**WRITTEN TESTIMONY OF**
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**STATE OF ALASKA**

**HEARING ON**
**"UNMANNED AERIAL SYSTEMS IN ALASKA AND THE PACIFIC REGION: A FRAMEWORK FOR THE NATION"**

**BEFORE THE**
**COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION**
***UNITED STATES SENATE***
**July 13, 2006**

## Introduction

Thank you, Mr. Chairman and Members of the Committee, for inviting me to present testimony on the potential use of unmanned aerial systems (UAS) in Alaska and the Pacific Region. I am the Deputy Director for Homeland Security for the State of Alaska and have held this position since September of 2005. Before beginning my service to the State of Alaska, I served 37 years in seven federal agencies, most recently three years with the Department of Homeland Security and Transportation Security Administration in Alaska. For eleven years before that, I worked with the Alaskan Region of Federal Aviation Administration (FAA). I also worked nine years with the Alaska Region of the National Weather Service and National Oceanic and Atmospheric Administration (NOAA).

Before transferring to Alaska from Washington, D.C. in 1982, I served with the headquarters of the Department of Energy working on fossil fuels research, the Joint Cruise Missile Project of the U.S. Navy and U.S. Air Force, several major defense programs, and on active duty with the U.S. Army in Vietnam and Washington, D.C.

With my experience in federal and state agencies with missions supporting science, safety, and security, I am in a position to analyze and describe the UAS initiative with a well rounded view.

## Initial Concepts

In October 2005, I first learned of NOAA's interest in UAS in Alaska to conduct long-term climate research in the Arctic. I understood their objective to be regular and frequent flights over the Arctic Ocean taking atmospheric and other scientific measurements to improve the climate prediction models.

I immediately saw a possible dual mission for these flights. During the flights to and from the Arctic, the aircraft could monitor the critical infrastructure of the Trans Alaska Pipeline System (TAPS), the oil production fields of the North Slope, refineries, oil storage facilities, and the Alaska Railroad. There was clearly a potential for one flight to accomplish two missions.

As I discussed this possibility with other state agencies and our federal partners, I realized that the range of potential missions was far broader than first evident. There was a clear need to examine the possibility of unmanned aerial systems achieving many missions on one flight – for science, safety, and security. Also, it was evident that while several organizations were interested in UAS, there was no forum for formal discussions and examination of the technology.

## Workshop on Unmanned Aerial Systems in Alaska

On April 18, 2006, the State of Alaska hosted an open workshop on unmanned aerial systems. The 55 attendees represented 34 federal and state agencies, universities, private sector companies, and non-profit organizations. I have included a list of the attending agencies and organizations with my written testimony. At the workshop, we exchanged information on current UAS activities and technology around the world and identified potential uses of unmanned aircraft vehicles and systems in Alaska. There was a strong emphasis on the possibility of Alaska as a testbed for UAS technology and applications that may prove beneficial to the entire nation across a broad range of public service missions.

The attendees at the UAS workshop identified many potential mission areas broadly aligned along the themes of science, safety, and security. Some potential missions recurring during the workshop included Arctic climate and weather research, ecosystems and wildlife habitat, monitoring volcanoes and wildfires, emergency communications platform, monitoring of critical infrastructure, fisheries enforcement, emergency response management, and search and rescue. These are representative of the missions that, on first examination, seem incongruent and incompatible. However, we found these missions shared three common elements:

- UAS could improve the effectiveness of achieving the mission of each agency;
- an integrated UAS program would likely reduce the costs of many aspects of the individual missions; and
- UAS could reduce the risks to flight crews and aircraft often operating in very hazardous conditions.

Undoubtedly, there are several lists of potential mission areas prepared by other organizations. These lists should be seen as complementary rather than competitive. The civilian UAS industry is a new field and the ideas are emerging rapidly from many quarters. It is too soon to definitively include or exclude any single idea. Rather, that should be left for a later, more detailed review and planning process.

To describe each potential mission would require testimony of several hundred pages. As an expedient, I will describe a few areas that illustrate the range and diversity of missions. While I describe these missions from an Alaskan perspective, the conditions and challenges in Alaska will replicate those found in other states and regions throughout the country.

- Arctic Climate and Weather Research -- I leave it to my associates from NOAA to describe the scientific missions for UAS in Alaska. However, I emphasize that whatever conditions NOAA detects and whatever predictions arise from improved climate models, Alaska -- its people, economy, and culture -- will be affected first. This mission, as I understand it, requires a platform with intercontinental range, sensing packages, and delivery systems for sondes.

- Monitoring of Critical Infrastructure – A significantly large amount of critical infrastructure in Alaska is located in remote areas. This infrastructure is critical to the people and economy of Alaska and Nation. We Alaskans take this charge very seriously. We devote a significant amount of state, local and corporate resources to deter, detect, and defend against all hazards and threats. To protect just the energy sector – power generation and distribution, oil and gas production fields, pipeline, pump stations, refineries, rail transport, and storage facilities -- there are more than two dozen federal, state, and local agencies and private sector corporations providing some piece of the overall protection. Through the coordinated use of UAS, we could radically improve our ability to integrate all these protective activities and eliminate any gaps, seams, or overlaps in the security. To meet this mission, a variety of aircraft platforms would be needed.

- Fire Management and Response – In this area the diversity of UAS technology and missions is dramatically demonstrated. The rapidly changing nature of firefighting, constantly shifting and always threatening, is extremely challenging to the firefighters and those supporting them. In some future fire scenario, there will be an integrated use of specialized unmanned aerial systems. A high altitude platform continually captures the perimeter, damage, and direction of all fires within range and locates the hotspots within the fire. This information is transmitted real-time to the incident commander who develops and refines the strategy and tactics for the entire fire area. A medium altitude aircraft serves as an airborne radio communications base to ensure every element is in constant contact despite the terrain or ground based stations. A medium to low flying platform drops weather sondes around the fire for atmospheric readings critical to extremely accurate weather predictions down to the range of one kilometer. In the past two years, Alaska has lost more than 11 million acres to wildfires – as much as the rest of the nation combined. There will be no shortage of opportunities to test technology, tactics, and techniques in Alaska that will be immediately useful to other states with wildfires.

- Volcano monitoring – Alaska has about 40 volcanoes active in historical times. As recently as January of this year, Mt. Augustine threatened communities along Cook Inlet and the air routes over the Northern Pacific. In recent years, other eruptions from Mt. Spurr, Mt. Redoubt, and Mt. Augustine, disrupted commercial aircraft operations throughout the Pacific and half the country. While NOAA, the FAA, and the Alaska Volcano Observatory have greatly improved their ability to monitor and predict the movement of ash clouds, other information remains difficult to obtain. During the UAS Workshop, there was speculation on the use of small, low-cost, sacrificial unmanned aerial vehicles to fly into volcanic ash clouds to gather and transmit information on the chemical composition and size of the particulate. Also, it would be of significant value to have an unmanned aircraft remain on station for hours or days to monitor and transmit visual and infrared information from the volcano. Again, a variety of unmanned aerial vehicles would supplement the ground and satellite based monitoring resources.

- River Ice and Flooding – Each spring as the ice on the Alaskan rivers begin to break up, dozens of river communities endure the uncertainty of if or when they may be flooded. During the Yukon River breakup in May 2006 – 150 miles of ice traveled downriver with the potential of blocking the river at any turn and flooding several communities. The river watch program of the National Weather Service and the State of Alaska flew small, piloted aircraft at slow speed and low elevation to monitor and assess the ice. This approach places pilot and crew at great personal risk and cannot stay on station for long. Similar conditions of seasonal flooding exist throughout the country. The process of gaining situational awareness of water conditions and rapidly identifying changes to predictions could immediately be exported to other states and regions.

## Model for the Civilian UAS Testbed and Operations Center in Alaska

It was evident from discussions during and since the April workshop that no single type of UAS could meet all these missions. Rather, the ideal UAS test program would include several platform types – from the high altitude, long endurance aircraft requiring a long runway to very small aircraft capable of low and slow flight, launched pneumatically or by hand, and easily deployed. Also, the UAS initiative is more than the vehicles and technology. The unmanned aircraft are essentially tools to acquire data and information for the other elements of the system to analyze and distribute.

To accommodate this wide range of aircraft and missions, I envision an operations center at one of the hundreds of State owned airports. The center is operated by a federal government agency or contractor. The center has hangar and maintenance space for the aircraft along with a test area for assembly, test, fabrication, and modification of payload equipment and technology. Near the aircraft base is the center for communications, information processing, logistical, and administrative support for a range of clients – government, academia, and industry. The operations center is linked to the clients in Alaska and throughout the nation via high-speed, broadband fiber optic and satellite network. The center has sufficient computing power for processing, analysis, and archiving huge amounts of data and imagery. The center provides for the maximize productivity of each flight hour by aligning missions, equipment, sensing packages, and priorities from clients. Further, the center would safeguard the information from unauthorized access and use.

Depending on the missions, there may be UAS forward deployed to other locations during seasonal events such as flooding, fire, wildlife migration, fisheries seasons, and breakup of river ice. There would be accommodations for the actively participating organizations as well as observers (real or virtual) from the private sector, other states, federal agencies, and even nations. These observers could learn first hand the UAS operations relevant to their needs and plans. Each could then make informed recommendations and decisions on the transfer of the UAS technology and procedures to their constituency or organization.

The center is governed by a charter that broadly prescribes how priorities are set, how conflicts are resolved, and how business is conducted. Through this governance, the participating agencies and organizations decide under what conditions to sacrifice a day of scientific observations to conduct a search and rescue operation or under what conditions to delay a wildlife census to monitor a threatening volcano.

## Profile of One Flight with Many Missions

I will describe the flight and mission plan for one flight of an unmanned aerial vehicle should this initiative be realized. While it is unlikely that a single flight will ever perform all of these, this hypothetical flight contains several mission elements that, individually, would be extremely difficult, dangerous, or expensive with manned aircraft or through satellite observations.

1. A long-range unmanned aerial vehicle launches from a base in Southcentral Alaska with its primary mission to drop weather sondes over the Arctic Ocean. It is also equipped with optical and infrared sensors to accomplish several secondary missions along the way.
2. The aircraft quickly climbs above the general aviation operating altitudes and heads north on its programmed flight.
3. As scheduled, the aircraft flies over the Trans Alaska Pipeline System, the pump stations and river crossings. The imagery is relayed through a high speed, secure downlink to the pipeline security operations center.
4. The aircraft also flies over Ft. Greeley and the national missile defense base. The imagery is relayed to security forces.
5. The UAS Operations Center receives a report from Alaska State Troopers of a boat overdue from a trip on the Yukon River from Circle to Fort Yukon. The aircraft is directed to divert slightly to follow and monitor the Yukon River. The aircraft collects the imagery and transmits it to the UAS Control Center. The center quickly analyzes the imagery and relays to the Alaska State Troopers the locations of the most likely search areas. The search by manned aircraft is now more focused and effective.
6. Over the North Slope, the aircraft begins collecting imagery of a caribou herd for several federal and state agencies as well as universities researching the wildlife of that area. The imagery is retained onboard the aircraft for later forwarding to the client agencies and universities.
7. As the aircraft approaches the Arctic Ocean, it flies a scheduled path over the oil fields at Prudhoe Bay and takes optical and infrared images to detect hotspots indicative of leaks and the surrounding areas for unauthorized people and vehicles. The imagery is relayed real time to the pipeline operations center.

8. Over the next several hours, the aircraft conducts its primary mission of atmospheric observations over a large swath of the Arctic Ocean.
9. On its return to the mainland, the aircraft follows the flight plan along the pipeline from Prudhoe Bay to Fairbanks, again concentrating on pump stations, river crossings, and other critical elements. It relays imagery in real-time to the pipeline operations center.
10. The UAS Operations Center receives a report from the Alaska Rescue Coordination Center (RCC) in Anchorage of an emergency locator transmitter detected near Chandalar Lake in the Brooks Range above the Arctic Circle. The Control Center recalls a portion of the imagery already collected for pipeline security and reroutes it to the RCC for analysis and action.
11. The aircraft flies a planned route through the military special use airspace near Fairbanks to simulate a commercial aircraft deviating from flight plan. This provides a highly realistic test for the FAA and the North American Aerospace Defense Command to detect, identify, and intercept an aircraft under these conditions.
12. The flight plan includes a scheduled reconnaissance flight over an active fire area near Nenana. The infrared and optical imagery of the fires is relayed real time to the Alaska Fire Service in Fairbanks who matches it with information from other UAS on low-level flights.
13. The aircraft continues southward above the Alaska Railroad and monitors the remote rail bridges before the transport of a large shipment of highly hazardous materials. The imagery is sent real time to the railroad operations center.
14. The aircraft completes its one flight and its many missions and returns to base. The imagery, atmospheric observations, and other data are downloaded for archiving, distribution, and analysis.

## Aviation Safety

I anticipate that the aviation community in Alaska may raise safety concerns about sharing airspace with unmanned aircraft. Alaska is the ideal venue to develop and test the standards for ensuring the safety of integrating UAS into the National Airspace System. While the per capita numbers of active pilots and registered aircraft in Alaska are the highest in the nation, there is still a great amount of airspace in Alaska. According to FAA records, there were about the same number of active pilot certificates in Alaska as in Maryland or Massachusetts, states with significantly larger populations but much smaller land area and airspace.

Also, Alaska has about the same number of registered aircraft – private, corporate, and commercial – as Ohio or Washington State, states with more population centers, fewer landing facilities, and more controlled airspace. I understand there are many other factors such as number of flights, distance and duration of flights, controlled and uncontrolled airspace, weather and radar coverage, and the limited road system. However, the risks of flying in Alaska are widely recognized and increasingly well documented.

It is often said, and I agree, that aviation is the lifeblood of Alaska – more so than any other state. Alaskans know and greatly appreciate the improvements in recent years in aviation safety and security. The collaboration between FAA, the aviation industry and associations, and the flying public is innovative, inclusive, and incredibly successful. The most notable programs in recent years are the Capstone program, the Medallion Foundation, the Circle of Safety, and the statewide system of weather cameras.

Aviation safety is and will remain vital to the state and worthy of the focus and resources afforded it. But there is strong need for the aviation community to collaborate on this initiative to confront other hazards that are just as threatening to our citizens. It is not enough to be safe while in flight as other imminent dangers – fires, floods, volcanoes, coastal and river erosion, terrorism – face our families and communities. The aviation community is a critical component of Alaskan life and it is critical to the thoughtful examination and implementation of UAS technology and operations in Alaska and across the Nation.

## Benefits to the Nation from a UAS Testbed and Operations Center in Alaska

A civilian UAS operations center in Alaska will facilitate the methodical test and evaluation of existing and emerging technologies in challenging field conditions. It also is the perfect laboratory to find the best means and timetable for introducing unmanned aerial systems into the National Airspace System.

For the emerging UAS industry in the United States to establish itself in the world market, it must demonstrate reliable technology that meets business needs and government missions, and that operates in the widest range of environmental conditions, and with logistical support. Alaska is the right location for such a testbed because there is more of the world like Alaska than many parts of the United States.

## Conclusion

My foremost duty is to provide for the safety and security for the people and economy of Alaska. The UAS initiative will significantly contribute to a safer and more secure Alaska. Just as importantly, I believe that a civilian testbed in Alaska also serves the best interests of other states and the Nation as a whole. Only in Alaska can we test the full range of potential missions of UAS without immediately confronting the complex airspace found in most of the National Airspace System. Only in Alaska can UAS be used to maximum efficiency through one flight conducting many missions – on each flight. Only in Alaska can the unmanned aerial system initiative be subjected to the most demanding climactic, environmental, logistical, and administrative challenges without dooming it to early and avoidable failure.

This concludes my prepared remarks. I stand ready to answer any questions you, or other Members of the Committee, may have.

# Unmanned Aircraft Systems in Alaska:
# A Workshop on Safety, Science, and Security

## Sponsored by the State of Alaska
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## Participating Agencies and Organizations

**State of Alaska Agencies:**

Alaska Department of Commerce, Community, and Economic Development
Alaska Department of Environmental Conservation
Alaska Department of Military and Veterans Affairs
- Alaska State Defense Force
- Alaska Air and Army National Guard
- Division of Homeland Security and Emergency Management

Alaska Department of Natural Resources
- Division of Forestry

Alaska Department of Public Safety
- Alaska State Troopers

Alaska Department of Transportation and Public Facilities
- Ted Stevens Anchorage International Airport

Alaska Railroad

**Federal Agencies:**

Department of Commerce/National Oceanic and Atmospheric Administration
- National Weather Service, Alaska Region
- Earth Systems Research Laboratory

Department of Defense
- Alaskan Command/Joint Task Force-Alaska
- Space and Naval Warfare Systems Command, San Diego

Department of Energy
- Sandia National Laboratory

Department of Homeland Security
- U.S. Coast Guard

Department of Interior
- Bureau of Land Management/Alaska Fire Service
- U.S. Geological Survey/Alaska Volcano Observatory

National Aeronautics and Space Administration
- Jet Propulsion Laboratory

**Academic Organizations:**
Alaska Geophysical Institute
New Mexico State University
University of Alaska Anchorage
    Aviation Technology Division
University of Alaska Fairbanks
    Geophysical Institute

**Private Sector:**
ACS Alaska
Aerospace Missions
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**Other Organizations:**
Alaska Airman's Association
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