its efforts to grow the industry. **Making a concerted, coordinated attempt to customize incentives for private industry investment within the state is therefore paramount.** With the right incentive structure in place, Alaska can help mitigate its current challenges, while at the same time promote those positive attributes and resources that the state currently holds.

As detailed throughout this section, a number of states have begun (or are planning to begin) offering tax incentives to private industry. For instance, California introduced a bill that provides a tax credit to firms choosing to manufacture UAS within their state. This could be a major opportunity area for Alaska with its industry attraction efforts. The state's current corporate income tax rate, 9.4%, ranks as the 5th highest in the nation. This, coupled with the high supply chain and labor costs associated with Alaska, make it difficult to entice businesses to relocate or invest in the state. However, Alaska could begin offering targeted tax credits aimed at creating a positive business environment ripe for investment from the UAS industry. These tax credits can come from the State, as well as from the respective Borough or Municipality. Possible tax credits at the State level that could be used to entice UAS industry investment include:

- **Research and development tax credits.** According to *Forbes*, 38 states offer an R&D tax credit as of 2013, thereby reducing state income tax liability for qualifying R&D expenses.²⁹ Under most accepted definitions, working to develop UAS technology for the market would qualify as R&D. Formulas for calculating the value of the credit vary widely from state to state, but generally include two components: a credit rate and a base level. The credit rate is the percentage of R&D expenses by which the tax liability is reduced. A base level is the minimum amount of expenditure before the

²⁹ "Eight Myths That Keep Small Businesses From Claiming The R&D Tax Credit"
<http://www.forbes.com/sites/deanzerbe/2013/03/28/eight-myths-that-keep-small-businesses-from-claiming-the-rd-tax-credit/>

credit applies. For instance, a state may offer a 10% R&D credit for qualified activity over \$1M. Some states attempt to make the credit more lucrative for small businesses by reducing or eliminating the base level, or making other adjustments. To promote sustained R&D activity, some states require multiple years of R&D activity before the credit can be claimed; others offer a higher credit to companies with multiple years of qualified activity. The effectiveness of state R&D tax credits is the subject of some debate; a 2007 study by the San Francisco Federal Reserve found that the credits often increase the amount of R&D activity occurring within a state. The report added, however, that these gains are usually “zero-sum,” meaning that they largely shift R&D activity between states rather than incentivizing new expenditure.³⁰

- **Hiring tax credits.** This type of credit reduces a company's state income tax liability for hiring certain classes of employees. In Alaska, a credit could apply to specific skillsets such as aerospace engineers to advance the development of a UAS industry. As an example, the State of Mississippi offers a tax credit of \$1,000 per employee each year for five years to companies that hire in scientific and technical fields and meet other requirements. Oklahoma also has incentives in place to spur their UAS industry. The state offers employers a tax credit of up to \$12,500 per qualified employee per year for five years for each aerospace engineer it hires. The State also offers a separate \$5,000 annual tax credit to each aerospace engineer who relocates to Oklahoma for their job, for up to five years. This provides incentives for both employers and employees to relocate to Oklahoma. This program is set to expire, however, on December 31, 2014.
- **Manufacturing tax credits.** These can take several different forms, including credits or exemptions for property, sales, or corporate income taxes. The State of Wisconsin, for instance, exempts manufacturing-specific machinery and equipment from property taxes. (The exemption does not extend to land or buildings associated with manufacturing, however.) Other states exempt manufacturing equipment purchases from sales tax, or provide credits against income taxes for such investments. It remains to be seen whether or not a UAS industry in Alaska would have a manufacturing component, but such credits could help to offset the cost of business if manufacturers show interest in locating production to the state. Given Alaska's current tax structure, however, the only manufacturing tax credits that would be available at the State level would be for corporate income taxes. Other taxes, such as property and sales taxes, would have to come at the Municipal or Borough level. An alternative option at the state level would be to replace any lost revenues to local governments who promote UAS development. This would provide additional incentives for local governments to help work with the state to develop a friendly climate for UAS development.

In addition to those tax credits and incentives offered at the State level, additional credits and incentives can be made at the Borough or Municipality level, including the following:

³⁰ “Overview of Research and Development Tax Incentive Strategies,”
http://www.lbb.state.tx.us/Other_Pubs/Overview%20of%20Research%20and%20Development%20Tax%20Incentives.pdf

- **Property tax abatements** for businesses operating in “Military Facility Zones.” A more specific type of incentive which the Alaska Legislature passed is an exemption or partial exemption from property taxes for up to 10 years if the property is in a military facility zone that creates or supports industry, development, or educational or training opportunities beneficial to a facility. HB 223, was introduced in January 2014, and signed into law September 2014. This bill permits local governments in the state to exempt businesses that serve military bases. Since the state does not levy a property tax, the exemptions are provided by municipalities or boroughs. As such, in this case municipalities and boroughs have the strongest ability to make UAS related investments more cost effective.
- **Manufacturing tax credits (local level).** As mentioned above, many states incorporate manufacturing tax credits through property and sales tax incentives. Given that within Alaska these taxes occur at the local level, these tax credits would need to come from boroughs and municipalities.
- **Sales tax abatements.** An additional form of tax incentive that can be offered at the borough or municipality level is a sales tax incentive. These would allow local governments to exempt particular purchases, or businesses within particular industries, from sales taxes. Local governments can craft these abatements in specific ways to help incentivize development of a UAS industry within their community.

On the whole, Alaska is positioned as one of the states with the best overall tax climate, despite having a relatively high corporate tax structure. The state levies no personal income or state sales tax, which offers great incentives for small businesses looking to establish within the state. However, the state’s high corporate income tax will make it difficult to attract investment from the largest industry participants. By offering tax credits aimed at large corporate investment within the state, Alaska can help to reduce some of the high costs of doing business in the state.

In addition to potential tax credits, the state can consider offering other useful incentives to help spur investment. As an example, Alaska could follow North Dakota’s lead by offering matching research and development grants for businesses in the UAS industry sector. These grants could be focused on projects involving a joint effort between private industry and the University of Alaska. This would allow the state’s university to receive targeted funding for projects of economic importance while at the same time aiding the industry’s development. Alaska could also choose to focus on expansion of Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants or rather contract funding from various agencies of the US government. The purpose of these awards is to provide early-stage research and development funding to advance technology. The state could consider matching successful SBIR and STTR awardees.

One important incentive available within the state stems from the recent passage of HB 316 during the 27th Alaska Legislature. The bill allows for the designation of Military Facility Zones, which would allow the Alaska Industrial Development and Export Authority (AIDEA), as well as the Alaska Housing Finance Corporation (AHFC) to fund projects occurring within these zones. The MFZ designation would allow

AIDEA to fund not only just the structures within the zones, but also for infrastructure development within the MFZ (such as sewers, sidewalks, and potential UAS infrastructure).

Other similar incentive opportunities include gap loans, equity financing, venture capital assistance, and interest rate buy downs. In some cases states are also developing targeted technical assistance support by providing information on how to start up a business, or make one more profitable within a specific industry. In these instances states are typically collaborating with existing technical assistance providers such as the Small Business Development Center to further bolster and support existing programs. The aim of state support in these instances is to reduce the overall risk and make the participating businesses more attractive for leverage of other resources.

Other incentives for consideration might include customized services targeted towards meeting the needs of individual businesses such as conducting relevant research, performing basic due diligence on high target locations for development, providing assistance programs to aid firms in navigating through state or local regulations, workforce development programs, and developing site-related infrastructure such as road access. Customized services are those incentives that will ultimately save firms in their development expenditures as well as convey a message to industry that Alaska is not only open for business, but keen in its understanding of what firms require to be successful in the UAS industry sector.

In order for Alaska to be competitive with attracting industry to the state, incentives will play a key role. Incentives will help to attract industry if they reduce costs associated with development within the state as compared to other locations. Incentives alone will not be enough, however. Nor should Alaska ignore its other attributes that make it a prime candidate for corporate investment.

Economic development practitioners are often criticized for developing incentive packages without first critically taking into consideration if the incentives are in the best interest of the state and/or local government and actually relevant to the business being attracted. Incentives can become too costly for the jobs created and may actually result in hurting businesses that are already in the marketplace. As Alaska moves forward in developing incentives to attract UAS industry it may be beneficial to focus first on those incentives that bolster existing Alaska firms already in the industry and then on those incentives that target new business activities that will again further support and bolster existing firms or bring about desired performance by the firms being attracted. **In all cases, a more comprehensive cost-benefit analysis should be conducted along with the establishment of performance metrics associated with incentives to ascertain they are achieving desired results.**

Tech Park

One approach to commercializing the University of Alaska's expertise on UAS is through the formation of a university research or technical park. These developments, also referred to as research parks or tech parks, are a common means of spurring regional innovation by connecting business with the research assets of a university. The Association of University Research Parks (AURP) defines the term as "physical environments that can generate, attract and retain technology companies and talent in alignment with sponsoring research institutions (universities and public and private research laboratories)."³¹ Famous examples include the Research Triangle Park in North Carolina (leveraging three large universities) and the Stanford Research Park in the heart of Silicon Valley. At the most basic level, these tech parks are real estate developments with leasable property for commercial tenants in targeted industries, allowing them to partner or affiliate with one or more universities. These research partnerships are a vital component to a successful tech park, as the availability of inexpensive real estate alone will not likely attract targeted industries. According to AURP, tech parks exhibit the following attributes:

- A property master plan designed for research and commercialization;
- Partnerships with at least one university or other research institution(s);
- Encouragement of the establishment and growth of new companies;
- Technology translation from the lab to the marketplace; and
- A focus on technology-led economic development.³²

The University of Alaska, in partnership with other public entities and private investors, may find that a tech park is a viable development vehicle. Companies wishing to establish R&D facilities related to UAS, ranging from large defense contractors or startup firms, would be potential tenants (parks often contain incubator components to support the startup of new firms). Chief benefits to the tenant include the ability to sponsor targeted research, access university labs and other facilities, utilize faculty as consultants, hire students and/or graduates, and license intellectual property. In essence, the university could act as an amplifier to the tenant firms' R&D operations, creating value for their intellectual property portfolios. As UAF has emerged as one of the nation's leaders in testing UAS in a variety of climates and geographies, it has also made itself a viable partner to industry for this purpose, and could leverage other assets in the Fairbanks area, including the four Interior military bases (Fort Wainwright, Eielson Air Force Base, Clear Air Force Station and Fort Greely) and access to runways and an international airport. Likewise, Anchorage would offer access to Joint Base Elmendorf Richardson, a university campus, as well as a large international airport. In either city, companies hoping to build a business around UAS would find adequate space to test the technology in consultation with leading experts.

Proximity to military bases would make a potential tech park attractive to defense contractors engaged in R&D. Of potential consideration, the US Army is expected to place one of its 17 Gray Eagle companies in Alaska. This company will have responsibility for 12 unmanned Gray Eagle aircraft, and

³¹ https://aurp.memberclicks.net/assets/documents/aurp_batelllestudy2012-final.pdf

³² https://aurp.memberclicks.net/assets/documents/aurp_batelllestudy2012-final.pdf, page 6.

includes a support staff of approximately 120 soldiers. The need to service and support these aircraft may present new business opportunities that dovetail with a tech park.

From the public sector standpoint, the benefits to a successful tech park are substantial. First the development would serve as the focal point for a new industry by building a knowledge center where expertise passes from university labs directly to interested firms. The park would provide a space for ideas to disseminate rapidly, helping to cement the state's status as a thought leader for UAS integration into the national airspace. Ultimately, the spillovers of knowledge—crucial to new industry formation—would spur the creation of new businesses statewide and bolster employment opportunities. Additional benefits include the generation of revenue through facility leases, and the enhancement of university stature. It should be noted, however, that success (defined as the attraction and retention of tenant firms, as well as formation of startups) depends on several critical factors. According to AURP, these include:

- Alignment between university competency and that of the targeted firms;
- Ability to assist early stage firms in commercialization;
- Access to investment capital for tenants;
- Access to university facilities, faculty, and students;
- Support of university leadership; and
- Support within the economic development community.³³

Foremost among these factors is the strength of the university partnership. Numerous university tech parks nationwide have failed to attract commercial tenants because they treated the development purely as commercial property to be marketed and leased in a manner similar to other types of real estate. This approach fails to differentiate the tech park from other leasable property. Instead, businesses must see tangible value in the access to university facilities and expertise, and these are the features that should be used to attract commercial tenants. For this reason, the park should be physically an extension of the campus, intermingled closely with other university facilities to maximize the sharing of resources and knowledge. Locating a tech park far from its affiliated university can often doom it to irrelevance, as core university assets, including faculty, students, and research facilities, become less accessible.

The physical layout and location of the tech park are thus important elements of success. The type of leasable space available to firms is also a relevant consideration. While the Research Triangle Park was able to attract technology companies in the 1950s by offering inexpensive land on which to build their own facilities, this model has lost much of its effectiveness as many corporations have scaled back their R&D facilities. Instead, businesses are looking for less capital-intensive mixed-use space in shared buildings. Occupying this type of real estate requires less upfront cost and strengthens the offering, as well as provides an open, collaborative environment where knowledge can be shared and new ideas take form. Nationwide, innovative firms are choosing to co-locate with complementary firms, research labs, and universities so they can share ideas and practice “open innovation”. Entrepreneurs and entrepreneurial firms increasingly seek to interact with like-minded firms and have efficient access to industry-specific

³³ https://aurp.memberclicks.net/assets/documents/aurp_batelllestudy2012-final.pdf, page 10.

guidance in addition to sophisticated equipment. New communication technologies make it possible for entrepreneurs to be successful nearly anywhere in the world, yet the “magic” occurs when entrepreneurs are able to leap forward due to shared thinking and utilization of space, workforce and innovations coming from an industry.

To help advance this type of innovation, university tech parks often include a business incubator or an accelerator to nurture startups. Both are facilities that provide physical space for new businesses, along with mentorship, assets such as laboratories and technology, and in some cases seed capital. Incubators generally host businesses for indefinite time periods (often years) until they are ready to “graduate” and leave the incubator. Accelerators, on the other hand, are designed to provide intensive guidance as part of a structured mentorship program for a fixed term, usually no more than 6 months. In either case, the operation may take equity in the startup businesses, or simply charge rent for use of the facilities. Incubators and accelerators can be centered on a specific type of industry segment, such as biotechnology or in this case, UAS. An operation of this sort might serve as an additional vehicle for commercializing university research, and established firms in the tech park could mentor, invest in, or ultimately acquire businesses started in an incubator.

As an additional note, Alaska’s remote location will present challenges for the development of a university tech park, as with many other types of business developments. UAS technologies in particular can be operated from remote locations, so project leaders will need to focus on the strength and value proposition of a university partnership to attract companies, and emphasize features unavailable elsewhere, such as the airspace and unique expertise. These alone may not be enough, however, as several other states are exploring similar concepts. The state may also need to explore financial incentives to attract targeted firms to the tech park (or elsewhere in Alaska) as explored earlier in this chapter.

Strategic Considerations

- University tech parks are a common strategy to advance innovation for the purposes of regional economic development, and a possible option to advance UAS commercialization in Alaska.
- Tech parks encourage linkages between university expertise and businesses with complementary needs, and provide opportunities to move innovations into the marketplace.
- UAS industry development could benefit from the formation of a tech park and/or systems for establishing a core knowledge center. See appendix 2 – Central Oregon example.
- Alaska based private sector firms commented via interviews on their need for special use airspace to allow for experimental UAS flights to prove airworthiness – a tech park could address this need.
- Success hinges on several critical factors, including financial, political, and market feasibility, as well as alignment between university competencies and those of the targeted industry.
- Tech park development closely resembles that of any other real estate project, with phases including pre-development, feasibility, site development, financing, and construction. See appendix 3 – Real Estate Development Process defined for greater explanation.
- An incubator or accelerator to help launch startups to scale could be incorporated into a tech park as an additional means to commercialize UAS technology and create an innovative environment.

6. Alaska UAS Strategic Assessment

The successful development of a UAS industry in Alaska will benefit the Alaska economy in terms of high wage/high talent job creation and new private sector investment. In addition to building a core competency for the state (UAS research and development), a successful industry development strategy will also work to strengthen existing and emerging sectors within the state, such as metal fabrication, aviation, and resource development. Foundational to a development strategy is to understand the current position or conduct a strategic assessment outlining the current competitive position of Alaska as a player within the global UAS industry, including current strengths and weaknesses (internal factors), as well as opportunities and threats (external). These are summarized by the “current position” table below.

Current Position

	Beneficial	Harmful
	Strengths	Weaknesses
Internal	<ul style="list-style-type: none">• Abundance of airspace for safe operations• Diversified need for this technology in the state – (public and private sector)• Strong aeronautical awareness (large number of pilots and aeronautic jobs)• Varied weather (good for R&D)• ACUASI leading UAS for over 10 years with great success• Strong legislative support for UAS development• UAS test range designation from FAA• FAA certified aviation schools, as well as strongly established maintenance and operation programs within these schools• Alaska UAS Interest Group	<ul style="list-style-type: none">• High cost of logistics, energy, and labor• Limited road infrastructure (necessary for small UAVs)• Public skepticism (must educate public on positive uses of UAS)• Lack of formal structure to receive inquiries from prospective UAS range users• Lack of methodology to guide prospective UAS range users through range selection and scheduling

While this strategy document has addressed the strengths and opportunities of a UAS industry in Alaska at length, threats and weaknesses must also be addressed and mitigated. These include a litany of common barriers to economic development in Alaska, such as high energy costs, a small workforce, long supply chains, and limited infrastructure (although this latter issue has probably helped spur the state’s aviation competencies).

Alaska must work to identify the most significant obstacles to private sector investment in UAS-related enterprise, and explore policy solutions. Similarly, state entities such as the Alaska Industrial Development and Export Authority (AIDEA) and the Alaska Aerospace Corporation (AAC) can participate in financing critical infrastructure if such investments can be justified in terms of economic development as well as tied to an overall strategic plan for the launch of a new UAS industry.

	Opportunities	Threats
External	<ul style="list-style-type: none"> • Education/informing the public as UAS are integrated in Alaska • Education/public schools system and University degree programs • Implementation in environmental monitoring, national security, and the oil industry • Opportunity to grow support industries (small aircraft maintenance, manufacturing, and metal and composite fabrication) • Ability to position Alaska on the cutting edge for UAS testing and implementation • Job creation and new investment 	<ul style="list-style-type: none"> • Safety of airspace in Alaska. Need to establish rules governing integration in common airspace • Declining value of test site designation as UAS are accepted into NAS • Budget cuts at the state and university level • Possibility of value creation not benefitting state—UAS could be built and operated out-of-state, not benefitting local economy

Core Competencies and Competitive Advantages

A Leader in Small Aircraft Maintenance and Knowledge

Alaska has a number of distinct core competencies and competitive advantages which make it an ideal climate for the development of a strong, well-integrated UAS industry. The state has the largest number of pilots per capita, at a rate of three times the next highest state in the country. This high concentration of pilots has allowed the state to develop small aircraft and aviation as a core competency. Accordingly, the state's aviation support infrastructure and expertise, including hundreds of remote airfields and aircraft service businesses, can be leveraged as assets for UAS development.

The importance of small aircraft has allowed this industry to develop within the state. The state possesses more than an adequate supply of trained small aircraft technicians and parts suppliers. Several specialized metal fabricators operate in Alaska that currently serve this niche market. For instance, one aircraft manufacturer in Southcentral Alaska manufactures components included on the Cessna Caravan, which are shipped all around the world, including Africa, New Zealand, and Australia. This core competency also spills over into the state's educational institutions, which offer associate degrees and certifications related to aircraft maintenance and operations. When viewed in this context, the state of Alaska has the proper support infrastructure in place (relating to small aircraft) to make it well situated for competition in the UAS industry.

A Harsh, Diverse Climate in America's Last Frontier

Perhaps one of Alaska's greatest strengths is its harsh, varied climate and rugged topography, which make it a perfect testing site for emerging UAS technology and applications. While these factors have historically inhibited economic development in Alaska, they provide nearly limitless applications for UAS technology. Such opportunities have been mentioned previously, and include the following:

- Volcano monitoring systems
- Oil pipeline monitoring
- Fish and Game monitoring
- Arctic weather deployment
- Mountain navigation and testing
- Extreme cold weather testing and innovation

Alaska provides opportunities for testing UAS in torrential rain (some Alaska locations receive the most rain in the US outside of Hawaii), extreme cold (temperatures in Interior Alaska can routinely reach - 50 degrees Fahrenheit in winter), and in arctic blizzards (a few of Alaska's cities can have extreme levels of snowfall as compared to other locations in the US). This varied and extreme climate provides amazing opportunities for the testing of UAS technology in some of the harshest of climates on Earth. This, combined with Alaska's other core competencies makes it one of the best locations in the US for the development of this technology.

While the state can market its climate as a unique strength setting Alaska apart with regard to testing UAS capabilities it is also important to understand that competitive locations will identify this as a disadvantage or weakness. Testing of UAS is typically conducted in clear, calm, dry locations. Poor weather conditions, icing, strong winds may ultimately delay the ability to test UAS. Every day that testing is stalled costs associated with testing increase. Ultimately Alaska will need to communicate the benefits of unique mountainous terrain, cold weather, arctic, and maritime testing opportunities to previously proven platforms as well as work closely to assist industry with best times for testing.

Strong Leadership at the State Level

One of the chief advantages for Alaska with regard to the development of a strong UAS industry is the strong leadership shown at the state and university level. These entities have taken the lead to ensure that Alaska is among one of the six designated test ranges nationwide for UAS technology. This designation will go a long way in helping to ensure Alaska's place within this emerging industry. Furthermore, the state government has shown the necessary leadership to form a task force to not only identify opportunities and threats within the industry, but to introduce proactive legislation to guide the industries development. This leadership has primed Alaska for success in the UAS industry.

Alaska's leadership has also played a prominent role in current efforts which strive to better understand the Arctic. Fran Ulmer (former Alaska Lt. Governor and UAA Chancellor) is chair of the U.S. Arctic Research Commission, where she has served since being appointed by President Obama in March

2011. Additional state leaders are involved in the Arctic Council, an intergovernmental forum consisting of Arctic nations such as Canada, Denmark, Finland, and others. For instance, ACUASI's deputy sits on the UAS Expert Group, a committee of the Arctic Monitoring and Assessment Group, which is one of the standing committees of the Arctic Council. State leaders are also active in other Arctic groups such as Arctic Circle, a nonprofit organization which offers a dialogue for key Arctic stakeholders. Alaska's strong leadership in Arctic policy and Arctic issues will be a key asset in developing its UAS industry, and furthering the Arctic applications and research of the technology.

In addition to a review of core competencies, a macro-marketing analysis was conducted to identify global and local factors that could potentially influence the UAS industry success in Alaska. This analysis is included as appendix 4.

Strategic Considerations

Critical to establishing an effective and growing UAS industry in Alaska is engaging all the players in a dialogue that purposefully focuses private sector firms along with economic development practitioners and public sector actors that may have an interest in or benefit from the development of the industry. While the public sector should not be the driver of an emerging industry, **it is often times the public sector that initiates the convening of industry members and may even fund an entity to serve as a public/private convening organization or designate staff to coordinate regular industry meetings.**

Pursuit of an anchor tenant or tenants is another strategy that often provides the ingredient for an industry to truly emerge. **Policymakers and economic development practitioners need to promote economic conditions that support the emergence of a new industry via the attraction of firms interested in developing the industry.** Business development practices might include, support for academic programs, encouragement of a strong entrepreneurial climate and even ensuring access to capital or incentives that may make the relocation of a firm to the area more economically viable.

Crucial to the establishment of an industry group is the interactions of competing and complimentary firms. In Alaska, the leveraging of existing and mature industry sectors such as the military, aviation and aerospace will provide crossovers when it comes to suppliers, professional service firms, distribution chains, customers as well as expertise in Alaska. **It will be important to involve not just UAS related firms, but to reach across sectors to seek out clear cross over competencies as well as other areas to be leveraged.** Key is ascertaining that firms and other economic actors are able to derive some economic advantage from their proximity to and engagement with the various industry stakeholders.

7. Strategy and Policy Considerations

In light of Alaska's current strength in UAS and the economic potential, a strategic framework for the continued development of the industry is an essential next step. Timing is critically important as other states are aggressively working their own strategies to grow and attract a UAS industry. This is a challenge to which Alaska must respond. The following establishes a strategic framework from which to launch.

Alaska has aspirations to achieve the following in an effort to grow the UAS industry sector:

- Promoting research, development and innovation;
- Advancing education and human resource development;
- Infusing marketing and branding; and
- Educating and engaging the public sector.

To achieve the objective of moving Alaska's UAS industry toward global competitiveness there are six interrelated drivers that leaders must advance concurrently. These drivers, listed below, and the following broad goal areas (innovation and entrepreneurship, education and training, communications, and public sector engagement) are intended to provide an actionable framework.

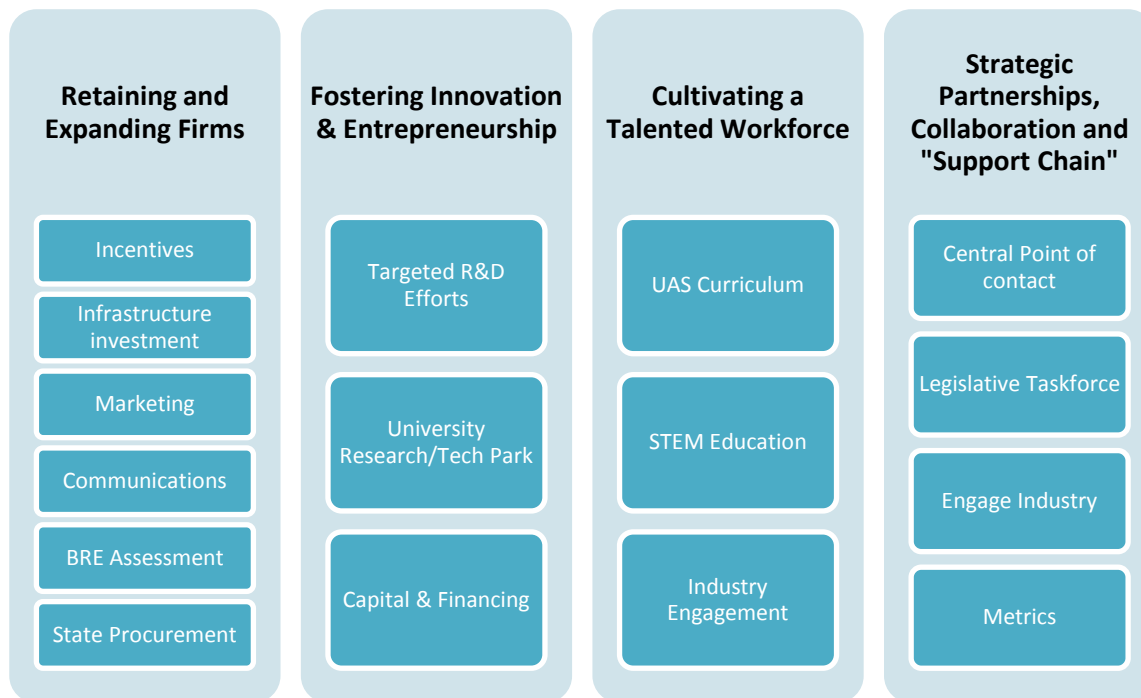
- Research and Networking
- Innovation and Technology
- Business Expansion
- Education and Training
- Commercial Cooperation
- Policy Action

The following strategies are intended to be implemented via a joint industry, government and university collaboration. The formation of an industry leadership council representative of these key anchors is an essential first step. The leadership council's role will be to further refine these strategies and then lead the implementation of critical actions. Implementing a joint industry, government and university strategy will bring cohesion and shared vision to growing the UAS sector.

The State of Alaska and Legislature can play a role in convening the right leaders and industry stakeholders. Further, the State of Alaska specifically through its Department of Commerce, Community, and Economic Development can serve a critical leadership role through the provision of staffing to the industry leadership council until the working council is firmly established. Over the long-term the leadership council will need to migrate towards self-structure.

The overriding aim of the leadership council is guide the linking and aligning of all industry contributors in order to arrive at a cohesive and iterative strategy that strengthens the way we work in partnership to achieved shared objectives.

A comprehensive strategy to grow and sustain a viable UAS industry for Alaska hinges on four major elements: strengthening the overall business climate, fostering innovation and entrepreneurship, cultivating the talent of tomorrow, and growing strategic partnerships.



Collectively these strategies seek to create a stronger business climate via:

- **Strategically incentivizing UAS investment to attract anchor firms.** Nationwide, most states and regions offer financial incentives (often in the form of tax credits or abatements) to attract businesses looking to expand or relocate.
- **Infrastructure investments.** Alaska must invest in critical infrastructure to support advancement of the industry. This may include facilities, special use roads, airfields, or training centers.
- **A coordinated, branded marketing effort.** States in competition with Alaska for UAS investment feature marketing efforts to attract investment in targeted industries, such as "Diversify Nevada."
- **Clear communication of the state's assets.** The state offers more airspace for UAS testing than any other, a long history with defense and aviation related industry, deeply rooted UAS expertise, and nationally-renowned aviation training programs. These and other strengths need to be communicated clearly and effectively.

Goal Area #1 Retaining and Expanding Firms

The FAA test range designation is attracting major, mid-size, and small businesses wishing to expand their UAS presence in Alaska. As a result, Alaska needs to review its public policy and related business attraction tools to encourage a strong business climate to support existing, and attracting greater, business investment. The development of a UAS industry in Alaska will lead to a number of spillover effects, including the expansion of existing businesses with niche skills. Many of the small aircraft maintenance and fabrication shops, along with other types of support businesses, will likely stand to benefit from a strong UAS industry in Alaska. There are also crossover applications from the small aircraft industry to the UAS industry, and these must be leveraged and expanded upon. While an industry development strategy will benefit small businesses, the reverse is also true: an industry cannot take shape without capacity expansion for the state's aviation-related firms. The following strategies aim to retain existing and expand on complimentary firms that will support this sector.

To support an improved ability to attract outside firms, state and local governments could begin offering tax and other specialized incentives. Property tax abatement for new businesses at the borough or municipal level is one avenue. Recent legislation (HB 223) at the state level established a property tax exemption for Military Facility Zones, as mentioned earlier.

Infrastructure needs should be better documented and a plan established to address deficits. The Alaska Department of Transportation and Public Facilities has responsibility for managing and maintaining Alaska's aviation infrastructure, such as its international airports and airfields throughout the state. These are assets in a UAS industry development effort. A needs assessment should be undertaken to determine any deficits as well as a plan to address any discovered.

Establishing a UAS industry in Alaska will require stronger marketing. As one example, the State of Nevada is leading an aggressive marketing campaign to attract the interest of UAS businesses from all over the country. The State of Nevada website (www.diversifynevada.com) is hosted through the Governor's Office of Economic Development. While web marketing and attraction efforts are not unique, the focus on UAS business development is. The UAS portion of the website focuses on the benefits of the state over its competitors. Further, Nevada has created an eight page brochure on the multiple advantages and extensive history of UAS in Nevada.

While Alaska is attracting firms already due to our strong UAS assets and geographic location, improving efforts and producing more "at a glance" information packages will improve the overall understanding of Alaska for these firms. The purpose of marketing efforts is to focus communications and rebrand Alaska as the national and international leader for development of policies, procedures, and flight safety protocols relating to UAS entering the NAS.

Attraction of new firms is one aspect of economic development, but strengthening existing businesses is another. A possible model for engagement is a traditional business retention and expansion (BR&E) effort, in which economic development organizations identify the needs of the business community

through surveys or interviews, and develop tailored strategies in response. To support this, the state must take inventory of such businesses to determine which are growth-oriented and what their specific needs are. The state should also provide these businesses with opportunities to participate in industry development efforts, as they will have a vested interest in its success.

Lastly, since state government has an interest in spurring private investment in UAS in Alaska, it should itself utilize UAS services where appropriate. DNR, DEC, and the Department of Public Safety, for instance, all use manned aircraft for a variety of tasks related to their core missions. If the state began incorporating UAS, it could act as a large customer helping to develop the industry while realizing the increased safety and efficiency benefits unmanned aircraft can provide.

Focus Area	Strategy
Incentives	Incentives <ul style="list-style-type: none"> • Tax credits • Loans • Equity investments
	Venture Capital Competencies <ul style="list-style-type: none"> • Need to educate and develop potential VC's as investors make decisions locally
	AIDEA <ul style="list-style-type: none"> • Investment and Lending policies related to UAS
	Airport(s) Readiness for UAS <ul style="list-style-type: none"> • Needs assessment
Infrastructure Investment	
Marketing	Establish a UAS marketing presence via the State of Alaska or Public/Private entity marketing Alaska <ul style="list-style-type: none"> • Web presence • Collateral pieces
Communications	Clear, consistent and compelling messaging
BRE Assessment	Market access to airspace and varied environments. Develop financing and incentive programs.
	Identify private sector "champions" to support development. Seek avenues for industry participation (i.e. UAS Interest Group). Utilize BR&E approach to identify needs.
State Procurement of UAS	Create a policy of using UAS services as an alternative to manned aircraft for activities such as wildlife monitoring.

Goal Area #2 Fostering Innovation & Entrepreneurship “Growing the Sector” & “Promoting Research”

This goal area requires that the state convey a clear message to industry that Alaska is “open for business,” encourage the growth of this economic sector, and allow Alaska to lead the country in aviation innovation.

A key driver for industry development will be Alaska’s ability to develop useful technology related to UAS. **While the state has been an early leader in the testing of UAS technologies, it must continue to innovate and harness the intellectual capital of the university system.** Alaska can build upon past successes by encouraging UAS manufacturers and operators to use Alaska as a laboratory, and partner with the university to benefit from its expertise. Alaska is well positioned to be on the front lines for research and innovation with regard to UAS deployment in a multitude of settings.

Each of the FAA test ranges relies heavily on the university system within their respective states. Further, each of the lead universities has developed partnerships with universities in other locations. UAF has partnerships with Oregon State University and the University of Hawaii, for instance. Increasing these partnerships will strengthen Alaska’s position as a research hub. UAA would be the first on the list or a regional partner as well as other university systems in the Pacific Northwest (University of Oregon, Washington State University). The further development of international relationships may also prove beneficial.

Alaska will almost certainly continue to serve as an important research laboratory for UAS testing, but taking research forward to the point of commercialization will lay the groundwork for a sustainable future. The university and its research partners must seek avenues to connect this expertise to private sector firms in order to realize economic benefits. This could be achieved in two ways: assisting in the launch of startup businesses utilizing UAS, or making the expertise available to existing firms through customized trainings or technology licensing, if appropriate.

Focus Area	Strategy
Targeted R&D Efforts	Promote University of Alaska Research & Development <ul style="list-style-type: none"> • Data Collection • Data Analysis
	Become International hub for UAS research
	Pursue new innovations (i.e. sensors, data collection, and data processing)
University Research &	Develop relationships and agreements with public entities and private sector firms to support shared research leading to commercialization
	Pursue and successfully obtain an FAA Center of Excellence designation for UAS

Technology Park	Expand rapid prototyping capacity to provide support for UAS innovations (i.e. 3D printing, CNC millwork, CAD/CAM)
	Encourage growth of light manufacturing – critical UAS components and systems
	Establish a legislative increment to support research as well as technology transfer and commercialization operations at the UA system
	Technology Park <ul style="list-style-type: none"> • Feasibility Study • Location Determination • Financial Plan Developed • Anchor Tenant(s) Identified • Business Plan
	Venture Capital Competencies <ul style="list-style-type: none"> • Need to educate and develop potential VC's as investors make decisions locally
Capital and Financing	AIDEA <ul style="list-style-type: none"> • Investment and Lending policies related to UAS

Goal Area #3 Cultivating a Talented Workforce

The availability of skilled and semi-skilled workers has always been a challenge for Alaska's industrial development. A thriving UAS industry, however, requires a specialized workforce capable of piloting the vehicles as well as tending to the operational systems. The growth of the UAS industry in Alaska will require advancement of educational programs from pre-K through high school, vocational, as well as at the university levels.

Both UAA and UAF offer nationally recognized aviation-related coursework, including degree programs in piloting, aviation administration, air traffic control, and aircraft maintenance. The University of Alaska is already testing courses for the emerging UAS industry. The next step is to develop curriculum that will lead to a certificate or degree. This will allow Alaska to better position itself as an educational leader, giving it a key competitive advantage over other regions.

The State of Alaska should undertake a labor needs assessment related to the UAS industry, and identify ways in which the Department of Labor and Workforce Development can provide support.

Focus Area	Strategy
World-Class Training Infrastructure – Specialized coursework in UAS field	Support the targeted expansion of workforce training with objective of becoming international hub for training and education relating to aviation and in particular unmanned aerial systems <ul style="list-style-type: none">• Payload operators and pilots• Mechanics and maintenance workers• Technicians
Invest in STEM education	Strengthen STEM education focus throughout Pre-K to High School
Higher Education and Vocational-Technical	Establish clear programming and degrees for unmanned ground systems
Engage Industry - Statewide Workforce Development	Undertake needs assessment of workforce gaps. Explore development of apprenticeship programs related to UAS work, and make training funds available.
Training Legislation	Need to encourage legislation at the local and federal level to support “diploma” or “Airman Certification” prior to FAA regulations being in place.
Funding for Initiatives	A variety of training or training infrastructure requires funding: <ul style="list-style-type: none">• UAA aviation requires software change to add UAS component to ATC simulator• UAS component to 141 flight school• Performance Training Standard test• UAS staffing and staff training

Goal Area #4 Strategic Partnerships, Collaboration and “Support Chain”

Alaska will need to act strategically if potential value is to be realized from UAS industry development. In the coming years Alaska must transition from holding a lead test range designation to becoming a state recognized for its established UAS-industry. Other states with fewer strategic assets and even in some instances no test range designation are simultaneously ramping up to claim the mantle.

Alaska has a unique opportunity given its competencies as well as geographic location to advance strategic relationships and develop a new industry for the state. Further, Alaska is well suited to aggressively position and market itself as the best place in not only the country but the world to address the needs and challenges of integrating UAS systems into the NAS. In so doing, Alaska must link and align its assets to grow a prospering new industry that advances collectively all stakeholders.

A key component in the development of a UAS industry in Alaska will be establishing clear roles for both the private and public sector. It will be important for the public sector to lead initially without competing with the private sector. Developing a framework by which the public sector can foster and facilitate the success of the private sector will be of utmost importance. Wherever possible, industry should be provided an opportunity to champion and lead.

Establishing a central point of contact, such as formalizing the Alaska UAS Interest Group or establishing a like entity and providing it with the authority, responsibility and resources to lead will serve to further the industry in significant ways. A key scope of work envisioned for the organization will be establishing working groups to address membership, finance, government and media relations, as well as workforce development initiatives. Ideally, this central point of contact would serve as chief liaison for the industry. This level of organization is necessary to facilitate a stronger collaboration across industry, academia and government agencies.

Working through the UAS Legislative Task Force, the State of Alaska and Legislature can aid the solidification of a UAS industry in Alaska. Firms seeking to relocate or establish additional offices in Alaska will first review the state's tax structure and incentives in place for industry. The Legislative Task Force can lead initiatives to establish new or rewrite existing incentive policies. It will be important that incentives are structured to not only benefit industry, but to also encourage any behaviors desired of industry. For instance, incentives that support greater education and training investments, as well as research investments will serve to benefit anchors such as the University as well as industry. In addition to improving the structure of incentives the UAS Legislative Task Force may also explore how to support industry having greater access to seed and venture capital as well as seeking to minimize any regulatory hurdles that exist. Further, the appointment of a special liaison to the central point of contact or UAS Interest Group discussed previously will likely be beneficial until the group can afford its own executive director.

Focus Area	Strategy
Central Point of Contact	Formalize UAS Interest Group or Like Entity – a standalone 501c3 model is envisioned
	• Programming – sharing of information
	• Membership – reaching stakeholders
	• Infrastructure needs
	• Capital and Financing
	• Government and Media Relations
Legislative Taskforce	Workforce Development
	Provide recommendations and guidance to state policy to support UAS for public and private applications
	• Incentives
Engage Industry	• Seed and Venture Capital
	• Streamlining regulatory hurdles
Metrics	Seek ways to empower the private sector to lead
	Establish tool to ensure success measures are established and used
	• Incentive tracking

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Appendix 1. UAS Tiers Defined

Prior to jumping into a full market consideration discussion it is first important to understand how UAS are typically classified as this classification system drives market behaviors. An “Unmanned Aircraft System” can be applied to a broad range of vehicle types, configurations, and sizes. For the DoD, “tiers” are used to differentiate UAV by size, speed, flight ceiling, functionality and capabilities. This tier system was developed by military planners to ensure integration of various models in an overall use plan. The US Air Force and Marine Corps each has its own tier system, and the two systems are themselves not integrated. Additionally the Army has designated UAS based on the nature of support received from other units. The US Air Force categorizes UAS in five tiers including:







- Tier : Small/Micro, low altitude
- Tier 1: Low altitude, long endurance
- Tier 2: Medium altitude, long endurance
- Tier 2+: High altitude, long endurance conventional
- Tier 3: High altitude, long endurance low-observable

Table A1.1. developed by Unmanned Aircraft Vehicles and System Services to classify UAS.

UAS Description	Weight (Pounds)	Size (Feet)	Mission (Altitude)	Mission (Speed M/Hr)	Mission Radius (Miles)	Mission Endurance (Hours)
Nano	<1	<1	<400	<25	<1	<1
Micro	1 to 4.5	<3	<3,000	10 to 25	1 to 5	1
Small	4.5 to 55	<10	<10,000	50 to 75	5 to 25	1 to 4
UAS						
Ultralight	55 to 255	<30	<15,000	75 to 150	25 to 75	4 to 6
Aircraft						
Light Sport	255 to 1,320	<45	<18,000	75 to 150	50 to 100	6 to 12
Aircraft						
Small	1,320 to 12,500	<60	<25,000	100 to 200	100 to 200	24 to 36
Aircraft						
Medium	12,500 to 41,000	TBD	<100,000	TBD	TBD	TBD
Aircraft						

FAA Defined Manned Aircraft Weight Categories

While already confusing, additional UAS Categories are also referenced by Grouping from 1 to 5 according to maximum gross takeoff weight, normal operating altitude and speed.

DoD Unmanned Aircraft Systems (As of 1 JULY 2011)					
General Groupings	Depiction	Name	(Vehicles/GCS)	Capability/Mission	Command Level
Group 5 • > 1320 lbs • > FL180		•USAF/USN RQ-4A Global Hawk/BAMS-D Block 10 •USAF RQ-4B Global Hawk Block 20/30 •USAF RQ-4B Global Hawk Block 40	•9/3 •20/6 •5/2	•ISR/MDA (USN) •ISR •ISR/BMC	•JFACC/AOC-Theater •JFACC/AOC-Theater •JFACC/AOC-Theater
		•USAF MQ-9 Reaper	•73/85* <i>*MQ-1/MQ-9 same GCS</i>	•ISR/RSTA/EW/ STRIKE/FP	•JFACC/AOC- Support Corps, Div, Brig, SOF
Group 4 • > 1320 lbs • < FL180		•USAF MQ-1B Predator	•165/85*	•ISR/RSTA/STRIKE/FP	•JFACC/AOC-Support Corps, Div, Brig
		•USA MQ-1 Warrior/MQ-1C Gray Eagle	•31/11	•(MQ-1C Only-C3/LG)	•NA
		•USN UCAS- CVN Demo	•2/0	•Demonstration Only	•NA
		•USN MQ-8B Fire Scout VTUAV	•14/8	•ISR/RSTA/ASW/ ASUW/MIW/OMCM/ EOD/FP	•Fleet/Ship
Group 3 • < 1320 lbs • < FL180 • < 250 knots		•USA MQ-5 Hunter	•45/21	•ISR/RSTA/BDA	•Corps, Div, Brig
		•USA/USMC/SOCOM RQ-7 Shadow	•368/265	•ISR/RSTA/BDA	•Brigade Combat Team
		•USN/USMC STUAS	•0/0	•Demonstration	•Small Unit
Group 2 • 21-55 lbs • < 3500 AGL • < 250 knots		•USN/SOCOM/USMC RQ-21A ScanEagle	•122/13	•ISR/RSTA/FORCE PROT	•Small Unit/Ship
Group 1 • 0-20 lbs • < 1200 AGL • < 100 knots		•USA / USN / USMC / SOCOM RQ-11 Raven	•5628/3752	•ISR/RSTA	•Small Unit
		•USMC/ SOCOM Wasp	•540/270	•ISR/RSTA	•Small Unit
		•SOCOM SUAS AECV Puma	•372/124	•ISR/RSTA	•Small Unit
		•USA gMAV / USN T-Hawk	•270/135	•ISR/RSTA/EOD	•Small Unit

Source: US Department of Defense

Appendix 2. Central Oregon Example

The Columbia River Gorge/Hood River example is provided to give further detail to how a specific area of a state is benefiting economically from UAS industry development. Oregon offers three specific Ranges including Pendleton, Tillamook and Warm Springs. The range designations have boosted what was already becoming a UAS focused cluster of Oregon startups and established companies.

Pendleton: Located in eastern Oregon, the Pendleton UAS Range (PUR) is centered at the Eastern Oregon Regional Airport and City of Pendleton. The airport enjoys 347 visual flight days per year and can accommodate up to a Boeing 757. In addition to two conventional runways, the airport provides a 2,800 foot UAS dedicated strip and a full-service UAS operating area. Beyond the airport the range extends over 14,000 square miles: North to the Columbia River; east over the Blue Mountains and Umatilla National Forest; south into the Elkhorn Mountains; and west outlining the borders of Restricted Area 5701 to allow easy access for specialty testing.

Tillamook: Tillamook Range is managed by Near Space Corporation, specializing in engineering, manufacturing and stratospheric balloon operations. The Range spans across miles of Oregon coastline, home to a mild and wet climate with very little seasonal temperature variation due to its proximity to the Pacific Ocean offering interesting marine and coastal research options.

Warm Springs: This FAA designated airspace directly overlies Warm Springs Reservation in the central Oregon Cascade Range near Madras and is managed by the Warm Springs Tribe. The Range supports controlled access to 1,000 square miles from the surface to 18,000 MSL of high desert and forest for testing a variety of UAS missions.

Since 2010, Economic Development for Central Oregon (EDCO), the organization leading the region's economic and business development activities, has been spearheading an effort to create a local hub of unmanned aviation technology. The emphasis behind this effort comes from Central Oregon having expertise in aerospace and aircraft industry manufacturing since 1992, but following the economic recession new attention was placed here as a way to diversify the region's aviation industry. Initially focus was placed on manufacturing SUAS airframes, but shortly thereafter more emphasis was placed on manufacturing the equipment that rides on UAS as well as developing systems for obtaining data, including sensors and optics.

Central Oregon lies near the center of Oregon, encompassing the Deschutes River Basin. Central Oregon is separated from Western Oregon by the Cascade Mountain range, which extend from southern British Columbia through Washington and Oregon to Northern California. Central Oregon's weather is mostly dry and sunny in the summer, snowy and cold in the winter, with light rainfalls and some cloud cover in the spring and fall. Central Oregon falls away from the Interstate-5 corridor nor does it provide access to a large population base, so resources had to be leveraged to draw in large companies. One of those resources is open air space.

Economic Development for Central Oregon launched the Oregon Unmanned Aerial Systems Business Enterprise (OR-UAS), a 501(c)(6) nonprofit. Today, OR-UAS is known as SoarOregon. The intent of SoarOregon is to establish Oregon as a leader in civilian UAS development. The organization's goal is to create jobs and economic growth by capitalizing on the development of SUAS and their associated applications. One of the first activities of OR-UAS was to solicit grant proposals for projects that will create UAS-related jobs or generate other UAS-related long-term economic activity in Oregon.

SoarOregon's initial funding came from a two-year, \$882,000 state grant from the Oregon Business Development Department and the Oregon Innovation Council, which was approved by the 2013 legislature. In the 2013-15 budget, the Legislature allocated \$882,000 to create the Unmanned Aerial Systems Center of Excellence — a research center and business incubator, that would include a flight-test site with proposed headquarters in Redmond or Bend. SoarOregon has worked to match this state funding with private investments, grants and other programs to get innovative projects off the ground and firmly establish a cluster of UAS activity.

The seed money provided by the state legislature to SoarOregon seeks to:

- Expand existing Oregon companies that support UAS technology;
- Assist Oregon companies in winning new contracts and grants;
- Recruit UAS firms to test vehicles, sensors, systems and applications in the state and to establish offices and facilities here; and
- Generate industry-leading applications that promote innovation

As Oregon hopes to position itself to be a national leader in the research, development, and manufacturing within the SUAS sector it has been working in close conjunction with its institutes of higher learning.

Oregon State University (OSU) has also raised the region's UAS profile, with about 20 faculty working on UAS-related research and technologies. OSU is working closely with Economic Development for Central Oregon, the US Department of Defense, OSU-Cascades Campus, the state of Oregon, Oregon Congressional leaders, private industry and others to help get the state involved. Specifically, Oregon State University's College of Engineering is growing its faculty expertise in this area, responding to burgeoning student interest, and offering the first SUAS engineering course in the Pacific Northwest this fall. "OSU's researchers are looking at unmanned vehicles for precision agriculture, forestry, snow pack observation, land-use monitoring, wildlife tracking and oceanographic mapping," said Rick Spinrad, vice president for research at Oregon State University and board president of SoarOregon.

Similarly, Central Oregon Community College has established the Unmanned Aerial Systems Degree Program. The Aviation Unmanned Aerial Systems Operations (UAS) trains individuals to work as professional UAS operators in the national/ international arena. Students learn to operate UAS to include conducting mission and preflight planning, mission briefings, and programming. Students are also taught to

perform limited UAS and ground support equipment testing, troubleshooting and maintenance.

Oregon is leveraging an advantage based on the growing cluster of UAS companies located in close proximity. Firms were initially concerned about not having product testing, but with the new test site designation that is no longer an issue. Not unlike the development of aviation systems in the early 1900's, the commercialization of UAS activity is taking off now as military uses are moving toward commercial uses.

Boeing-owned, Insitu Inc., which makes and designs unmanned aerial systems including the Scan Eagle™, Integrator as well as other UAS systems, is the anchor tenant. The Bingen, Washington based company employs about 800 people in the Columbia Gorge region and has provided a pipeline of talented engineers and aviators who have spun out to create their own firms. Other UAS companies and those who supply the industry in the region include AeroVel, American Aerospace Engineering, Cloud Cap Technology, Hood Technology, Sagetech Corporation, Sightline Applications, Trillium Engineering, Custom Interface Inc., Innovative Composite Engineering, Prigel Machine and Fabrication, Real Carbon and Zepher. The Gorge Technology Alliance collected data regarding the economic impact of the UAS industry for the region and reported that the more than 1,000 employees working in the UAS industry enjoyed an average annual income of approximately \$68,000 in 2012.

Oregon offers precision manufacturing, airframes, propulsion systems, applications and software from all corners of the state. From this core, suppliers followed and as aviation manufacturing slowed with the national recession, core competencies began focusing on UAS development.

The Portland metro area is also a rich hub for aviators. Companies include Columbia Helicopters in Aurora and Erickson Air-Crane Inc. in Portland. McMinnville-based Evergreen International Aviation operated both helicopter and UAV businesses before selling them off in advance of filing for bankruptcy protection. Outback Manufacturing currently boasts 20-40 percent of the company's business in manufacturing parts for the SUAS industry with this segment anticipated to increase in the coming years.

Appendix 3. Incentives Reviewed

	ED Incentive	Description	Advantages	Disadvantages
Tax Incentives	Research and development tax credits (state level)	<p>The tax credit formula includes two components:</p> <ul style="list-style-type: none"> • Credit rate (percentage of R&D expenses the tax liability is reduced;) • Base level (the minimum amount of an expenditure before the credit applies.) 	<ul style="list-style-type: none"> • Increases the amount of R&D activity; • Helps attract businesses from other states; • Allows the private sector to decide about allocation of funds; • Usually neutral and not aimed at a specific industry; 	<ul style="list-style-type: none"> • Shifts R&D activity between states rather than creating new expenditure; • Level-based R&D tax credits, with an increase in R&D expenses, the base level is also increasing every year and therefore it is more and more difficult to get a tax credit; • Aimed mostly at big companies rather than small businesses, as the base level is usually calculated based on reported average expenses in R&D. • May lead to projects with a low rate of return, unprofitable without tax credit.
Tax Incentives	Hiring tax credits (state level)/Job Creation Tax Credit	<p>There are several variants of the hiring tax credit:</p> <ul style="list-style-type: none"> • For employer: it may reduce a company's state income tax liability for hiring certain classes of employees or provide certain class jobs (rural, technology or high-wage) or enable hiring of certain employees with a specific level of payroll. • For employee: it may be provided to an employee for relocation to a particular state (may also exist in a shape of employee's relocation assistance program). 	<ul style="list-style-type: none"> • Provides incentives for both employers and employees to relocate to the state; • Promotes efficient allocation of resources; 	<ul style="list-style-type: none"> • Availability of tax incentives is only one factor among many that businesses consider when deciding about relocation, and it is not the main one. • Zero-sum game;

Tax Incentives	Manufacturing tax credits	Municipal or borough level: <ul style="list-style-type: none"> • Credits or exemptions for property; • Credits of exemptions for sales; State level; <ul style="list-style-type: none"> • Credits or exemptions for corporate income taxes; 	<ul style="list-style-type: none"> • Allows tax money to stay in private hands and be used more efficiently; • Promotes efficient allocation of resources; 	<ul style="list-style-type: none"> • Availability of tax incentives is only one factor among many that businesses consider when deciding about relocation, and it is not the main one; • Zero-sum game;
Tax Incentives	Property tax abatements (municipal or borough level)	In Alaska: an exemption or partial exemption from property taxes for up to 10 years if the property is in a military facility zone that creates or supports industry, development, or educational or training opportunities beneficial to a facility	<ul style="list-style-type: none"> • It is simpler and less restrictive than tax credit; • It is more useful for smaller projects. • Stimulates relocation of businesses to specific zones to which tax exemption is applied. 	<ul style="list-style-type: none"> • Availability of tax abatements is usually limited.
Tax Incentives	Sales tax abatements (municipal or borough level)	These would allow local governments to exempt particular purchases, or businesses within particular industries, from sales taxes, if the company relocates and retains jobs within the state.	<ul style="list-style-type: none"> • It is simpler and less restrictive than a tax credit; • It is more useful for smaller projects. 	<ul style="list-style-type: none"> • Availability of tax abatements is usually limited.

Investment incentives	Matching research and development grants	Funding from federal, state and private sources for research grants, research equipment acquisition, and product development/commercialization;	Promotes cooperative efforts between private businesses and the university system; Promotes early-stage research and development funding to advance technology;	Funding usually requires availability of matching funds.
Investment incentives	Funding by AIDEA and the AHFC to projects within Military Facility Zones (MFZ).	AIDEA has several financing programs: Loan Participation, Conduit Bonding authority, Loan Guarantees and Development Finance.	<ul style="list-style-type: none"> Helps build UAS infrastructure within MFZ. The trend of using these zones as a primary incentive tool has moved towards supplementing them with broader programs; 	<ul style="list-style-type: none"> Funding usually requires availability of matching funds.
Investment incentives	Gap loans	It is used when the banks and business owner are unable to secure funds necessary to complete the total project amount, leaving a “gap” between the two. Usually this type of financing is limited to specific geographical location.	<ul style="list-style-type: none"> Provides business with cash to operate while waiting for the funding; 	<ul style="list-style-type: none"> Usually comes with high interest rate.
Investment incentives	Equity financing	The process includes selling shares of the company to raise capital. This incentive is efficient only if there are potential equity investors or business angels within the state.	<ul style="list-style-type: none"> Cash infusion with flexible timeline to pay back; Potential partnering with local professionals (business angels) which are aimed at positive financial results; 	<ul style="list-style-type: none"> Splitting profits with equity investor.
Investment incentives	Venture capital assistance	The process includes investing in startup companies, which are usually highly-technological. This incentive is efficient only if there are potential venture investors within the state. In Alaska one of the examples is Alaska Venture Partners, LLC.	<ul style="list-style-type: none"> Potential investment is usually up to \$5 million; Access to knowledge and technical assistance. 	<ul style="list-style-type: none"> Venture investors expect large return on investment; The necessity to share company equity.

Other Types of Incentives	Job Creation Grants	Depending on the industry, companies creating a minimum required a number of new jobs and making a minimum required capital investment is eligible to receive discretionary cash grants (e.g. job creation grants provided by SBA.)	<ul style="list-style-type: none"> Stimulates small businesses to create new jobs. 	<ul style="list-style-type: none"> A lot of paper-work to apply for grant; Competitive basis, so grant availability is not guaranteed.
Other Types of Incentives	Energy Discounts	Some utility providers may offer grants and reduced rates to projects resulting in new job creation and investment. This incentive may also exist in a view of energy incentive loan which includes a no interest loan to pay for energy costs for a particular period of time.	<ul style="list-style-type: none"> Important incentive to stimulate businesses to relocate to Alaska as it helps reduce high energy costs; Creates competitive advantage for the business; 	<ul style="list-style-type: none"> Usually limited to specific industries or projects.
Other Types of Incentives	Free or discounted land	Negotiated lease or sale of land owned by a locality or state, often at a below market cost. Approach is often used via a sole source contract to assist a company needed land for location or expansion.		
Other Types of Incentives	Technical assistance	Local economic development organizations may provide technical assistance for new businesses or companies relocating facilities.		

Appendix 4. Real Estate Development Process Defined

The basic approach to developing a tech park is essentially similar to any business planning process. Elements include due diligence on the part of the owner and research surrounding market characteristics and product factors that then drive decisions surrounding the business venture. For a tech park in the Fairbanks area with an emphasis on UAS technology, these characteristics include land availability, access to airfields, and proximity to university facilities.

From an economic development practitioner's perspective, project planners must follow an established process to establish a tech park. Much like any real estate project, steps include:

1. Pre-development
2. Feasibility – (market; financial and political)
3. Site characteristics and considerations (site and engineering analysis)
4. Financing
5. Contractor selection (negotiations and public approval process precede)
6. Construction
7. Marketing
8. Facilities occupancy and ongoing management

The pre-development phase focuses on aligning a business development idea such as a tech park with a specific site or sites. Typically the businesses targeted for the tech park have an idea of what they want and can well describe their ideal location. This phase typically includes a pre-feasibility or basic low cost assessment, to determine whether the concept “pencils out.” It is critically important to engage in conversations early with all key stakeholders including tenants, owners, lenders, and partner organizations.

The feasibility phase is about determining the market; political and financial viability of the proposed development. With regard to a UAS tech park, the key question to be addressed is whether market demand is sufficient to offset the development and operational costs associated with the project. Political feasibility requires determining if the local political climate will support the proposed development. For instance, some communities are more concerned about UAS activities than others (for example: has the community supported any bans on UAS or business development?). Financial feasibility requires identifying the various costs associated with business and site operations and factoring these into a pro forma or financial analysis to prove to investors (debt or equity) that risks associated with the financial investment are less than the ultimate reward of financial returns.

Site review and engineering assessments include working with local municipal permitting and regulatory entities to determine if characteristics associated with the site will ultimately impact operations and plans for site development. This includes researching and seeking expert opinion on items such as environmental impacts, flood plain characteristics, run off patterns, earthquake zone, parking requirements, special restrictions, egress and ingress characteristics, and similar concerns.

Financing is a critical hurdle for nearly every real estate development project. In most cases,

multiple investors will negotiate terms and ownership interests in the development. In the case of a UAS tech park, investors may include stakeholders such as city or borough governments, the University of Alaska, federal agencies, Native Corporations, or private sector anchor tenants. In many cases both debt and equity investments are necessary due to the high costs associated with real estate development. For a public-private project such as a tech park, highly sophisticated and hybrid financing packages are typically needed to meet these expenses.

Contractor selection can be challenging if the developer is new to real estate development, particularly when led by a public sector entity. In short, this involves outlining the type of construction to be undertaken and providing bidding contractors with architectural and engineering schematics to follow. In some cases, contractors are asked to design and build, which can result in a less expensive and at times higher use property if there is cohesion of vision between the contractor and the developer. The contractual process can also be driven by financing requirements. For instance, if the public sector is contributing funds, a competitive bidding process will most likely be required.

Marketing is often a forgotten element, but really should be started early on in the process and may require an ongoing effort to lease all available space. At times, marketing is also necessary to raise capital for construction. In all circumstances, outreach and relationship building are essential to ensuring initial contracts with key anchor tenants are in order and confirm base operational costs are covered. For a UAS tech park, marketing efforts may form one component of an attraction program to recruit new businesses to Alaska. In turn, this may require tax or financial incentives to draw firms to the state. Of crucial importance is the targeting of firms that complement existing university research efforts.

The ongoing management of the property, once it is developed, typically involves two critical areas: day to day management and then longer-term renewal, replacement and eventual sale of the property. Both of these factors are of particular importance if the developers do not have real estate professionals on staff.

Appendix 4. Macro Market Environment Review

A macro-marketing analysis was conducted to identify global and local factors that could potentially influence the UAS industry success in Alaska. These factors include: political, economic, social, technological, maintenance, concept of operations, environmental, and legal considerations.

Political Considerations

All types of UAS have US domestic and international applications for law enforcement, land surveillance, wildlife tracking, search and rescue operations, disaster response, border patrol and photography, among many other tasks. Federal agencies, along with most states and foreign countries, are debating if and how this emerging technology should be regulated; taking into account privacy concerns, the benefits of use, and business interests. As mentioned previously, FEMRA established the program to integrate UAS into civilian airspace, including the formation of the six test ranges. This was a highly competitive process with at least 50 primary teams representing 37 states requesting FAA-portal access for proposal submissions. The international effort to incorporate UAS into respective airspace is primarily led by the International Civil Aviation Organization (ICAO) which “mirrors” many of the policies engaged by the FAA, but is aggressively leading the manned - unmanned airspace integration effort thus far. There continues to be an ever-changing political landscape in the United States relating to and for UAS. A recent FAA list, spurred by Freedom of Information Act lawsuits, indicates that an additional 81 public agencies have applied to the FAA for authorization to use UAS. Pending State Legislative measures focus on a variety of issues including:³⁴

- Definition of a drone or unmanned aerial vehicle;
- Use of unmanned aerial vehicles by law enforcement and other state agencies;
- Use of UAS by the general public;
- Formation of various study committees;
- Bans and moratoriums on operations; and
- Resolutions requesting to be an FAA test site.

The Alaska Legislature adopted a joint Concurrent Resolution (HCR006C) in 2013, creating a Legislative Task Force on Unmanned Aircraft Systems (LTFUAS) tasked with reviewing FAA regulations on drones and creating written recommendations and legislation that “protects privacy and allows for the use of unmanned aircraft systems for public and private applications.” In addition to members of the legislature, the task force is comprised of members representing the commissioner of public safety; the Adjutant General of the Department of Military and Veterans' Affairs (DMVA); the ACUASI at UAF; the Academy of Model Aeronautics, the state Aviation Advisory Board and most recently a public representative and two

³⁴ National Conference of State Legislatures, website, <http://www.ncsl.org/issues-research/justice/unmanned-aerial-vehicles.aspx>

industry members. The task force provided a final report to the Legislature on June 30, 2014.³⁵ In this report, the LTFUAS concluded that the FAA is adequately addressing the safety concerns of integrating UAS into the National Airspace System (NAS).

Alaska has prime airspace to prove an assortment of civil applications for UAS. "Alaska's extreme and ever-changing environment can put these systems to the test," Lt Gov. Mead Treadwell stated, "and the technology, along with our university's new supercomputer, can show how unmanned aircraft can support Arctic science, help manage natural resources and respond to emergency situations." Treadwell continued, "The synergy between the two technologies here in Alaska keeps us on the cutting edge of aerospace development....and an investment of \$5 million approved by Gov. Sean Parnell to further the University of Alaska's UAS research helps too."³⁶

Political debate, discussion and efforts to understand the consequences of UAS operating in the NAS will continue. Most of the debate stems from concerns regarding use in the military to the potential for invasions of privacy. At the core of the debate surrounding UAS advancement is uncertainty associated with the widespread use of a relatively new technology, and the potential for misuse by government or industry. The emerging regulatory framework should mitigate most of these concerns.

Economic Considerations

Economic issues such as federal sequestration and the continuance of budget resolutions are expected to keep producing uncertainty in the marketplace. Federal sequestration legislative actions took place in FY 2014 (and are further scheduled for 2015-21). Fiscal politics in congress currently attempt to cap defense and non-defense discretionary spending; a rise in one area will generally be offset elsewhere, limiting grants or R&D funding with potential impacts on UAS.³⁷

According to the Unmanned Vehicle Systems International (AUVSI) 2013 "New Economic Report,"³⁸ the main inhibitor of US commercial and civil development of UAS is the lack of a regulatory structure. Due to current airspace restrictions, non-defense use of UAS has been, and will continue to be, extremely limited. This primarily affects *Tier I and II platforms, whereas Tier III UAS is able to comply with FAA requirements for operations in the NAS with thorough coordination. **To better understand UAS tiers, please refer to appendix 1.*

AUVSI further projects an \$82.1 billion infusion into the US economy due to UAS operations over the 10 years following the mandated 2015 integration deadline. Agricultural applications of UAS alone could pump \$75.6 billion into the economy over the decade, according to an optimistic report published by AUVSI

³⁵ Legislative Task force on Unmanned Aircraft Systems, Final Report to the Legislature as required by Legislative Resolve 17 SLA-13, June 30, 2014.

³⁶ Alaska can be Arctic Proving Ground for UAS, Office of Lt Gov Mead Treadwell, 2012

³⁷ Center on Budget and Policy Priorities, website, various articles, <http://www.cbpp.org/cms/?fa=view&id=3635>

³⁸ The Economic Impact of Unmanned Aircraft Systems Integration in the National Airspace, AUVSI, March 2013, http://higherlogicdownload.s3.amazonaws.com/AUVSI/958c920a-7f9b-4ad2-9807-f9a4e95d1ef1/UploadedImages/New_Economic%20Report%202013%20Full.pdf

in March.³⁹ Public safety and “other applications, like natural resource management, will produce \$3.2 billion each,” the report claimed. The industry is projected to create just over 100,000 jobs during the same period, two-thirds of which will spring up in the first three years after integration into the NAS. Many of those jobs will be manufacturing positions that pay more than \$40,000 annually.

AUVSI identifies the following criteria required before any viable UAS growth in the US:

- The FAA must develop new regulations integrating UAS into the nation’s airspace; this effort is directly tied to the successful operation of the six test ranges.
- Job growth distribution in the US will mimic current aerospace manufacturing employment; reflective of UAS design/production and not necessarily applicable to UAS services support.
- There must be sufficient capital available to encourage smaller manufacturing companies.
- There must be financing available to UAS purchasers, foreign and domestic.
- There must be adequate insurance to cover liabilities associated with UAS design/production as well as operations.
- US Gross Domestic Product (GDP) needs to grow at least 3% annually over the designated time period for assumptions to hold.⁴⁰
- Overall, NAS integration is the greatest factor effecting UAS market growth whereas Original Equipment Manufacturers (OEMs) will be more affected by the health of the economy.

Social Considerations

There are widespread public assumptions that domestic integration of UAS will result in “lethal war machines buzzing their neighborhoods” and personal privacy will diminish as result. Overcoming these fears will continue to be a challenge. Some opposition camps view the aircraft as a “Big Brother” technology that will bring prying eyes into citizens’ homes.⁴¹ Consequently, there continues to be a significant effort by states to understand and regulate UAS operations. Conversely, there is a growing realization of the economic value of the domestic UAS marketplace and associated opportunities for applying this technology across federal, academic, and commercial arenas.

Similar to the earliest days of manned aviation, increased education about UAS applications, cost-benefits, safe and regulated operations, and the ability to take the human risk out of the “dull, dirty and dangerous” jobs will eventually bring greater acceptance across society.

³⁹ Booming Unmanned Aircraft Industry Straining to Break Free of Regulations, June 2013, <http://www.nationaldefensemagazine.org/archive/2013/May/Pages/BoomingUnmannedAircraftIndustryStrainingtoBreakFreeofRegulations.aspx>

⁴⁰ The Economic Impact of Unmanned Aircraft Systems Integration in the National Airspace, AUVSI, March 2013, http://higherlogicdownload.s3.amazonaws.com/AUVSI/958c920a-7f9b-4ad2-9807-f9a4e95d1ef1/UploadedImages/New_Economic%20Report%202013%20Full.pdf

⁴¹ Booming Unmanned Aircraft Industry Straining to Break Free of Regulations, June 2013, <http://www.nationaldefensemagazine.org/archive/2013/May/Pages/BoomingUnmannedAircraftIndustryStrainingtoBreakFreeofRegulations.aspx>

Technological Considerations

UAS technologies for UAS continue to develop rapidly. Small, *Tier I UAS appear to be generally developing faster than Tier II or III as manufacturers are able to enter the market more quickly and with less capital investment. Tier II UAS is led by Boeing-Insitu with their service-proven Scan Eagle™ mentioned previously, and follow-on program of record, "Integrator," primarily supporting DoD in the GWOT. The trend (for both Tiers I and II) is for vehicles that can carry an array of smaller, interchangeable, more capable sensor systems (Electro-optical, infrared, optical/Infrared/Multi or Hyperspectral); the addition of hard point for wing-mounted payloads; and standardized ground control systems. Tier III design has relatively slowed as the full range of capabilities have for the most part been demonstrated, and now the focus is on greater fidelity and expansion of sensor suites, along with reducing the overall operation and sustainment costs. There is also a significant cost barrier to enter the Tier III market, even as a service provider rather than an original equipment manufacturer (OEM). **To better understand UAS tiers, please refer to appendix 1.*

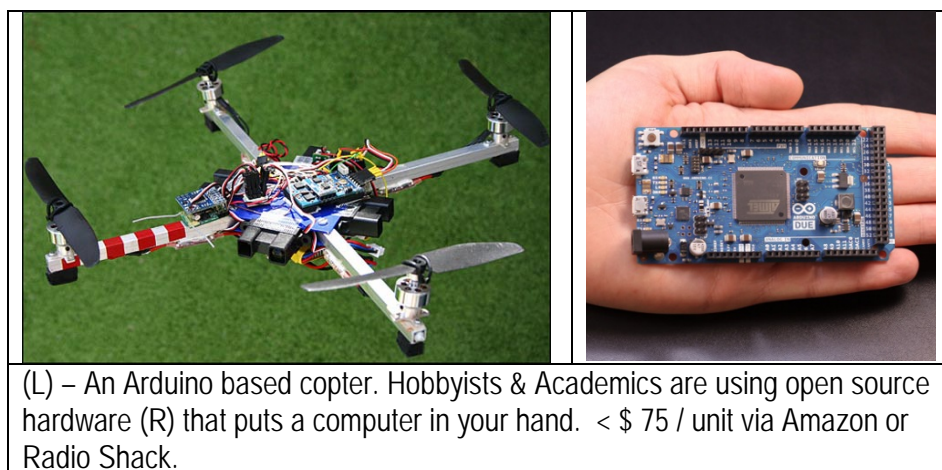
Specific technology considerations include:

Vehicles: UAS can be fixed wing, rotary or a combination of both. Historically, the most common options have been fixed wing as these operate more quietly, with greater efficiency and longer duration. This is not necessarily true as technology is advancing rapidly. As an example, Rotary Tier I options are becoming more common in law enforcement (e.g. Aerovironnet Qube) which can be tailored for low altitude/short range/short duration missions ranging from security support to precision agriculture.

Payload/Sensor Suite: Primarily Electro-optical (EO), Infrared (IR), and Hyperspectral capabilities. Cameras are getting smaller, as well as integrated with higher fidelity. Synthetic Aperture Array-based Hyperspectral systems are rapidly being miniaturized for small platforms. Overall, greater fidelity in data collection is being provided with smaller equipment, expanding the flexibility to meet customer needs.

Data storage/transfer/analysis/processing: Data storage (physical volume, weight, cost-per-Giga Byte) continues to plummet, which translates to a greater ability to collect and store more streams of data simultaneously aboard the platform. Likewise, data transfer algorithms and processing power have become more efficient (and compact). Manufacturers, universities and even hobbyists are now able to create sophisticated *Tier I UAS platforms (e.g. Tier I Quad Copter) using open-source processing (e.g. Arduino, Raspberry PI). This disruptive technology, is in essence aiding in the creation of a new market that may displace an earlier technology. As a result, this technology may produce similar changes in the UAS industry, like the introduction of personal computing over 40 years ago. **To better understand UAS tiers, please refer to appendix 1.*

Figure 10: Tier I Quad Copter



Training/Simulators: The DoD's "Report to Congress on Future UAS Training, Operations, and Sustainability," of April 2012 provides details regarding the requirements and initiatives being addressed regarding UAS in the NAS for UAS Executive Committee (EXCOM) activities (DoD, DHS, FAA, and NASA) out to 2017.⁴² Of note:

- UAS will not achieve their full potential or utility unless they can achieve the same freedom of navigation, responsiveness, and flexibility as manned aircraft.
- Many DoD UAS now require rapidly expanded access to the NAS and international civil airspace to support operations, training, testing, and broader governmental functions.
- Traditional training provided by OEM as part of the UAS sale and sustainment logistics support, is giving way to smaller companies specializing in UAS training across a range of different UAS platforms (particularly with the standardization of ground control systems). Some customers (DoD and most foreign countries) are requiring the OEM to support a "train the trainers" approach so that training can be accomplished "in-house" to save money. Some of this is the result of DoD acquisition managers' efforts to reduce the life cycle sustainment costs of UAS developed under "programs of record" and by foreign countries to develop their own capabilities, avoiding the continued dependence on foreign OEMs. Simulators are quickly being developed to support training in lieu of having to coordinate limited airspace for flight time, affording operators and maintainers the opportunity for platform and payload training.

⁴² DoD Report to Congress on Unmanned Aircraft Systems Training, Operations, and Sustainability, Under Secretary of Defense for Acquisition, April 2012, <https://www.fas.org/irp/program/collect/uas-future.pdf>

Maintenance Considerations

Logistics and field maintenance support became critical as UAS were incorporated into the battle force within combat zones. Consequently, focus expanded to include requisite field maintenance of software and hardware, requiring Subject Matter Expertise (SME) functions to be continuously available. Configuration management and field upgrades resulted in total integration of civilian contractors into the military combat environment. Those same contractors have brought their expertise back to the home front where they anxiously await integration into the NAS.

Concept of Operations Considerations

Two types of approaches are prevalent in the UAS marketplace: own/operate and fee for service (FFS). Own/operate follows the conventional model with direct purchase of a UAS product from an OEM (or a growing number of independent integrators tailoring specific UAS for customer needs, like UAV Factory (<http://www.uavfactory.com/>). Training and sustainment support derives from the OEM directly or thru certified vendors. Each OEM provides the customer a UAS product from a growing array of available platforms. Typically the systems are highly proprietary (not “plug & play”) with various additional sensor packages/equipment purchases required. The customer, in this case is also responsible for upgrades, training and sustainment requirements.

The FFS model primarily grew from the incorporation of Boeing-Insitu's Tier II Scan Eagle™ and AAI's “Aerosonde” in support of the US Marine Corps operating out of Iraq in 2005, and expanded into Afghanistan and elsewhere around the world. This customer-focused approach requires the contractor or vendor to identify user mission requirements, or “end-product,” and provide everything needed to meet those requirements: UAS platform and ground equipment, training, certification, sustainment/upgrades, and data collection/transfer to the customer.

Overall, as UAS proliferate into non-DoD applications, mission profiles must also accommodate ever-changing requirements while minimizing costs to customers. A UAS program with customer-driven focus on securing requisite data of the highest quality at the least cost will require the right platform/sensor selection to meet mission requirements, and effective planning of sustainment costs.

Legal Considerations

The regulations and standards affecting the UAS community are in a rapid state of change and modernization.

The latest legal information regarding State legislative actions are found at:
<http://www.aclu.org/blog/technology-and-liberty/status-domestic-drone-legislation-states>