UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM

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TRANSPORTATION AND
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UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM

Wednesday, March 29, 2006

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON AVIATION, COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, WASHINGTON, D.C.

The subcommittee met, pursuant to call, at 10:00 a.m., in Room 2167, Rayburn House Office Building, Hon. John L. Mica [chairman of the committee] presiding.

Mr. MICA. Good morning. I would like to this hearing of the House Aviation Subcommittee to order and welcome everyone this morning. I think we have an interesting hearing, a little bit different, and the title of the hearing is "Unmanned Aerial Vehicles (UAVs) and the National Airspace System."

The order of business today is going to be opening statements by members, then we have two panels of witnesses we will recognize. So we will launch our hearing here and I will start with my opening statement and we will begin.

Welcome, everyone. Today's hearing is going to be a little bit different, as I said, and, like the hearing on commercial space transportation just over a year ago, launches a new era in commercial transportation oversight.

We have just come to the end of 100 years of manned flight, and now we are entering a new century where unmanned aircraft will be used in ways that, in fact, defy even today's imagination.

I was going to fly this thing this morning. Somebody took the battery out of it. We got one of these—yes, a little bit of a wounded prop. But the thing actually does fly in a remote fashion. And it is not outside the realm of possibility that sometime in the future we will see pilots located at remote consoles as they fly cargo and passengers through an aviation system that is yet to be defined.

From the early days of flight to the development of jet engines, to the introduction of helicopters and now unmanned aerial vehicles (UAVs), and also unmanned aerial systems, progress continues and the safe integration of new technologies has to be assured in our national airspace; and that is part of the reason that we are having this hearing today.

Well, historically, UAS, the systems have been used primarily by the Defense Department and DOD in military settings, and sometimes outside the United States border, there is growing demand for both government and commercial operations of unmanned aircraft in our integrated national airspace.

Federal agencies such as the Customs and Border Patrol Service, the Drug Enforcement Agency, the Federal Bureau of Investigation, the Transportation Security Administration, the Federal Emergency Management Agency, and State and local law enforcement agencies are all interested in utilizing UAVs and the UAS system in our national airspace; and, of course, that creates a lot of questions and problems and airspace issues. Additionally, UAVs are also an emerging segment of our commercial aviation industry.

These advancements in aviation technology demand an ever-changing and evolving aviation system. Therefore, today, our subcommittee will learn about the development and the use of unmanned aerial systems. We will also hear about the Federal Aviation Administration's role in safety over flight, and the safe introduction of UAS into the integrated national airspace system.

We all understand that the FAA has sole authority over the safe and efficient use of our national airspace and is responsible for overseeing the safety of our civil airspace, including the operations by military, government, private pilots, and commercial entities.

In considering the operation of unmanned aircraft in the integrated national airspace, the FAA has identified two major safety concerns that need to be addressed: first, the need for proven unmanned aerial systems command and control redundancies. And there should be—if there is a disruption, rather, in communications, or should the operator lose contact with the vehicle, what happens? Secondly, the need for reliable, as they say, detect and avoid capability so that unmanned aerial systems and vehicles in the air can sense and also avoid other aircraft. These are a couple of essential safety responsibilities and jurisdictional responsibilities for the FAA.

The FAA has stated that unmanned aircraft will need to achieve the same level of safety as a manned aircraft. Such a level of safety requires further technological advancements, and maybe we will hear a little bit today about what is in store in regard to these new systems. Until this level of safety is achieved, however, the FAA has been working with DOD, the Border Patrol, and other government agencies to allow limited use of these unmanned aerial vehicles and systems in our national airspace.

The FAA has issued Certificates of Authority (COAs) and created Temporary Flight Restrictions (TFRs) to allow public or governmental operations of UAS in our national airspace. The FAA has also issued experimental certificates to allow limited commercial operations in our national airspace. But these processes deal with only a case-by-case issue or basis, and they can take time and place additional demands on limited FAA resources.

The number of requests to operate unmanned aircraft in our national airspace is growing, particularly for operations in support of homeland and national security. While the FAA has worked hard to expedite Certificates of Authority and that review process, ultimately, a longer term solution is probably going to be required. Therefore, the FAA has asked the RTCA, Inc., which is a private not-for-profit corporation that develops consensus-based recommendations for the FAA on certain technical issues—they have asked the RTCA, Inc. to help develop standards for operation of the UAVs and UAS systems.

The RTCA Special Committee 203 will answer two key questions: How will the systems handle command and control, these unmanned aerial systems handle those two issues? And how will they detect and avoid other aircraft? Both of these questions are dependent on the development of technology and operational procedures, and some of those we will hear about.

Certainly, supporting this emerging industry is in the best interest of the United States, especially in light of growing homeland and national security demands, and also in light of increasing international competition in this area. At the same time, ensuring that the FAA fulfills its oversight responsibility with regard to safety is certainly a priority for this subcommittee.

Like commercial space transportation, the integration of aerial systems that are unmanned will create new challenges to the safe and efficient use of our national airspace, and also require our FAA to address a whole host of issues regarding use of the national airspace by these new unmanned vehicles and aerial systems.

We welcome the witnesses. We appreciate the time they have taken to come testify before us today, and we look forward to hearing from all of them, and am please to yield to Mr. Boswell at this time.

Mr. BOSWELL. Well, thank you, Mr. Chairman. And I want to thank Ranking Member Costello for having this hearing. Mr. Costello is in a markup in another committee, I understand, so I am privileged to be here with you.

I do feel privileged in this sense. We all have our history, and some of my history was in charge of the drones flying out of Finton Army Airfield in Germany in the 1960s. Some of you might remember some of those. Those were pretty yellow, pretty antique-ish, I guess, compared to what we are doing today, but I did do that. And then I had the assignment for a time flying the SLAR, the side-looking radar, under L-23s, the twin Bonanza, along the East German border, trying to keep track of the Russian movements and so on. And, of course, we were in the soup most of the time flying and we were depending on radio compass, you know, to ADFD to track, and the Russians figured out a way to overpower that and make their needles swing to the right. And then if you slipped over there, they would just shoot you down because you were violating their space. So we were pretty attentive to making sure that that needle wasn't doing an unexpected swing. If it did, we turned a 240 and left the area.

But those are kind of exciting times for the young aviator that I was at that time.

But, anyway, today we are here to talk about unmanned aerial vehicles, and I do associate myself with what the Chairman said very enthusiastically, but it is timely because government and commercial operators are starting to compete for the use of our national airspace. UAVs come in all shapes and sizes, from as little as four pounds. In fact, even this Batcat—I just got a copy of their little information—is a one pounder, I understand. And they may be programmed to work autonomously or by a computer operator.

UAVs are currently being used for military, law enforcement, homeland security, firefighting, weather prediction, and tracking purposes. According to a recent Aviation Week & Space Technology article, the UAV market is expected to be worth $7.6 billion through 2010, with the majority of UAVs being purchased by the

U.S. We must ensure that this emerging industry receives the proper Federal safety oversight without discouraging the development.

The increasing use of UAVs in the national airspace represents several challenges for the FAA and the community. Of paramount importance, of course, is safety. The FAA is the sole authority—is the sole authority, as I understand it—charged with controlling the safe and efficient use of the national airspace. It is my understanding that adequate detect, sense and avoid technology that will enable UAVs to avoid other aircraft is probably 20 years away. It is years away, anyway. Therefore, safety must be their top priority as the FAA makes decisions regarding UAV airworthiness and integration into operations of our national airspace.

Moreover, FAA has recently accommodated the use of UAVs by implementing large-scale flight restrictions. An example: they established a Temporary Flight Restriction (TFR) along the U.S.-Mexico border at Arizona-New Mexico to allow the Department of Homeland Security's Customs and Border Protection to conduct UAV border surveillance without colliding with other operators in the area. The TFR is 300 nautical miles long and 17 miles wide; has an effect of 12,000 to 14,000 feet, and is active from 5 to 7 daily. In my view, the use of TFRs, especially one that is large in scale to allow for UAV operation, is not a workable long-term solution. It is going to be a challenge for us, I understand that, and I hope that we all do.

I am pleased that Mr. Sabatini is here to discuss the agency's efforts in the short term to ensure the safety of UAVs that currently fly in the space, as well as any long-term solutions to allow for certification of mainstream integration of these vehicles with other commercial use in airspace without—without—resorting to widespread use of TFRs.

The Department of Defense and Homeland Security, the two primary government users of UAVs, must also work in concert with the FAA to ensure both the safety of UAVs operating in the space and that our military and homeland security needs for UAV operations are being met.

Today we have representatives from both DOD and CBP to discuss these efforts, so I am looking forward to hearing from our witnesses, on the second panel as well, regarding future commercial applications, the challenges faced by these emerging industry, as well as some of the potential procedural and technological solutions that will enable the full and safe integration of these in the space.

Thank you, Mr. Chairman. I look forward to your comments. And I will just tell you up front I am very, very concerned about general aviation. It is a big part of our economy and there is a big need for it, and I hope you keep that in mind every time you sit down and discuss this, as well as the other needs. Thank you very much.

Mr. MICA. Thank you.

Any other members have opening statements? None on this side. Ms. Johnson?

Ms. JOHNSON. Thank you very much, Mr. Chairman. I am due in the same markup that Mr. Costello is in, so I might leave out shortly. But I want to thank you and the Ranking Member for holding this hearing this morning on the issue of unmanned aerial systems.

Without question, the usage of unmanned vehicles in the areas of surveillance and recognizance missions has proven to be an invaluable tool in the missions of our military. The U.S. military has demonstrated that the UAV development serves a cost-effective answer to a number of modern military needs. In addition to UAV deployment by the U.S. military, the Congress has also called for the usage of UAVs to support homeland security and other law enforcement related missions.

Now it appears that there are various segments within the commercial aviation industry interested in utilizing UAVs in the national airspace system. Obviously, this type of demand for UAVs begs the question that if commercial usage of UAVs are permitted, how do we, as policymakers, ensure that the necessary safeguards are in place for the protection of public safety?

It is my understanding that FAA has identified two primary safety issues with regard to the UAVs' operation in the commercial aviation industry: one, the need for UAV command and control redundancy should a disruption in communication arise; and, two, the need for a reliable detect and avoid capability so that the UAVs can sense and avoid other aircraft.

I welcome our witnesses this morning and look forward to gaining additional insight into whether or not the FAA feels expanding commercial UAV usage is a good idea. And, if so, what are their plans to address safety and oversight issues as they relate to the UAVs.

Thank you, Mr. Chairman. I yield back.

Mr. MICA. Additional members with opening statements?

[No response.]

Mr. MICA. We have no additional members, so we will turn to our first panel of witnesses. And we have approximately four witnesses, I believe, on the first panel. Let me introduce them. We have first Mr. Nicholas Sabatini, who is the Associate Administrator for Aviation Safety with FAA. We have Mr. Gerald F. (Fred) Pease Jr., Executive Director of the United States Department of Defense, Policy Board on Federal Aviation. We have Mr. Dyke D. Weatherington, Deputy, Unmanned Aerial Systems (UAS) Planning Task Force. He is with the Office of Under Secretary of Defense for Acquisition Technology and Logistics Defense Systems and Air Warfare with the United States Department of Defense. And then our last witness on that panel is Mr. Michael Kostelnik, and he is the Assistant Commissioner for Customs Border Protection, Office of Air and Marine Activities, in the Department of Homeland Security.

So I would like to welcome all of our witnesses. We ask if you have a lengthy statement or information that you would like to have made part of the official record of these proceedings, to request so through the Chair. Hopefully, you can summarize in approximately five minutes your testimony. So we welcome you.

Mr. Sabatini is no stranger to this panel, and welcome him back and recognize him at this time. You are recognized.

TESTIMONY OF NICHOLAS SABATINI, ASSOCIATE ADMINISTRATOR FOR AVIATION SAFETY, FEDERAL AVIATION ADMINISTRATION; MICHAEL KOSTELNIK, ASSISTANT COMMISSIONER, CUSTOMS AND BORDER PROTECTION, OFFICE OF AIR AND MARINE, DEPARTMENT OF HOMELAND SECURITY; GERALD F. (FRED) PEASE JR., EXECUTIVE DIRECTOR, UNITED STATES DEPARTMENT OF DEFENSE, POLICY BOARD ON FEDERAL AVIATION; AND DYKE D. WEATHERINGTON, DEPUTY, UNMANNED AERIAL SYSTEMS (UAS) PLANNING TASK FORCE, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS DEFENSE SYSTEMS-AIR WARFARE, UNITED STATES DEPARTMENT OF DEFENSE

Mr. SABATINI. Good morning, Chairman Mica, Congressman Boswell, and members of the subcommittee. I am pleased to appear before you today to discuss a subject that serves to remind us that the future is now. The development and use of unmanned aircraft (UAs) is the next great step forward in the evolution of aviation. As it has throughout its history, FAA is prepared to work with government and industry to ensure that these aircraft are both safe to operate and operated safely. The extremely broad range of UAs makes their successful integration into the national airspace system (the NAS) a challenge, but certainly one worth meeting. To meet this need, the FAA has established an Unmanned Aircraft Program Office which has the expressed purpose of ensuring a safe integration of UAs into the NAS.

At the outset, you must understand that UAs cannot be described as a single type of aircraft. UAs can be vehicles that range from a 12-ounce hand launched model to the size of a 737 aircraft. Obviously, the size of the UA impacts the complexity of its system design and capability. Therefore, each different type of UA has to be evaluated separately, with each aircraft's unique characteristics being considered before its integration into the NAS can be accomplished. FAA is currently working with both other government agencies and private industry on the development and use of UAs.

The number of government agencies that want to use UAs in support of their mandate is increasing.

In working with government agencies, the FAA issues a Certificate of Authorization (a COA), that permits the agency to operate a particular UA for a particular purpose in a particular area. In other words, FAA works with the agency to develop conditions and limitations for UA operations to ensure they do not jeopardize the safety of other aviation operations. The objective is to issue a COA with terms that ensure an equivalent level of safety as manned aircraft. Usually, this entails making sure that the UA does not operate in a populated area and the aircraft is observed either by someone in a manned aircraft or someone on the ground. In the interest of national security, and because ground observers were not possible, the FAA worked with DHS to facilitate UA operations along the Arizona-New Mexico border with Mexico. In order to permit such operations, the airspace is segregated to ensure system safety so these UA flights can operate without an observer being physically present to observe the operation. The FAA is working closely with DHS to minimize the impact of the segregation methods on other aviation operations. In the past two years, the FAA has issued over 50 COAs. With the purposes for which UAs are used expanding steadily, the FAA expects to issue a record number of COAs this year.

FAA's work with private industry is slightly different. Companies must obtain an airworthiness certificate by demonstrating that their aircraft can operate safely within an assigned flight test area and cause no harm to the public. They must be able to describe their unmanned aircraft system, along with how and where they intend to fly. This is documented by the applicant in what we call a program letter. An FAA team of subject matter experts reviews the program letter and, if the project is feasible, performs an onsite review of the ground system and unmanned aircraft. If the results of the onsite review are acceptable, there are negotiations on operating limitations. After the necessary limitations are accepted, FAA will accept an application for an experimental airworthiness certificate, which is ultimately issued by the local FAA. The certificate specifies the operating restrictions applicable to that aircraft. We have received 14 program letters for UAs ranging from 39 to over 10,000 pounds. We have issued two experimental certificates, one for General Atomics' Altair and one for Bell-Textron's Eagle Eye. We expect to issue at least two more experimental certificates this year.

Each UA FAA considers, whether it be developed by government or industry, must have numerous fail safes for loss of command and control link and system failures. Information must be provided to FAA that clearly establishes that the risk of injury to persons on the ground is highly unlikely in the even of a loss of link. Because FAA recognizes the seriousness of this situation, we are predominantly limiting UA operations to unpopulated areas. Should loss of link occur, the pilot must immediately alert air traffic control and inform the controllers of the loss of control link. Information about what the aircraft is programmed to do and when it is programmed to do it is pre-coordinated with the affected ATC facilities in advance of the flight so that FAA can take appropriate actions to mitigate the situation and preserve safety.

The COA and Experimental Airworthiness Certificate processes are designed to allow a sufficiently restricted operation to ensure a safe environment, while allowing for research and development until such time as pertinent standards are developed. The development of standards is crucial to moving forward with UAs integration into the NAS. FAA has asked the RTCA, an industry-led Federal advisory committee to FAA, with the development of a Minimum Aviation Safety Performance Standard for detect, sense, and avoid, command, control, and communication. These standards will allow manufacturers to begin to build certifiable avionics for UAs. Until there are set standards and aircraft meet them, UAs will continue to have appropriate restrictions apply.

Because of the extraordinary broad range of unmanned aircraft types and performance, the challenges of integrating them safely into NAS continue to evolve. The certification and operational issues described herein highlight the fact that there is a missing link in terms of technology today that prevents these aircraft from getting unrestricted access to the NAS. Currently, there is no recognized technology solution that can make these aircraft capable of meeting regulatory requirements for see and avoid, command and control.

FAA is fully cognizant that UAs are becoming more and more important to more and more government agencies and private industry. The full extent of how they can be used and what benefits they can provide are still being explored. Over the next several years, when RTCA has provided recommended standards to the FAA, we will be in a position to provide more exact certification and operational requirements to UA operators. The future of avionics and air traffic control contemplates aircraft communicating directly with one another to share flight information to maximize the efficiency of the airspace. This certainly could include some models of UA. Just as there is a broad range of UA, there will be a broad range of ways to safely provide them access to the NAS. Our commitment is to make sure that when they operate in the NAS, they do so with no denigration of safety system.

In our history, FAA and its predecessor agencies have successfully transitioned many new and revolutionary aircraft types and systems into the NAS. Beginning in 1937, we completed the U.S. certification for the first large-scale production airliner (the DC-3), then went on to certify the first pressurized airliner (the Boeing 307 in 1940), the civil helicopter (the Bell 47 in 1946), turboprops, turbo jets like the Boeing 707 in 1958, as well as the supersonic transport (the Concord in 1979), and the advance wide-body jets of today. It seems appropriate that as we begin a new century and new millennium, advances in aviation technology present us with another addition to the fleet with great potential: unmanned aircraft.

Mr. Chairman, FAA is prepared to meet the challenge. We will continue to work closely with our partners in government, industry, and Congress to ensure that the national airspace has the ability to take maximum advantage of the unique capabilities of unmanned aircraft.

This concludes my prepared remarks. I would be happy to answer your questions.

Mr. MICA. Thank you. We will withhold questions until we have heard from the other witnesses.

The second witness is Fred Pease Jr., Executive Director under the United States Department of Defense Policy Board on Federal Aviation. Welcome, and you are recognized, sir.

Mr. PEASE. Thank you, Mr. Chairman, Congressman Boswell, members of the subcommittee. I do want to thank you for inviting me to be here today. As the Executive Director of the Department of Defense Policy Board, I represent the services and the DOD on policy in working with the FAA. The PBFA, as we call it, was formed about 20 years ago to not only work more closely with the FAA, but also represent interests on mission accomplishment in the DOD.

As you know, the Department of Defense is not only a user—we operate fleets of aircraft—but we also—some people don't think about this part, but we are also a provider of air traffic services. The DOD has about 4,000 air traffic controllers who are a seamless partner with the FAA to provide those air traffic services to not only military, but also civilian, general aviation, commercial. Last year, the DOD controllers provided air traffic services for over 15 million operations, of which 3.5 million were civil, general aviation, and commercial traffic.

The Policy Board on Federal aviation is comprised of senior executives and general officers from all the services and from the Joint Staff and members of the Office of the Secretary of Defense, and this body is supported by various subgroups, one of which is UAS subgroup, which has recently been established over the last couple of years and is working harder, believe me, every day as we go along through this issue.

Although I have been involved in air traffic issues, especially for the Air Force, and airspace and whatnot for a long time, I just assumed this position with this DOD hat last December, and I can assure you that UAVs have been at the top of a very small list of issues that I deal with every day. I work directly with Mr. Sabatini; my organization works directly with his organization. And I am confident—and other senior leaders in the FAA, and I am confident that we are going to be able to work the issues that we need to work to integrate unmanned vehicles both into the national airspace system for DOD and working with the FAA, helping them bring—helping them also to integrate these into the overall system.

As you pointed out, Mr. Chairman, we are going through a period of very rapid technology advancement—you see some of that on your desk today—and also an awful lot of operational know-how that you find in any conflict where technology is used in innovative ways. There are folks in Iraq and Afghanistan that are using that UAV that you have on your desk today in operations.

As with any technological advancement, it challenges us to provide the policy and the guidance that we have to do to incorporate this thing, these technologies. I am sure that there will be some segments of the user community, including perhaps some in my own user community, that will be a bit frustrated because we are not going fast enough, but I believe that we are on the right path, what I have seen over the last couple of months that I have been doing this, and I am confident that we will be able to provide the regulatory guidance with the FAA that we need to safely integrate these platforms.

My colleague, Mr. Weatherington, can provide you some more detailed discussion about the acquisition issues associated with unmanned vehicles in the Department of Defense. And having said that, again, I want to thank you for having invited me today, and I will be happy to answer your questions at the appropriate time.

Mr. MICA. Thank you.

We will turn next to Dyke Weatherington. He is Deputy of the Unmanned Aerial Systems Planning Task Force with DOD. So we welcome you and we recognize you.

Mr. WEATHERINGTON. Good morning, Mr. Chairman, Mr. Boswell, and members of the Committee. Thank you for the opportunity to discuss with you today a very important area. As you have indicated, I am deputy for the Unmanned Aircraft Systems Planning Task Force within the Office of the Under Secretary of Defense for Acquisition and Technology, and in that capacity I am primarily responsible for the acquisition and development of our very robust unmanned aircraft systems. I appreciate the opportunity to provide you overview of our plan to integrate these very large and dynamic systems into our national airspace and international airspace safely.

DOD unmanned aircraft system are playing a major role in combat operations both in Iraqi Freedom and Operation Enduring Freedom. During the past year, unmanned aircraft operations supporting the global war on terrorism expanded dramatically, and theater and tactical unmanned aircraft flew over 100,000 hours just last year, and I hopefully have a graphic of that coming up.

Unmanned aircraft systems are playing an ever-increasing role in a wide range of DOD missions, but they are also playing an increasing role in homeland defense, disaster support operations, as well as support to civilian agencies such as Department of Homeland Security for Border Security.

Today, the military departments have a force of over 2600 small unmanned aircraft, one of them you have an example of up there, and about 300 larger unmanned aircraft that support military operations worldwide.

It is important to note—and Mr. Sabatini made this point—that our unmanned aircraft system span a broad range of capability. We have small ones up on your desk and large ones like Global Hawk that are over 27,000 pounds.

I just have a couple examples of those. The Raven, which is the next graphic, is an example of a small unmanned aircraft system, and this is the most polarific unmanned aircraft that we have in the force today. It is typically operated by one or two soldiers; it is primarily used for situational awareness at a fixed site location. The range of the system is typically 5 to 6 nautical miles. It operates at altitudes typically of a couple hundred feet, but up to 1,000 feet; and the endurance is about an hour. Generally, this aircraft has performance similar to what you might see in a commercial radio-controlled model aircraft.

The next graphic shows an example of the next level, our tactical unmanned aircraft systems. This happens to be Shadow, which the Army operates. It ranges out to up to about 80 nautical miles, typically operates at altitudes less than 5,000 feet and at air speeds typically less than 80 knots. Its endurance is about five hours, and its size and performance is similar to many manned ultra-light aircraft. It typically operates from small, unimproved airfields and it carries an electro-optical and infrared camera system, one similar to what you might find in a traffic helicopter.

The next level of performance in DOD's unmanned aircraft are shown with the Predator A system here. Predator A is about 2400 pounds, roughly the same size as a Cessna 172. And the next figure, Global Hawk, which I mentioned previously, is about 27,000 pound aircraft. These systems generally operate at altitudes ranging from 15,000 to over 60,000 feet for very long endurances, sometimes in excess of 30 hours, and they operate from established airfields. They carry a variety of sensor systems, including electro-optical, infrared, imaging radar, single intelligence payloads, and some others. They are typically operated beyond the line of sight in that we operate them through a satellite link. And as an example, the figure I showed of Predator, we have multiple Predators in theater today. Virtually all of these are operated through a satellite link and they are commanded and controlled from an Air Force base in Nevada.

The term "unmanned aircraft system" properly identifies the airborne component as an aircraft, which is consistent with the Federal Aviation Administration's view of these platforms. During the last year, the Office of Secretary Defense released our third edition, in August of 2005, of the unmanned aircraft systems roadmap, which is our broad-range plan for integrating service developed systems and capabilities into the longer-term goals.

I would like to point out that one of our top goals in this roadmap was to foster the development of policies, standards, and procedures that enable safe, routine, and timely operations by unmanned aircraft in both controlled and uncontrolled airspace.

Military unmanned aircraft have historically been flown on test and training ranges that were restricted, or in war zones, and, thus, they were largely segregated from manned civilian aircraft. But this is changing, as has been pointed out recently. In order to fully integrate unmanned aircraft into the national airspace outside of restricted airspace, there are regulatory and technology issues that must be addressed by both DOD, FAA, and other industry partners. Our airspace plan for the integration of unmanned aircraft details these issues and key drivers that must be addressed to achieve the goal of safe routine use of the national airspace certainly by DOD unmanned aircraft and likely by commercial entities in the future.

In 1997, FAA and DOD agreed to allow DOD unmanned aircraft access to the NAS using the previously described Certificate of Authorization process. The COA process allows for DOD unmanned aircraft access to the NAS for events that are planned well into the future, and this process has served all parties very well and continues to do so today. However, it is insufficient to support operations of an unplanned nature, such as disaster operations or homeland defense. A significant number of DOD COA approvals recently have increased in length of processing. and in some cases a few DOD programs have experienced some delays that impacted the programs.

Now I am happy to report today that I have been informed that a number of those pending COAs are about to be approved today, and that is certainly good news to DOD.

While ground-based radar has been the primary means for providing equivalent level of safety for the COA process, it has limitations and, in DOD's view, it is not a long-term solution. To mitigate radar limitations, DOD is developing technologies that fall under the broad category of collision avoidance, also been described as sense and avoid technologies, and we believe this capability will be organic to many DOD unmanned aircraft. We also believe that these capabilities will likely exceed the capability of the human eye.

Directly related to this technology development is the need for standards to design and build to, and to collect data to measure the effectiveness of these specific sense and avoid systems. DOD is planning to demonstrate optical systems that have a sense and avoid capability later this year.

Our airspace integration plan for unmanned aviation also recognizes that not all unmanned aircraft will likely be qualified to file-and-fly in all classes of airspace, and DOD promotes three categories for unmanned aircraft. The first category fully complies with Title XIV, Part 91, including the ability to see and avoid, and systems that would meet that qualification could be Global Hawk with future technology upgrades.

The next category would be similar to light sport aircraft or ultra-lights. They probably would not have a full capability and would likely, at least in the near term, require Certificate of Authorization to operate in the NAS. And Shadow may be an example of one of those.

Finally, the last category are the small unmanned aircraft, similar to RC model aircraft. We do not believe a COA is probably appropriate for these, at least an individual COA, and BATCAM and Raven might be candidates for this category.

Standards and technology enabling unmanned aircraft to be qualified for file-and-fly are still being developed; however, DOD is investing significantly in this area. Once the technology is developed and proven, regulatory changes will likely be required to allow DOD unmanned aircraft to file and fly. Regulatory changes that could allow DOD more flexibility for small unmanned aircraft we believe, however, could be implemented very soon, and DOD needs that.

In summary, DOD has safely accumulated hundreds of thousands of unmanned aircraft flight hours, many of which were in congested airspace in Iraq. DOD unmanned aircraft increasingly require routine access to national airspace outside of restricted areas for combat training, homeland defense, and disaster relief operations. Routine access at the current COA process does not accommodate well. Changes to the current COA process can provide more routine access and safe access to the NAS now, while DOD and FAA work together to define and implement a long-term plan for airspace integration for the full range of unmanned aviation.

DOD's priorities for immediate action are: first, to continue to work with FAA to approve all our pending and future COA requests in an expeditious and timely manner; second of all, to work with FAA to provide great airspace access for our small unmanned aircraft operations outside of restricted airspace; and, finally, to work with FAA and other government agencies for the development of standards for sense and avoid capabilities.

Today, DOD and the Department of Homeland Security unmanned aircraft operations in the NAS typically occur over very low population areas and airspace with very low densities, and our safety record clearly demonstrates that DOD unmanned aircraft operations in the NAS have not posed a significant risk or threat to the public or have been a hazard to safe airspace operations, and DOD fully intends to keep it that way.

This concludes my prepared remarks, and I would be happy to answer any questions at the appropriate time.

Mr. MICA. Thank you.

We will now hear from our last witness on this panel, Mr. Michael Kostelnik. He is Assistant Commissioner of the Customs and

Border Protection Office of Air and Marine under the Department of Homeland Security.

Welcome, sir, and you are recognized.

Mr. KOSTELNIK. Thank you, Mr. Chairman, Congressman Boswell. Thank you for the opportunity, at a time period when the Nation's security is on the people's mind, to have the opportunity to share with you how U.S. Customs and Border Protection is actually using UAVs today in the national airspace in concert with the Department of Air Force, Department of Defense, and our good friends at the FAA.

U.S. Customs and Border Protection, now three years old, got into the UAV business through legislation and direction under the Intelligence and Terrorism Prevention Act in 2004, and with the funding that was subsequently provided in 2005 and 2006, we were able to competitively choose and procure two operational systems. We chose a Predator B, which is a larger version of the Predator A that my colleague just showed, very similarly equipped, but much more capable in terms of duration. We actually entered into service with the first vehicle in September of last year, and it has been very high performing, as was indicated by earlier comments, in the southwest border under the auspices of the Border Patrol.

Now, the UAV is not the panacea for all our missions. They are not going to approach manned approaches to border surveillance, but they certainly are force multipliers, in our view, and we use them very carefully where they make a lot of sense. We have a lot of activities and a lot of infrastructure dedicated toward border surveillance, much as Congressman Boswell talked about. We still have aircraft with standoff radars looking around our borders, much as we did in the 1960s and later in the 1970s, when borders were important overseas. But today it is much more sophisticated and we have other capabilities: we have air stats, airships covering the southwest border, P-3 aircraft and other smaller aircraft carrying a wide variety of sensors and multi-spectrums, doing border surveillance. And our UAV use of the Predator B fits nicely into this approach.

The aircraft we have chosen is a fairly large aircraft by UAV standards, realizing there are many issues with a wide variety of UAVs that exist today. It is about 10,000 pounds max gross weight, a wing span of about 66 feet. So if you saw this in person, you would pretty much think that you were looking at a light homebuilt type of aircraft.

The issues that have been raised in terms of safety, the continuity of command and control, see and avoid are all issues that we try to deal with in some way. The Predator B design was specifically chosen because of the specific robustness in this area because of the size of the vehicles and the design. There are multiple redundancies built into the programs, multiple options for fail safe approaches during emergencies. And although the vehicle itself is unmanned, there are large crews on the ground in the near vicinity where the aircraft is operated and remote sites with radar coverage over all of the flying infrastructures in the Country that watch our vehicles in the areas we choose to fly in throughout all the regimes of flight.

Our specific area of operation is currently in the Arizona border, participating in a wide variety of activities, trying to secure the southwest border. The typical missions launch in the evening. We fly pretty much at night, from dusk until dawn the next day, typically 14 hour missions. The vehicle is out doing surveillance with both radar, infrared and electro-optic sensors, looking for illegal immigration, looking for illicit narcotics movement, and working with Border Patrol and other equities on the ground to recover.

I am proud to say that we have had very good result from our systems since our system has been operational, one vehicle since September of last year. This vehicle, in concert with Border Patrol equities on the ground, have been responsible for detecting 1800 illegal immigrants trying to come across the border in the southwest. Twelve hundred of those were actually detained and apprehended as a result of inter-relationships between the UAVs and people on the ground. About 7,000 pounds of illicit narcotics, mostly marijuana, has been recovered, and the seizure of four vehicles. So you could see if you took just the street value of those things and the potential issues if some of those immigrants turned out to be terrorists or terrorist-oriented, rather than economic emigres, the significant impact the UAVs are currently having in our border security initiatives to date.

We are very pleased, working very close with the FAA and will continue to do so in the future to ensure that we not only keep the national airspace safe, but we keep our borders safe as well. We honestly believe with greater facilities like the air marine facility out in Riverside, California, and current connectivity, all the time we are flying with the vehicle through radar in current connectivity with the FAA, the way we file with flight plans, the redundancies of the vehicle, we feel very strongly not only can we operate the vehicle safely and around the times and the areas we specifically choose and need to protect our borders, we think we can contribute very purposely to the learnings and to hopefully the requirements definition for how other UAVs could be modified with similar approaches to fly in broader reaches of the airspace. We are a member of the group with the FAA and look forward to working with them to extend the operations through the remainder of the borders.

I look forward to your questions. Thank you, sir.

Mr. MICA. Thank you. I have a few questions I will start out with.

First of all, Mr. Pease, I think I attribute this quote to you, that the COA, this current process of approval, is not a long-term solution. I think that was a comment that I heard from DOD. And then I think one of you alluded to the fact that some COAs that have been pending are about to be approved. I don't know if it is as a result of the hearing, but one of the problems that we have heard, that this current process that we have takes a long time, and we have current congestion in the approval pipeline, and we probably expect more in the future. So your comments or DOD's comments that this is not a long-term solution, what do you suggest?

Mr. PEASE. I am not sure, Mr. Chairman, that I said that. In fact, I don't think I did. But—

Mr. MICA. It was either you or Weatherington.

Mr. PEASE. Yes, sir. I would like to address it, however. I think the COA process was a good process when it was put in place, and it has worked very well over the last—I believe it has been working since the late 1990s. But in any process, especially when you are dealing with very rapid changes, as I talked about before, in technology and operational know-how and increased demands, then, and as Mr. Sabatini said, the numbers of COAs are starting to get up very—becoming time intensive, if you will, for staffs and whatnot. And we have, again, since I started looking at this last December, we started to look at the process itself to re-engineer the process. So I think up until—in the past the COA process has been adequate, but in the future we are going to have to look at making it more streamlined. And I believe we are committed—I know the FAA is committed—to making it more streamlined.

We have looked at the COAs that are about to be approved. We took about a 90-day look at them again, just to make sure we are operating safely, because of what we see as there going to be a proliferation of new requirements in the future.

And I will let Mr. Weatherington add anything to that he wants.

Mr. WEATHERINGTON. Sir, I would just confirm what Mr. Pease indicated. For some activities the COA process still probably fits DOD's requirements pretty well if we can fix this backlog that we have. There are some operations, however, because of their very time intensive nature, that a COA process does not seem well suited for. Now, we do—DOD and FAA do have other methods to accommodate those. They aren't well developed yet. So DOD and FAA will be continuing to work the improvement of the COA process and the refinement of other options. TFRs were mentioned as potentially another solution. There are limitations and potential drawbacks to TFRs also, however. So the long-term aspect from DOD's perspective is we need to develop the technologies that for the most case will allow DOD's unmanned aircraft to file and fly and gain access to the NAS similar to what commercial aviation does today.

Mr. MICA. And for the DHS representative, you are being called on more for border patrol enforcement purposes. Are you seeing the same problem, the approval process is awkward or out of date, or we need some expedited means of approval?

Mr. KOSTELNIK. I think for the present, Mr. Chairman, we are actually in pretty good shape. We are in fact operating under a COA in Arizona in about a 100-mile stretch, and we do have one of those pending that is in the final stages of approval this week, which we expect to get authorities to extend that coverage to 344 miles. But for us, since we only have one operational vehicle and will not get our second aircraft until summer, actually, we are the beneficiary of taking time to do this, and I would submit that each one of these COAs needs to be kind of driven, the time of it, by the risk associated with the type of aircraft that is seeking approval, the location and way in which that aircraft will be flown, and the risk both to civil aviation and the purposes on the ground. So for us, in the areas where we are flying now, in the Arizona, soon to be Arizona and New Mexico border, and hopefully downstream in the Texas border, we will be flying, by and large, late at night and over uninhabited areas, again, with a very sophisticated radar coverage.

So we are comfortable with the process to date, and we don't really have the number of assets that DOD has to require such a fast turnaround, so I think we are comfortable with where we are today.

Mr. MICA. Mr. Sabatini, having known him for some time, is sort of Missouri-oriented in his philosophy, sort of like Mr. Show-Me. He said in his testimony that we do not now have the technology to monitor these unmanned aerial vehicles. And then I heard—and again I don't have names—one of the DOD representatives said see and sense and avoidance systems are right around the corner. How close are we, Mr. Weatherington or Mr. Pease? In fact, one of you testified that—my notes here—it would be better than the human eye. When can we expect that technology?

Mr. WEATHERINGTON. Yes, sir. From a technology perspective, DOD has extensive work modeling human pilot performance, and we have the opportunity then to take that human pilot performance and run it through a number of simulations. And our data indicates that for some scenarios, the human eye, assuming that the pilot is very responsive to visual cues, still is not sufficient to avoid some near miss situations. So that was really the basis for a remark that, from DOD's perspective, the detect and avoid systems that we are developing we believe need, in most cases, to be an improvement of what the human capability is today.

I also mentioned that—

Mr. MICA. When do you think that you will have something that meets Mr. Show-Me's requirements?

Mr. WEATHERINGTON. DOD has been in consultation and has briefed FAA on—

Mr. MICA. Are we talking a couple of years, a decade, right around the corner?

Mr. WEATHERINGTON. Sir, it really depends on the performance of the system. Certainly by the end of the decade DOD believes that we will have technology sufficient to provide an equivalent level of safety for a Predator class system in visual flight condition rules, and hopefully have that onboard the system.

Mr. MICA. Quick question. What kind of safety record do we have now with both DHS and DOT? Have we had—I thought somebody told me we had some near misses. Is that the case or am I getting a bad scoop?

DOD?

Mr. WEATHERINGTON. Sir, for NAS operations, I am not aware of any incident that we have had in the last seven years that resulted in a near miss with commercial or general aviation aircraft. Now, I will say that in restricted areas DOD operates somewhat more aggressively to simulate combat operations. In those cases we do integrate manned and unmanned very closely. We have not encountered any unsafe operations, but it really depends on how you ask the question as to what answer you get back.

Mr. MICA. DHS?

Mr. KOSTELNIK. No, sir. In our operational experience since September of 2005, we have had no incidents, safety or otherwise, with the Predator B that we have been flying.

Mr. MICA. Mr. Sabatini, you are spending more and more resources, time and effort in this current approval process. Is there anything that can be expedited? You saw from the charts the number of these flights; just in like the last year it looked like they doubled. What are we going to do from your standpoint? You are going to need more resources just to handle the current processing. Is this going to be out of control in a short time without technology to deal that you deem satisfactory?

Mr. SABATINI. Mr. Chairman, let me say that I would agree that the COA process is certainly not a long-term solution, recognizing that this has now become quite prominent in terms of unmanned aircraft seeking access to the NAS. This past year I established an unmanned aircraft office, program office, with three people assigned to it. Again, those folks are taking out of hide. We had not anticipated growth so early. So that basically has come out of our hide, as I say. But in the 2007 budget I am asking for six people that can add to the processing of COAs and experimental airworthiness certificates.

I believe that we are being quite responsive to the needs of the different Federal agencies. Where today, again, beginning with a process that started fairly recently, we had a 60-day turnaround. We are cutting that down to 30 days as we have gained experience. It is also important to note that we have a long history with the military in terms of they are responsible, as we all know, for the defense of this great Country of ours. They have been able to access the airspace, the NAS, to conduct their business on an ongoing basis, and they have developed an expertise. If you recall the discussions we had a few years ago around public use aircraft, they have a resident expertise in the certification of their own airframes. As other Federal agencies come online and wish to operate in public use aircraft over which the FAA has no direct certification responsibility for the airframe, those agencies need to develop their own expertise similar to what DOD has done very successfully.

So we are anxious to work with the Federal agencies, and I believe that we can turn around COAs in a very timely way.

Mr. MICA. Thank you.

Mr. Boswell.

Mr. BOSWELL. Thank you, Mr. Chairman.

Just to continue there, Mr. Sabatini, how long do you visualize before final resolution for the regulations for the UAV integration into the national airspace?

Mr. SABATINI. It is difficult to put a time on that, Mr. Boswell. We have, again, proactively, engaged and tasked the RTCA to address the command and control, detect, sense and avoid issues because they are—those capabilities are lacking on unmanned aircraft today. The RTCA has been quite responsive in expediting the process that they are using. Remember, this is a voluntary basis on the part of industry. They come together at their own expense and work with FAA and the Federal agencies in determining what those requirements need to be. And we believe we will have an outline of what those requirements may be by the end of this year, in 2006, and expect further development by the end of 2007 for positioning us then for rulemaking.

Mr. BOSWELL. Okay. When you lose control, what do you do, destroy the aircraft, or do you land it, crash it? What do you do with it if it gets away from you?

Anybody.

Mr. KOSTELNIK. I will go ahead and answer that for DHS. Flying the Predator B I think is very typical of the Predator A. We fly these things both line of sight with a C-band and also beyond line of sight, especially in the DOD, with Ku-band radar. The aircraft are programmed such that if you lose line of flight, it preprograms into an alternative. In the case of DHS Predator B, we can fly the vehicle through another source. Even though we typically have line of sight only for our aircraft, we can fly them through an Iridium satcom that allows us to take the aircraft back to a locale where it can re-establish line of sight. If it cannot establish realignment with the line of flight [sic], then it goes into an orbit for a certain amount of time and then ultimately returns back to field and hopefully gives an opportunity to pick up again line of sight control. And if line of sight is not picked up, then typically it is either landed or purposely crashed in a non-inhabited area.

So you can program and have backups to all kind of contingencies that happen. In the case of DHS, during these kind of emergencies, we are always monitored by our radar facility out in California, through local radars in the area where we are immediately following, and through feeds directly that are tied with the FAA. Everything that happens with a vehicle is watched on radar with multiple people in the loop. So, today, losing a line of sight communication is not a big deal, and when it happens usually we are able to reacquire an alignment shortly thereafter.

Mr. BOSWELL. I am just curious about line of sight. You know, if you are flying at, for some of us, 200 feet doesn't reach out there too far.

Mr. KOSTELNIK. No, that is true, and certainly the vehicle you have, the actual performance and the design of the vehicle and the way you operate it are first order effect on this. In our case, we fly our missions at 13,000 feet, so we are fairly high altitude, and we fly well within our line of sight range to have margins there which add to our redundancy to make sure we can maintain line of sight control.

Mr. BOSWELL. Okay, thank you.

Back to you, Mr. Sabatini. I understand you have issued guidance to require a company to apply for an experimental aircraft certificate for a particular UAV before it can flight test. I hear that some companies have suggested that you should develop the equivalent of a company certificate of authorization to allow them to conduct private operations in remote areas for multiple aircraft models. What are your thoughts? What are you doing there?

Mr. SABATINI. Well, for many, many years the experimental airworthiness certificate has been the vehicle that we have used to allow companies such as those that have suggested that to conduct research and develop. It is the perfect vehicle. And because it is an experimental, we then work out restrictions and limitations, and protect the public and keep those operations in areas where it cannot do any harm to people on the ground or in the air. Safety is paramount.

Mr. BOSWELL. Okay.

Mr. Pease, in the COA process employed by the FAA to allow military use of UAVs, is it sufficient to ensure our needs, do you think?

Mr. PEASE. Yes, sir. Up until now—again, when I started my position as the Executive Director of the Policy Board on Federal Aviation and these COAs were coming up to expiration, I wanted to make sure that we had—and these COAs, again, as I said before, had been in place since 1997 and a lot of things had changed since 1997. So we instituted, with the FAA, a review of our process. Again, I think that the COAs are a good process to deal with for the kinds of activities that we are conducting. As in any process, it can be re-engineered, it can be made better. We are trying to do that. And I think that it will, in the short-term, we will be able to meet our needs, but in the long term we are going to have to look at other things, as has already been discussed.

Mr. BOSWELL. Okay, this last question or comment, what is your consideration to develop these TFRs, general aviation and their impact? How much do you involve that in your decision-making process? Anybody.

Mr. Sabatini, I will help you out. You first.

Mr. SABATINI. Certainly, all those factors are considered and we work with the various associations.

Mr. BOSWELL. Do you actually contact, like, for example, AOPA to see what their feelings are? Do you actually engage them at the table?

Mr. SABATINI. Well, I don't know that we actually might be at a table together, but we certainly have conversations. For example—

Mr. BOSWELL. They are pretty nice folks. You ought to get at the table once in a while.

Mr. SABATINI. Well, Mr. Boswell, I am a member of AOPA.

Mr. BOSWELL. So am I, but that is not the point.

Mr. SABATINI. But I do know them, and we work very closely with them, and I will tell you that we certainly consider, very definitely consider their concerns and their issues before issuing a TFR. Their needs are well understood and accommodated for.

Mr. BOSWELL. Okay. Well, thank you. We will count on that. I appreciate that.

Thank you, Mr. Chairman. I yield back.

Mr. GRAVES. [Presiding] Mr. Coble?

Mr. COBLE. Mr. Chairman, I have been between hearings, Judiciary and here, and have missed most of this. I just want to thank the panel for being here, but I have no questions.

Mr. GRAVES. Mr. Hayes, questions?

Mr. HAYES. Thank you, Mr. Chairman.

Congressman Boswell, don't rush off here, now. Is it true that they accused your helicopter of being unmanned when you were flying it?

[Laughter.]

Mr. HAYES. Leonard and I are very good friends and have an extremely high interest, as does Chairman Graves, in this whole issue.

I think the integration into the system—and I apologize for not hearing the first part of your testimony. I appreciate your being here and appreciate Chairman Mica holding the hearing.

When will there be routine operations, in the opinion of the panel, taking place in the national airspace? Well, let us start with that. When might this take place, or, in your opinion, General Kosteli [sic], is that happening now?

Mr. KOSTELNIK. No, sir, I certainly don't think it is happening now. And I think, given the policy issues with the wide variety of UAVs, I mean, there are some like the model that is sitting up there, you know, it is not very capable compared to a 10,000 pound, 66 foot wingspan. So we have everything—and Global Hawk even larger—we have everything in between. I would certainly, as a professional pilot myself, be more comfortable with these larger systems operating with all the kind of things it would have and all the redundancies. I would not be as comfortable with that flying in the routine national airspace with small things.

For us in Homeland Security, the good news and the bad news for us is we are flying at very specific locales, very close to, in many cases, DOD ranges that exist, very close to the border, where you wouldn't expect a lot of commercial civilian traffic; and mostly our missions are late at night, when usually the people that are flying in those locales are up to no good. So a lot of our activity, which I would say is not routine, is very carefully orchestrated, using a wide variety of assets, and I think we are probably not much of an impact or threat to impacts on civilian aviation into the national airspace. And as we continue to grow this capability, we will be growing in different border locations, the northern border in particular, as well as the south and some of the coastal regions, but typically they will be in locales that are low-density populations and very carefully orchestrated towards very specific ends.

Mr. HAYES. So you don't really see this, at this point, as being a major conflict. As is Leonard and Sam, we are all concerned about conflicts. The general aviation industry is so important to our economy, the commerce, aircraft manufacturers in this Country are so important. I want to make sure, going forward, that we don't fail to blend this in, but it is an important tool.

I am led to believe, in my home State of North Carolina, recently a police department had talked about using an unmanned aerial vehicle. Is that being contemplated, is that being done? Anybody on the panel now. How common is that?

Mr. SABATINI. Well, it is not very common, Mr. Hayes. We did have conversation with the police chief at Gastonia, North Carolina, and he has been very cooperative. We helped him understand the complexities of introducing a vehicle into the airspace, the difficulties in the perhaps unsafe operations over congested areas, and he has agreed to operate those aircraft in accordance with what we are doing to help them be successful in those operations.

Mr. HAYES. Anybody else have a thought on that? As long as we keep the coordination and cooperation going and keep everybody in the loop.

Mr. Weatherington?

Mr. WEATHERINGTON. Sir, yes. I don't know if you saw the graphic I showed earlier. Last year, DOD flew in excess of 100,000 hours. Now, most of those hours were in combat operations.

Mr. HAYES. Absolutely.

Mr. WEATHERINGTON. Approximately 30,000 of those hours, slightly greater than that, were for operations in CONUS. Most of those were in DOD restricted airspace. However, as DOD continues to populate the forestructure, more and more of those hours will be flown outside of restricted airspace. A specific example of that is later on this year the Air Force will begin regular operations at Beale Air Force Base with Global Hawk. Beale is Class D airspace up to 3,000 feet, I believe, but once you get above 3,000 feet of airspace, you are in the NAS.

Now, Global Hawk transitions relatively quickly up to a relatively high altitude at low congestion levels, but those operations will become very common later on this year, and certainly next year.

Additionally, General Atomics, which I believe Admiral Cassidy is on the next panel, has operations very close to DOD restricted airspace near Edwards Air Force Base. There are regular operations ongoing at those locations also. Typically, they transit into DOD restricted airspace to conduct most of their operations.

But in answer to your question, from DOD's perspective, there is a significant amount of activity happening today in the NAS. Again, most of that is in restricted airspace today, but the percentage of hours outside of restricted airspace will grow considerably over the next five years.

Mr. HAYES. If I might, Mr. Chairman, just one more question. Is it safe to assume—now, I am assuming that military operations are very precisely choreographed and handled, and the operator of the vehicle is in contact with the appropriate control facilities as the vehicle penetrates airspace. If I am correct, assure me that is the case. Where my concern goes, if there is a significant number of uncontrolled by various and sundry agencies just out doing whatever Gastonia—not to say that it is anything bad. But that is where my concern begins to get great.

Thank you all for your testimony. I apologize for going over.

Thank you, Mr. Chairman.

Mr. GRAVES. We are going to go ahead and set the next panel now. We are going to have a vote coming up in about 10 or 15 minutes, so we want to try to get started as quickly as possible. I apologize all of you being here today.

And we will set the next panel, which is going to be Dr. Robert Owen, Professor of the Department of Aeronautical Science at Embry-Riddle Aeronautical University; Mr. Andrew Cebula, Senior Vice President, Government and Technical Affairs with the AOPA; Dr. Mike Heinz, Executive Director of UNITE UAV National Industry Team; Rear Admiral Thomas J. Cassidy, who is President of General Atomic Aeronautical Systems; and Mr. Jay Mealy, Programs Director at The Academy of Model Aeronautics.

Thank you all for being here. We will go ahead and start with Dr. Owen.

TESTIMONY OF DR. ROBERT C. OWEN, PROFESSOR, DEPARTMENT OF AERONAUTICAL SCIENCE, EMBRY-RIDDLE AERONAUTICAL UNIVERSITY; ANDREW CEBULA, SENIOR VICE PRESIDENT, GOVERNMENT AND TECHNICAL AFFAIRS, AIRCRAFT OWNERS AND PILOTS ASSOCIATION (AOPA); MIKE HEINZ, EXECUTIVE DIRECTOR, UNITE UAV NATIONAL INDUSTRY TEAM (UNITE); RADM THOMAS J. CASSIDY, JR. (RET.), PRESIDENT, GENERAL ATOMIC AERONAUTICAL SYSTEMS; AND JAY MEALY, PROGRAMS DIRECTOR, THE ACADEMY OF MODEL AERONAUTICS

Dr. OWEN. Thank you. Members of the Committee, first of all, let me say, like everybody else does, that I am honored to be here. These are important hearings and I am glad to be a part of them.

If I may impose on you for just a moment, I want to explain Embry-Riddle's interest in unmanned aviation. As the world's only university centered on aviation, we take a broad interest in anything that has to do with building aircraft, conducting and supporting flight operations, and managing aviation business. This interest extends to unmanned aviation as well. Currently, we are addressing UA through a variety of engineering, flight test, human factors, air traffic and flight simulation, and policy development activities.

In my remarks here, I intend to lay out a few important what I call truths of commercial unmanned aviation for your consideration and to suggest two legislative priorities springing from those truths. My hope is that these points will make the case that the time for more active congressional involvement in this area is now, not later.

First, it is important that we all understand that private and commercial operators are flying thousands of unmanned aviation vehicles and systems in this Country and around the world. I list a few areas of application here on the slide just for illustration; there are many, many more. The problem is that there is no body of law or regulation in this Country that enables the conduct of routine, safe, and profitable unmanned commercial flight. While the FAA's Advisory Circular 91-57 covers the flight of recreational model aircraft, neither it nor any other document allows people to fly similar or more sophisticated unmanned aircraft for pay. If, for example, I use a three pound radio-controlled aircraft to photograph my house for fun, AC 91-57 makes that a legal operation. If, on the other hand, I use the same aircraft on the same flight to photograph my neighbor's house and charge him $10, I am operating outside the bounds of regulatory approval.

Next slide.

Virtually all of the systems operating commercially today are low-end systems. Most of those are small systems as well. These are aircraft, often only a few pounds in weight, controlled directly by the operators, who maintain visual, line-of-sight contact with their aircraft and their operating environments. As the bullets in this slide indicate, the commercial advantages of low-end systems include: their small size; and operating patterns that usually don't require flying more than a few hundred feet above the ground, well below normal air traffic. Not often recognized is the economic benefit of their operation by what I call adjunct pilots, pilots who fly the aircraft as an aspect of their job, but not as the primary focus of that job.

In contrast, there are no high-end UAS systems that have entered civil government or commercial markets on a routine basis. By high-end, I mean systems that tend to be large, perhaps tons in weight, and, most importantly, that operate outside of the visual range and, quite often, beyond the electronic horizon of the operator. The current barriers to applying high-end UASes to commercial operations are profound. Most importantly, the absence of permissive regulation makes it impossible for operators to put them into national airspace routinely or predictably. Also, their control infrastructures, whether terrestrial or space-based, are expensive. The size of these unmanned systems also represent significant risk to other aircraft and people on the ground, resulting in high insurance costs. Last, the flight and support crew costs of these high-end systems at the moment are more expensive than those of manned aircraft doing similar missions.

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As I believe this panel is aware already, the focus of UA regulatory development has been on high-end systems. This focus has made sense given the immediate interest of the military and the major manufacturers providing its unmanned aerial systems. But from a commercial perspective, this focus is ironic since it serves realms of UA that are the least likely to be viable economically on a large scale and in the near term, and ignores the low-end realm that has become economically active despite the neglect.

The point of this slide simply is that the state of UA knowledge and regulation today makes it difficult to measure its business attributes and potentials. The absence of a common analytical language, for example, about things like categories of commercial UA operations and cost calculators, hinders rigorous discussions of their economic and business attributes. Likewise, we need some regulator decisions on things like control system, crew member, and safety standards to provide a basis for making credible calculations of cost and profits. Last—and this is my pet peeve—the manufacturers and operators tend to hold their data pretty close to their proprietary chests, which makes it difficult for somebody like me to build up a case for the commercial application of those systems.

This discussion leads to a couple of what I think are legislative priorities. The first, above all else, is the need for Congress to accelerate the entry of UA into the national airspace and economy. The next step in that process from the congressional perspective, I would think, may be to charter a GAO and/or other studies to summarize where we are now and to suggest things like how to categorize these operations and certify them and move them on into the national airspace. This also would be a good time to pull together a relatively compact tiger team of government, industry, and academic thinkers to provide a summary assessment of near-term legislative and regulatory requirements, and perhaps even to draft language to ease military and civil operations in the national airspace and to promote the development of commercial UA.

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Second, I believe that Congress needs to charter a Federal knowledge manager for civil unmanned aviation. The role of this knowledge manager will be to provide a single office of primary responsibility for advising and supporting other agencies moving into UA activities, overseeing, and in some cases funding research and development of relevance to civil and commercial operators, and encourage the public dissemination of useful information and knowledge. There is an imminent need for such a knowledge manager. Federal and, as we have just seen, State agencies interested in exploring the application of UA to their missions do not have a single source of objective and comprehensive advice and support available to help them make effective and efficient decisions.

With that, I would like to thank you again for the opportunity to make my comments, and I will be standing by with everybody else to answer questions. Thank you.

Mr. MICA. [Presiding] Well, thank you for your testimony. I guess our next witness, having just come in, is Andrew—is it Cebula?—Cebula, Senior Vice President, Government and Technical Affairs, Aircraft owners and Pilots Association.

Welcome, and you are recognized.

Mr. CEBULA. Well, good morning. As you said, my name is Andy Cebula, and I am with the Aircraft Owners and Pilots Association. We are an organization that represents more than 406,000 pilots and aircraft owners, more than two-thirds of all the active pilots in the United States.

Thank you, Chairman Mica and Mr. Graves, for holding this timely hearing on the safety of unmanned aerial vehicles and incorporating them into the Nation's airspace system.

Although the FAA has been considering this issue for over 15 years, other than these Certificates of Authorizations, which have been discussed, with governmental agencies, no requirements for UAV operations have been issued. Meanwhile, various agencies within the government have made investments in UAVs and want to operate these unregulated in the national airspace system. Because there is no FAA regulation, the solution has been to use flight restrictions that prohibit flights within a specific area of airspace, defined by ground references during stated dates and times as the means to separate manned aircraft from UAVs.

AOPS members are extremely concerned about this approach of using Temporary Flight Restrictions, or TFRs. The recent use of airspace restrictions stretching for over 100 miles to accommodate UAV operations by CBP in the southwest part of the United States has created problems for pilots in the area. Members tell us that there are problems maintaining radio contact with the FAA in areas of high terrain that avoid the TFR. It has added to the numerous restricted airspace in the southwest, and it presses pilots to fly under the ceiling created by the TFR.

We understand that the TFR will once again be increased over 300 miles later this week. This is just another in a string of airspace restrictions, such as the Washington, D.C. Air Defense Identification Zone, that illustrates the FAA is losing control for the safe and efficient use of the nation's airspace. And as we have seen with these other TFRs, they are anything but temporary. In fact, just recently I know that this subcommittee made certain that language was included in H.R. 4437, the border protection legislation, that ensured that the FAA retained the authority to oversee, regulate, and control the safe and efficient use of airspace in the United States as UAV operations were implemented. We appreciate your action, but it underscores the need for the FAA to issue regulations.

A unique problem the FAA faces in doing so is the fact that UAVs challenge a historic foundation of pilot and aircraft certification because they operate unlike any other aircraft in the airspace system: by remote control. This makes the basic safety principle of see and avoid extremely difficult. I know that the RTCA special committee is addressing this threshold issue.

In preparation for this hearing, we surveyed pilots, asking them how UAV operations should occur, by restricting airspace or certifying their operations in the airspace system. Not surprisingly, an overwhelming majority favored certification. However, pilots tell us that the following safety concerns must be addressed before UAV operations should be considered: the inability of UAVs to detect, see, and avoid manned aircraft; the inability of UAVs to immediately respond to ATC instructions; the absence of testing and demonstrations that UAVs can operate safely in the same airspace as manned aircraft; and the need to certify UAVs to the same level of safety as manned aircraft. There are also questions about the loss of control by the operator that affects not just the aviation system, but buildings and people on the ground.

Finally, as entrepreneurs are finding innovative ways to use UAVs, an example appears in the November 28th issue of last year's Washington Post that featured a story on Aeroview International's use for agricultural and environmental evaluations. Just last week, the University of North Dakota held a summit discussing its development of research in the use of UAVs. Clearly, this is a technology that is garnering a great deal of interest and building momentum.

Our request to the subcommittee is to press the FAA for expeditious action on regulations for UAVs. Failure for prompt action threatens safety and the efficient use of the aviation system. Neither accidents between UAVs and manned aircraft, nor the implementation of flight restrictions is acceptable. The pressure for expanded use of UAVs will continue, and we believe that the time for FAA to act is now. Thank you.

Mr. MICA. Thank you for your testimony.

Mike Heinz, Executive Director of UNITE/UAV National Industry Team. You are recognized. Welcome.

Mr. HEINZ. Thank you, Mr. Chairman.

Thank you for this opportunity to provide an industry perspective on the issue of integrating unmanned air systems, or UASs, into the national airspace.

Today we are witnessing a repeat of aviation history. Military operations in World War I served as catalysts for maturing manned aircraft. This maturation was necessary to unleash the full potential of manned aviation for civil and commercial applications. Likewise, recent military operations have matured unmanned systems. Today, UASs are indispensable to battlefield commanders and are now on the threshold of exerting the same influence in civil and commercial fields.

We can now envision a future in which UASs provide 24/7 border and port surveillance to guard against terrorist intrusion, or a future in which UASs are deployed rapidly in disaster relief operations to fill communication needs, while normal infrastructure is incapacitated. Other examples are limited only by our imagination.

However, to realize this future, we must first solve the challenge of operating UASs safely and routinely in the NAS. Currently, as has been already discussed this morning, the FAA allows temporary and restricted operations of UASs in civil airspace through the COA process or through experimental certificates. These impose operational constraints, such as observers being within visual range of the UAS, which negates the inherent advantage of unmanned systems: that is, being able to operate remotely from a human.

For the promise of UASs to be fulfilled, we must find a way to gain file and fly access to the NAS and do it with no compromise to safety. As you heard earlier today from Mr. Sabatini, FAA has embraced this goal. The FAA in fact is, it is in the FAA flight plan. However, the FAA must continue to restrict access until evidence is developed that UASs can operate safely in the NAS. This requires a combination of technology, systems development and flight demonstrations to guide the development of regulations and standards. This job requires multi-agency collaboration and a Government-industry partnership.

There is an urgency of action dictated by DOD and DHS mission needs, some of which were addressed earlier today. There is also an urgency in maintaining U.S. aviation leadership. U.S. leadership in manned aviation has contributed directly to U.S. national security, global trade and quality of life. The potential for unmanned systems to make similar contributions has not gone unnoticed by the rest of the world. Indeed, the European Union has sponsored a road map for Europe to have a major influence in civil UASs.

U.S. industry is eager to retain leadership and to satisfy its customers' needs. However, it is disadvantaged by the inability to conduct industry-sponsored flight tests of new or improved UASs. Experimental certificates are a great step forward. But industry ultimately needs more flexible and timely flight test access to the NAS to remain competitive.

Also, as noted in the Committee's DHS authorization bill last week, the FAA faces challenges when certifying new products. This challenge also applies to UASs and needs resolution for sustained U.S. leadership.

To effectively deal with this national need, UNITE makes the following recommendations. First, developed a unified plan in which the efforts of multiple Government agencies are coordinated, redundancies are eliminated and gaps are filled to generate a sound technical basis for informed rulemaking and certification standards.

Second, define an organizational construct within which all relevant Government agencies, industry and academia can participate in a collaborative environment, but in which one agency is assigned as lead to integrate the overall effort or each major element of the plan. And third, provide the Federal funding necessary to implement the plan through the appropriate agencies.

Thank you once again for this opportunity. Industry looks forward to a participative relationship with Government to solve this pressing national priority.

Mr. MICA. I want to thank you for your testimony.

I will tell you what we are going to do, we have two additional witnesses. I have asked Mr. Graves to proceed and vote and return, rather than have one of you start your testimony and me walk out if he is not back. What we will do is stand in recess for just a couple of minutes until Mr. Graves returns, and then I will vote. We will do a little tag team here. But he should return shortly, and I have a limited amount of time to get to the floor to vote.

So we apologize for this interruption in this panel's testimony. But Mr. Graves will be coming back and he will recognize Mr. Cassidy and Mr. Mealy at that time. So we will stand in recess. I would not disappear, I would say three to five minutes, Mr. Graves will reconvene the hearing and we will hear from our other two witnesses, and then get to questions.

So we will stand in recess until that time.

[Recess.]

Mr. GRAVES. [Presiding,] Admiral Cassidy, I believe you are up.

Admiral CASSIDY. Thank you very much, Mr. Chairman. It is a pleasure to be here today to discuss this very important subject of flight of unmanned aircraft systems in national airspace.

Predator, the unmanned airplane controlled by an instrument rated commercial pilot, first flew in June 1994. This event was the beginning of a new era in powered flight. This same airplane type, and variants of it, have been involved since that time in supporting our military services in combat operations worldwide. Numerous types of UAVs, most without professional pilots at the controls, have actually been flying in confined areas for years before that, but the serious effort to fly unmanned aircraft type missions for very long periods began about 12 years ago.

Predator type airplanes have now flown close to 200,000 flight hours. They have operated over five continents, providing situational awareness and defensive strike capability to our military by performing missions that cannot be performed by manned airplanes. These aircraft, depending on the type, can fly for 30 to 50 hours up to altitudes of 50,000 feet. They carry cameras and radar systems and weapons and are controlled by a ground-based pilot through an electronic satellite link.

Most aircraft operating over Iraq and Afghanistan are controlled by pilots and sensor operators in the Las Vegas, Nevada area. Some are controlled locally line-of-sight.

The numbers of these aircraft and the number of daily missions required to be flown in the continental United States to prepare pilots and system operators in the global war on terrorism has dramatically increased in recent years. The real problem is pilots that operate these aircraft must be trained in the United States before they deploy. Most of the 200,000 hours I talked about are flown overseas. But we have to prepare people in the United States to get them ready to go.

Military pilots typically fly in restricted airspace adjacent to these bases. Our company pilots, who deploy into combat areas, must train at our company airports, which are not always in or adjacent to the restricted areas. Our company has some 70 deployed personnel in Iraq and Afghanistan and elsewhere in various combat areas supporting the U.S. Government. They must be trained at our airports and we must also fly airplanes between locations in the U.S.

The capabilities of these aircraft systems are continuously being improved with the addition of new sensors that must be developed and tested. These operations, often on company-owned airplanes, are conducted at company airports. The prop-jet Predator B is now flying near daily missions on the U.S. southern border for the Department of Homeland Security. The success of this operation is so impressive that you can expect tremendous growth in the number of Predator Bs operating over the borders of the continental U.S. in the near term.

The U.S. Air Force is standing up 15 new Air National Guard Predator and Predator B squadrons throughout the United States. These aircraft must fly where they are needed, which may include border protection missions. But they will be operating in probably 12 different States.

Now, these activities will dramatically increase the number of unmanned aircraft systems that must fly in national airspace. The problem is with us now and the solution must be provided now. Up until October 1st, 2005, our company operated under a COA which allowed us to then file with the FAA and fly. It was a workable solution. After October 1st, the FAA memorandum stated an intent to only issue COAs to military services.

We met with the FAA and Congressional staff and argued that since our company provides pilots to fly military Predators over Iraq and Afghanistan in combat, that our company should be considered a semi-military organization for the purposes of the COA, and under these rules be issued COAs so our company pilots can be trained in the U.S. for overseas deployments.

Our company still does not have a COA, and under the current rules cannot obtain one. The Air Force and Army now have COAs to fly. The DHS now has a COA and a very small operating area approved down in Arizona. And the Navy does not yet have a COA, even though we have the Navy Predator B sitting on the ramp ready to fly right now, but we don't have a COA to fly it.

The COAs for each user tend to be different, even though the aircraft are flying from the same locations. I might add that the Predator B flying the U.S. southern border had to fly in a confined, military restricted area south of Fort Huachuca for the first two months of the operation, able to only identify people and material entering the U.S. illegally that had the misfortune to select the route into the U.S. that happened to underlie a restricted area. The other 2,200 miles of border were off limits to the Predator B surveillance airplane, since it could not fly in national airspace.

So in the immediate near term, we need to expand the capability of these types of unmanned aircraft systems capable of filing and flying an IFR or VFR flight plan to routinely fly in national airspace and on IFR flight plans under positive control. TCAS or other collision avoidance systems can be installed with a few months lead time. In fact, we are in the process of developing a TCAS system to go into Predators as we speak.

The FAA must provide COAs in order to fly aircraft of the type we produce to any Government agency, including our company, who have a need to fly those airplanes to support national defense objectives. We need to issue one COA, one COA, to our company to operate airplanes in support of all military and DHS operations. We need to establish reasonable and expanded operating areas over and adjacent to our airports at Gray Butte and El Mirage.

We need to allow company owned and military, DHS and NASA/NOAA owned airplanes to operate in these areas and also file and fly IFR flight plans on support missions. And we need to develop a quick response process that will allow our company-produced unmanned airplane systems to be recognized as airworthy for purposes of operating in low density areas in national airspace.

In the long term, realistic operating criteria must be developed by the FAA that will allow unmanned aircraft systems capable of IFR flight clearance to operate in the NAS clear of heavily congested airspace.

Thank you for the opportunity to provide these comments.

Mr. GRAVES. Thank you, Admiral. Mr. Mealy?

Mr. MEALY. Thank you, Mr. Graves.

We have submitted our formal testimony previously to the Committee. That form includes three documents that I will refer to in my summation here. I thank you for allowing us to present this morning.

The Academy of Model Aeronautics has been in existence since 1936 and has grown to represent more than 170,000 members nationwide who participate in the sport of building and flying model aircraft. Prior to 1936, we were part of the National Aeronautics Association through which we were represented to the world governing body of sport aviation, the Federation Aeronautique Internationale. Since our establishment, we have represented our members to the FAI directly.

The Academy charters over 2,500 clubs and sanctions more than 3,000 flying events annually, the largest of which is the National Aeromodeling Championships. We are also responsible for supporting our national teams, representing the United States in world competitions and hosting numerous world competitions in this Country on a regular basis. These programs and activities have established the United States as a recognized leader in the sport of aeromodeling.

The Academy's mission as a world class association of modelers is focused on promotion, development, education and advancement of modeling activities. The Academy is also dedicated to model aviation as an educational tool for the formal classroom as well as the informal after school clubs activities and camps. Through the active educational outreach program of the Academy, we support classroom teachers and leaders of communities who wish to infuse topics of math, science and technology with engaging aviation activities.

Since our inception, we have worked closely with local, State and Federal agencies to establish and ensure the high level of professionalism and safety that our members exhibit and the general public has come to expect in a sport as beneficial as building and flying model aircraft. The sports spans all socioeconomic boundaries and brings together families, friends, communities and even countries in an atmosphere of camaraderie, competition, education and recreation.

Building and flying model aircraft develops such important life skills as creativity, patience, goal setting and perseverance, no matter what age it is entered into. The Academy has established a long and cooperative working relationship with such Government agencies as the Federal Communications Commission, the Federal Aviation Administration, the Transportation Security Administration, to name a few. These relationships and interactions have demonstrated the valuable resources and talents possessed by the Academy and the Academy's willingness to utilize those resources and talents in a meaningful resolution to provide for the preservation of this sport, and for the benefit of future generations.

In 1972, the Academy realized the need for guidance for modelers. "FAA was interested in the fact that AMA had proposed safety code which could be utilized as a set of standards for addressing the operation of model aircraft within the national airspace system." That is when the original National Model Aircraft Safety Code was adopted, an historic event.

In addition, and as an example of cooperation and joint effort between the Academy and the FAA, an advisory circular titled "Model Aircraft Operating Standards" was created in July of 1972, designated AC-9134 and later revised in June of 1981 as AC-9157 for the purpose of outlining and encouraging voluntary compliance with safety standards for model aircraft operators.

I am before you today to speak on behalf of the AMA and its members, to preserve our privilege to operate in the National Airspace System, a system which is being asked to make room for the burgeoning UAV community and the vehicles they are creating for commercial and military purposes. It is not the intent of the Academy to in any way impede such development, evolution and acceptance. We are fully aware of the market and utility of such vehicles in enhancing the lives of us all.

We do, however, note that because of the superficial similarities between model aircraft and UAVs the potential does exist to look at them as one group. They may look the same, but they are definitely different. And that difference is not in their appearance, but grounded solidly in their intended use.

The focus of the AMA is on recreation, sport and competition, activities that are available to model aviation participants. Our 70 years of overseeing this sport speaks highly of the ability of the Academy and its members to continue to operate effectively in a cooperative manner with related governmental and non-governmental agencies. Model airplanes may have been a huge contributing factor in the development of UAVs, but model airplanes are still model airplanes, fulfilling their intended purpose of recreation, sport and competition, as they have for decades.

Our request to this Committee is that model airplanes be permitted to continue operating within the National Airspace System as we have for more than years, as we commit to tirelessly working with all pertinent Government agencies and in particular, the FAA, as we have always, to guarantee the safe and sound operation of model aircraft in this Country. We request that model aviation not be innocently sucked into a black hole of regulation, a place in which, based on its long and successful history, it does not deserve to be.

Thank you for your understanding and consideration in this very important matter. I look forward to providing answers to any questions you may have. Thank you.

Mr. GRAVES. Thank you.

Can you all, and I guess it's directed to everyone, I would be very interested in ultimately what we are looking at, how far we are going to go with this. Obviously the commercial applications of UAVs are incredible. There is a lot of things that can be done out there, which concerns me a little bit as a pilot, which is the reason for this hearing.

But I will direct it to, and we will start with you, Dr. Owen, what ultimately are we going to be seeing? I think in your testimony we saw that already in the world we are seeing crop dusting operations and we already know that things are going on with the military and INS, things like that. But I'm talking about commercial operations. What are we ultimately looking at?

Dr. OWEN. I am told by my engineering buddies that for a million dollars they could convert a Boeing 747 into a UAV for cargo operations. I can't verify those numbers exactly, but they would say that that is certainly within the realm of possibility.

We held a conference on the commercialization of unmanned aviation at Embry-Riddle last October. We will hold a second one next March. And one of the questions we asked was, how much or how willing would people be to commit their lives to a robot, to an automated system. We had a historian give a very good paper, his point was, looking back historically is that with the right kind of performance and the right kind of publicity, people will put their lives in the hands of machines.

So I guess I am one of those people who say it is in the realm of possibility that we could see passenger aircraft flying somewhere out there some time in the future, not with me on board, but without pilots. Whether or not we would ever get social permission to go that far, I don't know.

More to the point now, though, is that I think, in fact, I know, there are literally hundreds of people out there who are either already performing commercial operations outside the bounds of regulation, generally without insurance, but who are more than ready to do so. So as you point out, this could be, I think particularly at the low end of the short term, it is a large industry waiting to be born. In fact, it is already born to some degree.

Where we will go in the long run depends on a lot of essentially non-technological issues, sociology, politics, economics, business, human nature and so forth, that have not been well explored. So I don't know the ultimate answer.

Mr. GRAVES. Anyone else? Admiral?

Admiral CASSIDY. We have actually been involved to some level in forest fire monitoring with these airplanes. I don't know all the details, but I know we had Predators deployed down in the Louisiana area for Katrina and also in Texas. I don't think they were ever flown because of this National Airspace problem.

But the people that own these airplanes, in this case the U.S. Air Force, felt that they could contribute and they moved the airplanes down there but never got to use them. So there is a lot of potential out there. I think if we move faster that we are moving on this problem that we will get a lot of use out of these airplanes.

Mr. GRAVES. Mr. Heinz?

Mr. HEINZ. I think as in any embryonic industry the applications are limited only by our imagination at the moment. But some of the near term applications that come to mind, probably one of the most promising would be, since these systems can operate, let's say, in near space for very long periods of time, they could potentially serve as communications satellites for all practical purposes, not necessarily replacing space-based satellites but certainly complementing them and filling in gaps and allowing that last mile problem to be fixed.

Someone mentioned unmanned cargo. That is certainly in the realm of possibility out in the future. There are many other commercial applications that have already been mentioned.

So it is embryonic, it is waiting to be unleashed. Only time will tell exactly where the market forces take us.

Mr. CEBULA. One of the big issues, and I think the Subcommittee has done a great job in bringing the issue to the forefront, because I don't know that most people in civil aviation have really thought about what may be the future for UAVs or what's even the current reality. So this is a very good start.

But there are some really significant issues and ones that really concern us, which is, the Customs continued desire, and we certainly can't fault them for what they are attempting to do, but it all requires temporary flight restrictions or, in the case of year-long flight restrictions. And when they are talking about the entire southern border, and I think he also alluded to, the previous witness alluded to Canada, in that order.

That could have a very significant impact on aviation. I think one of the things that has to happen is that the FAA must have a regulatory framework for the operators of UAVs to know what it is that they have to meet.

Mr. GRAVES. Well, this may be a question that is more appropriate with the last panel, but I will ask it, because, Admiral Cassidy, you brought it up VFR versus IFR. How often are flight plans filed VFR as opposed to IFR? Can you tell me that, or do you know?

Admiral CASSIDY. Well, when we transit any place in the in the Predator, the Predator B, it's typically on an IFR flight plan at high altitude, above 18,000 positive control. The pilot is talking to an FAA controller the entire time. He takes vectors just like the airliner in front and behind him are doing. And they fit, the controller really doesn't even know it's an unmanned airplane. He is talking to an instrument rated pilot who can follow his direction. We have never had a problem with it.

Now, VFR, we really don't transit VFR. We always go IFR. And that is the way I think we ought to be doing this, under positive control.

Mr. GRAVES. VFR is what I am worried about. If you are loitering over an area or whatever the case may be, and VFR is what I am worried about more than anything else. You are obviously going to be changing altitudes, you are going to be moving, it is just, that is what I worry about, I guess.

When you talk about restricted areas, and using those areas to train, are you looking at, I mean, what would you ultimately like to see, more restricted areas? Or my belief is, we have restricted areas out there for military personnel to train in. That is what they are set up for. We as regular pilots, private pilots, are supposed to stay out of those restricted areas.

Are you looking at, or would you like to see more restricted areas or access to those restricted areas for your company, that is trying to train pilots and obviously having a problem with that, trying to get that access?

Admiral CASSIDY. The airports we operate and own are within about 20 miles of the Edwards restricted area. When we do operate at Edwards, we have to pay a tremendous amount of money by the hour to use the restricted area. So to me, that is not very desirable.

Plus, the rules for using it and the oversight border on, I don't want to say the word, but it is extremely complicated. I would prefer we didn't have to use restricted areas. I would prefer we have temporary flight restrictions. Any time we are operating, put a NOTAM out. If we had TCAS in the airplanes, that is a step forward. I would even go so far as to add another camera gimble to the airplane that you could use to rotate 360 degree continuously to see and be seen.

I fly a KingAir. I can see about this much in front of me. I can't see anything behind me or above me. If you have a camera gimble on these unmanned airplanes that is rotating, you can see a lot more than the typical commercial or general aviation pilot can see. So I just think we need to get a little more aggressive in what we are asking the UAV operators to do and let's get on and do it.

Mr. GRAVES. Personally, I would rather not have the TFRs. I would rather have you in a restricted space that is just yours and we will stay out of it and leave your training to that. But that is a personal opinion, I guess, or what I would think. I am a little concerned about it. I understand the use. I understand how important it is, and I know it is doing wonderful things in Afghanistan and Iraq. I can see, I am a little frustrated by the fact that it would cost so much to train a pilot that is going to be doing military operations. If it is commercial operation and you are training somebody for commercial, I can see a little bit different, obviously a difference there. Maybe we need to set something up for that.

I do have a question for Mr. Mealy. This is, what right now, and I know you sanction clubs and you sanction flying. I know there is a lot of flying that goes on. For the most part, when you are talking about model airplanes, it is all line of sight. I used to do that, radio controlled, in our city, used to do a lot of it. What are the restrictions right now with the use of, and I am curious, because I know in my home town, a lot of the guys that fly RC, they come out to the airport and they use the airport. If somebody is flying, they pretty well shut down.

What is the restriction right now? I know with your organization, you obviously have to have a field for insurance purposes and that sort of thing. But what is the restriction on use of a public use airport?

Mr. MEALY. At the present time there is no restriction. If you refer to the AFD, there are approximately 150 general or public use aircraft airports that in their note section of that document report model aircraft activity upon their premises. What we do is encourage safety procedures, the following of the National Model Aircraft Safety Code, and the agreement and consensus of both parties.

In other words, the club has to be appreciating the activity of full scale pilots and vice versa. There has to be a common agreement between the tenants of that airport, the users of that airport, both full scale and modeling, that those activities can happen safely without compromising the safety or utility of that general aviation airport.

Mr. GRAVES. I certainly recognize the difference between the AMA and what you all are doing. And obviously what we are talking about here with UAVs, it is a completely different situation. I know you all want to be kept out of any possible restrictions that might be placed out there. I hope that is the case.

Mr. MEALY. On the other hand, Mr. Graves, if I may, I also want it to be known that understanding the complexity that seems to be entering into the National Airspace System, we are willing to work with the responsible agencies, so that we can all benefit from the use of the airspace system and maintain that same level of safety and utility that we have all become used to.

Mr. GRAVES. Absolutely.

I do not have any more questions. We will keep the record open for two weeks to allow members to submit questions for the record and accept any additional written testimony. I might point out that all the statements made by the witnesses and the members will be placed in the record in their entirety.

I do appreciate you all coming here. This is an extremely interesting subject, something that is dear to my heart as a pilot and it concerns me. I am excited about the potential, but it concerns me. More traffic in the airspace, particularly traffic that doesn't have somebody sitting in the cockpit, concerns me a lot. Hopefully we can work something out and take a look at this as it continues to develop and air traffic continues to develop.

Thank you all for being here. This hearing is adjourned.

[Whereupon, at 12:15 p.m., the subcommittee was adjourned.]

OPENING STATEMENT OF
THE HONORABLE LEONARD L. BOSWELL
AVIATION SUBCOMMITTEE

UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM
MARCH 29, 2006

- I want to thank Chairman Mica and Ranking Member Costello for calling today's hearing on *Unmanned Aerial Vehicles and the National Airspace System.*

- This hearing on Unmanned Aerial Vehicles, or UAVs, is timely as both governmental and commercial operators are starting to compete for use of our national airspace system (NAS). Unmanned Aerial Vehicles, or UAVs, come in all shapes and sizes – from as little as four pounds or as much as 100,000 pounds -- and may be programmed to work autonomously or by computer operator.

- UAVs are currently being used for military, law enforcement, homeland security, firefighting, weather prediction and tracking purposes. According to a recent *Aviation Week and Space Technology* article, the UAV market is expected to be worth $7.6 billion through 2010, with the majority of UAVs being purchased by the U.S. We must ensure that this emerging industry receives the proper federal safety oversight without discouraging development.

- The increasing use of UAVs in the NAS represents several challenges for the Federal Aviation Administration (FAA) and the aviation community. Of paramount importance is <u>safety</u>. The FAA is the sole authority charged with controlling the safe and efficient use of the national airspace. It is my understanding that adequate "detect, sense and avoid" technology that will enable UAVs to avoid other aircraft in the NAS is years away. Therefore, safety must be the FAA's top priority as it makes decisions regarding UAV airworthiness and integration of these operations into the NAS.

- Moreover, FAA has recently accommodated the use of UAVs by implementing large scale flight restrictions. For example, the FAA established a temporary flight restriction (TFR) along the U.S.-Mexico boarder in Arizona and Mexico to allow the Department of Homeland Security's Customs and Boarder Protection Service (CBP) to conduct UAV boarder surveillance without colliding with other operators in the area. The TFR is approximately 300 nm long and 17 nm wide, is in effect from 12,000 to 14,000 feet, and is active from 5 pm to 7 am daily. In my view, the use of TFRs – especially one that is this large in scale -- to allow for UAV operation is <u>not</u> a workable long-term solution.

- I am pleased that Nick Sabatini, FAA Associate Administrator for Aviation Safety, is here today to discuss the agency's efforts in the short term to ensure the safety of UAVs that currently fly in the NAS, as well as any long term solution to allow for the certification and mainstream integration of these vehicles with other commercial uses in our airspace - without resorting the widespread use of TFRs.

- The Departments of Defense and Homeland Security -- the two primary government users of UAVs – must also work in concert with the FAA to ensure both the safety of UAVs operating in the NAS, and that our military and homeland security needs for UAV operations are being met. Today, we have representatives from both the DOD and the CBP to discuss their efforts in this area.

- I also look forward to hearing from our witnesses on the second panel regarding future commercial applications of UAVs, the challenges and faced by this emerging industry, as well as some of the potential procedural and technological solutions that will enable the full and safe integration of these UAVs in the NAS.

- Thank you once again, Mr. Chairman, for holding this hearing. I look forward to hearing from our witnesses.

Congressman Russ Carnahan (D-MO)
House Transportation Committee
Aviation Subcommittee
Hearing on Unmanned Aerial Vehicles (UAVs) and the National Airspace System
Opening Statement
March 29, 2006

- Thank you, Mr. Chairman.
- In the past, Unmanned Aerial Vehicles (UAVs) were primarily used by the Department of Defense for military purposes. However, there is an increasing need and desire for the use of UAVs by civilian entities.
- Integration of UAVs in the National Air Space should be undertaken carefully. The FAA should take appropriate action to ensure the safety of the public, in the air and on the ground.
- I thank the Chairman and the Ranking Member for holding this hearing, and I look forward to hearing testimony from the witnesses today.

27 March 2006

STATEMENT
OF
T. J. CASSIDY, JR.
TO
THE HOUSE AVIATION SUBCOMMITTEE

Mr. Chairman, members of the Committee:

It is a pleasure to be here today to discuss the very important subject of flight of unmanned aircraft systems in national airspace.

Predator, an unmanned airplane controlled by an instrument rated commercial pilot, first flew in June 1994. This event was the beginning of a new era in powered flight. This same airplane type, and variants, have been involved since that time in supporting our military services in combat operations worldwide. Numerous types of UAV's have actually been flying in confined areas for years before that, but the serious effort to fly unmanned aircraft type missions for very long periods really began in 1994.

Predator type aircraft have now flown close to 200,000 flight hours and have operated over 5 continents, providing a situational awareness and offensive strike capability to our military by performing missions that cannot be performed by manned aircraft. These aircraft, depending on the type, can fly for 30 – 50 hours up to altitudes of 50,000 ft. They carry camera and radar systems, and weapons, and are controlled by a ground based pilot through an electronic satellite link. Aircraft operating over Iraq and Afghanistan are controlled by pilots and sensor operators in the Las Vegas, NV area.

The numbers of these aircraft and the number of daily missions required to be flown in the continental U.S. to prepare pilots and systems for operations in the global war on terrorism has dramatically increased in recent years.

So what's the problem:

- Pilots that operate these aircraft must be trained in the United States before they deploy. Military pilots typically fly in restricted airspace adjacent to their bases. Our company pilots who deploy into combat areas must train at our company airports which are not in or adjacent to restricted areas. Our company has some 70 deployed personnel and pilots in combat areas supporting the U.S. Government. They must be trained at our airports. We also must fly airplanes between locations in the U.S.

- The capabilities of these aircraft systems are continuously being improved with the addition of new sensors that must be developed and tested. These operations are conducted at company airports.

- The prop jet Predator B is now flying near daily missions on the U.S. southern border for the Department of Homeland Security. The success of this operation is so impressive that you can expect tremendous growth in the number of Predator B's operating over the borders of the Continental U.S. in the near term.

- The U.S. Air Force is standing up 15 new Air National Guard Predator and Predator B squadrons in the Continental U.S. These aircraft must fly where they are needed, which may include border protection missions.

These activities will dramatically increase the number of UAS's that must fly in national airspace. The problem is with us now and the solution must be provided now.

Up until 1 Oct. 2005, our company operated under a COA (Certificate of Authorization or Waiver) which allowed us to then file with the FAA and fly. It was a workable solution. After 1 October, the FAA Memorandum stated an intent to only issue

COA's to military services. We met with the FAA and Congressional Staffs and argued that since our company provides pilots to fly military Predators over Iraq and Afghanistan in combat, that our company should be considered a semi-military organization under these rules and be issued COA's so our company pilots can be trained in CONUS for overseas deployments.

Our company still does not have a COA and under the current rules cannot obtain one. The USAF and the Army now have COA's to fly, the DHS now has a COA and a very small operating area approved, and the Navy does not yet have a COA. The COA's for each user tend to be different, even though the aircraft are flying from the same locations.

I might add that the Predator B flying the U.S. southern border had to fly in a confined military restricted area south of Fort Huachuca for the first two months of the operation, able to only identify people and material entering the U.S. illegally that had the misfortune to select a route into the U.S. that happened to underlie a restricted area. The other 2,200 miles of border were off limits to the Predator B surveillance airplane since it could not fly in national airspace.

In the immediate near term:

- We need to expand the ability of these types of unmanned aircraft systems capable of filing and flying an IFR or VFR flight plan to routinely fly in national airspace and on IFR flight plans under positive control
    - TCAS or other collision avoidance systems can be installed with a few months' lead time

- The FAA must provide COA's in order to fly aircraft of the type we produce to any Government Agency, including our company, who have a need to fly those aircraft to support national defense objectives

- Issue one COA to GA-ASI to operate aircraft in support of all military and DHS operations

- Establish reasonable and expanded operating areas over and adjacent to our airports at Gray Butte and El Mirage

- Allow company owned and military, DHS, and NASA/NOAA owned aircraft to operate in these areas and also file and fly IFR flight plans on support missions

- Develop a quick response process that will allow GA-ASI produced unmanned aircraft systems to be recognized as airworthy for purposes of operating in low density areas in national airspace

In the long term, realistic operating criteria must be developed by the FAA that will allow unmanned aircraft systems capable of IFR flight clearance to operate in the NAS clear of heavily congested airspace.

Thank you for the opportunity to provide these comments.

3/27/06

GENERAL ATOMICS
AERONAUTICAL SYSTEMS

21 April 2006

The Honorable John L. Mica
U.S. House of Representatives
Chairman, Subcommittee on Aviation
2313 Rayburn House Office Building
Washington, DC 20515-0907

Attention: Ms Holly Woodruff Lyons

Enclosure (1) Response to US Committee on Transportation And Infrastructure

Dear Chairman Mica:

Thank you for conducting the recent hearing on Unmanned Aerial Vehicles and the National Airspace System. I appreciated the oportunity to provide testimony on this very important subject.

I have prepared responses to the questions you provided in your 6 April 2006 letter.

We feel strongly that the Predator/Predator B type of UAS operated by an instrument rated pilot is qualified to conduct IFR flight in National Airspace and should be cleared to do so. I hope our responses to your questions are helpful in supporting this effort, especially if we can expand the operations of these aircraft to support the war on terror and border protection.

If you have any further questions, or if I can provide any further information, please let me know.

Sincerely,

Thomas J. Cassidy, Jr.
President
Aircraft Systems Group

16761 VIA DEL CAMPO COURT, SAN DIEGO, CA 92127-1713 FAX (858) 455-2801 TEL (858) 455-2810

Response

to

US Committee on Transportation and Infrastructure

Ref: 6 April, Chairman J. L. Mica

Prepared by:

General Atomics Aeronautical Systems, Inc.
16761 Via Del Campo Court
San Diego, CA 92127-1713
(858) 455-2810

April 21, 2006

First Question:

You note in your testimony that, in the long term, realistic operating criteria must be developed by the FAA that will allow unmanned aircraft systems capable of instrument flight rule clearance to fly in the NAS. In your view, what are realistic operating criteria that should allow for UAV access to the NAS?

The term unmanned aircraft systems (UAS) applies to a broad range of aircraft types ranging from man-portable systems weighing just a few pounds to high-altitude long-endurance aircraft weighing tens of thousands of pounds that are equipped with avionics and sub-systems similar to those systems installed in general aviation, commercial and military manned aircraft. The majority of unmanned aircraft systems that have been developed are the smaller type and are not equipped with the communication, navigation, and avionics systems required to operate in the national airspace system. Until the FAA issues comprehensive regulations, these systems will have to continue to operate on a very limited and restricted basis in the NAS. Realistic operating criteria will have to be developed to handle these types of UAS that may likely take years to draft and issue. The more capable UAS such as the Predator, Predator B, and Altair are fully capable of operations in the NAS today, under published regulations and should be permitted to do so now by filing and flying IFR flight plans.

Predator, Predator B, and Altair are equipped with the standard or equivalent IFR instruments required to conduct instrument as well as visual flight and have equipment installed as outlined in FAR part 91.205 & 91.215. (i.e., Flight instruments, engine instruments, anti-collision and position lights, two-way radios, mode 3/A or S transponder, etc.). Navigation is conducted by redundant GPS systems and moving map displays that incorporate current aeronautical charts. These aircraft are flown by FAA instrument rated pilots under instrument flight rules and are operated just like manned aircraft. The Predator family of aircraft have operated at our Gray Butte and El Mirage Flight Operations facilities as well as at numerous airports in the United States, and in fact on five continents safely and routinely for over a decade. They currently operate on a daily basis in United States national airspace at these locations, along the US southern border, and for customer delivery flights without incident or disruption to the NAS. They have also operated at military and civilian airports in the United States and routinely operate on a daily basis at numerous locations overseas flying some 5,000 hours per month. Their ability to integrate, fly routinely, and safely in the national airspace is not a technological issue, it has only recently become a regulatory issue. With the appropriate procedures that we have developed in conjunction with the FAA Air Traffic Organization and the inherent capabilities of aircraft of this type, there is no technical reason why these aircraft should not be allowed to operate now, in national airspace on an IFR flight plan.

Promising new technology such as a detect-see-and-avoid system (DSA) can reduce the few special provisions required to operate UAS in the NAS but waiting for the development and certification of such a system should not preclude the more advanced

UAS from operating in the NAS today. DSA systems may be several years away from being proven and certified but there are also numerous issues that should be addressed as soon as possible. The FAA needs to define the method for a UAS to comply with 14 CFAR 91.113 (b) which states that, "... vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft." The FAA has communicated that UAS's require an equivalent level of safety (ELOS) as manned aircraft but they need to define what that means. Until the FAA can provide a clear definition of how this FAR pertains to UAS and determine a suitable method of compliance, flight in Class A airspace (positive control airspace) where positive separation services are provided by ATC, should be permitted, provided the UAS has the capability and equipment to operate in the NAS.

Procedures should be developed that allow integration of UAS, in the Predator class, with manned aircraft operating in the NAS. These operations can be initially limited to low density traffic areas until reasonable comfort levels are established. UAS capable of IFR flight should not be separated from manned aircraft through the use of TFRs or other procedures. Unmanned systems that have equivalent equipment and capability to operate readily in the NAS should be permitted to file and conduct IFR flights in Class A airspace (positive control airspace) where separation services are provided by ATC. This class of UAS should be issued guidance that permits them to fly nationwide in Class A airspace provided they avoid flights into heavily congested airspace and minimize flights over populated areas. Guidance can be issued that defines areas that are off limits such as Class B Airspace, the busiest Class C airspace, and flights over major metropolitan areas. Departure and arrival airspace required to access Class A airspace should be a local issue, coordinated with the special use airspace (SUA) authority or pre-coordinated in the FAA Certificate of Authorization (COA) or Experimental Certificate.

In summary, the Predator, Predator B, and Altair are considered able to fly routinely and safely in the national airspace system today under the current regulations and standards that apply to all aircraft and should be permitted to do so. These types of UAS's are flown by FAA instrument rated pilots that maintain communications with ATC and have standard or equivalent equipment and instruments necessary to participate in the national airspace system. Initially, flights of these types of aircraft should be permitted to conduct IFR flight in Class A airspace (positive control airspace) with reasonable provisions such as the requirement to avoid flights over populated areas or into congested airspace. Additional safety of flight related capabilities such as TCAS and detect-see-and-avoid systems such as the use of an onboard camera gimbal to detect other aircraft can be implemented with sufficient lead time. Visual awareness of aircraft presence can also be enhanced in the vicinity of operating airports by traffic advisories provided as a result of the use of terminal area radars and optical detection systems. Consideration should also be given to establishing Class D airspace over privately owned airports such as Gray Butte and El Mirage, where all UAV operations are conducted to support national defense and homeland security operations.

Second Question

Do industry-wide standards exist for the manufacturing and operation of unmanned aircraft? If not, what is the industry's plan to develop common standards?

Industry-wide standards do not exist for the manufacturing and operation of unmanned aircraft as a specific class of aircraft. As a company, GA-ASI uses 14 CFR Part 23 certification standards as a guide in designing aircraft. We also operate all aircraft in accordance with applicable Part 91 general operating and flight rules. All our pilots are FAA certified per Part 61 requirements and then receive specific training in our unmanned aircraft within a USAF or company approved training program. Since 1992 our company has adopted sound and proven aviation practices and has utilized FARs as guidelines. This has enabled us to successfully achieve over 180,000 flight hours operating on five continents.

We consider the implementation of standards for UAS to be a two step process. The first is to classify UAS into various types based on size and capability so that the more capable UAS such as the Predator, Predator B, and Altair type are able to fly in the NAS today. The second step is to address the longer term developmental, infrastructure, and standards efforts required to maintain and advance the US dominance in the unmanned commercial and military sectors for all classes of UAS.

UAS's must be classified by type to simplify the regulatory and standards work. Classification will separate and permit the class of UAS such as the Predator, Predator B and Altair that are suitably equipped with the navigation, communication, and flight control systems necessary to fly in the NAS. In parallel, standards should be developed for the smaller less sophisticated types that present the greatest regulatory challenges. The "more capable" class of UAS could be operated nation-wide in low density air traffic areas under realistic procedures while additional capabilities that would further enhance flight safety are developed and implemented.

General Atomics Aeronautical Systems, Inc. (GA-ASI) first provided a proposal to the FAA Administrator on 4 August 2000 to identify and implement a series of categories for UAS's. Establishing categories based on size, capability, and reliability could break the standards problem into manageable parts that would allow existing UAS's that support national priorities, like Predator and Predator B, to continue to have access to the NAS. Examples of categories are as follows:

Category A: Remotely Piloted Aircraft (RPA). Cleared for IFR flight in controlled and uncontrolled airspace but required to avoid heavily congested airspace and minimize flights over populated areas. Flight segments where positive separation is not provided by ATC should allow separation by: special use airspace, chase, other radar services (such as Customs and Border Protection's AMOC), or a detect-see-and-avoid system when available. Requires FAA certified pilot with instrument rating.

Requires:

- Airworthiness declaration
- Reliable data link
- Voice link between pilot and ATC
- Mode C or S Transponder
- FAA approved navigation and position lights
- Visual camera system to assist in taxing, flight, and to detect air traffic.
- Collision avoidance system for traffic alerts (i.e. TCAS, ADS-B)

Example: Predator, Predator B, Altair could be in this category

Category B: Remotely Operated Aircraft (ROA). Cleared for pre-coordinated transition flights through Class A airspace for the purpose of high-altitude operations above FL510. Requires FAA certified pilot during segments in Class A airspace and below. For high altitude segments the operator is required to be familiar with aviation terminology and FAA/ATC regulations.

Requires:

- Airworthiness declaration
- Reliable data link
- Voice contact between the operator and ATC
- Mode C or S Transponder
- FAA approved navigation and position lights
- Visual camera system to assist in taxing and location of traffic
- Collision avoidance system (i.e. TCAS, ADS-B)

Example: Global Hawk, Pathfinder solar aircraft, high altitude airships could be in this category

Category C: Unmanned Aerial Vehicles (UAV's) > 55 lbs. All unmanned aircraft that fly, that are not in category A or B.
Restricted to flight clear of clouds, below 400 ft AGL, within visual line of sight of the operator, and only over low population and low density air traffic locations. A Notam must be issued 24 hours in advance. Operations outside of these provisions must apply for an Experimental Certificate or COA.

Example: Prowler, Shadow, Hunter, etc.

Category D: Unmanned Aerial Vehicles (UAV's) < 55 lbs. All unmanned aircraft that are not in category A or B and weigh less than 55 lbs.
Must follow FAA guidance on safe flight of model airplane types.

Example: Pointer, Dragon Eye, etc.

Such a classification scheme should allow immediate operations of Class A and B type UAS's conducting the most critical UAS operations today to continue without disruption while realistic regulations and standards are developed.

There is also national infrastructure, technology development and/or certification work that should be performed by the USG and industry. The NASA Access 5 project had made some headway before it was cancelled by NASA. Standards, technology, and infrastructure should be worked in concert due to the influence of one on the other.

The Congress should mandate that the USG working with industry be directed and funded to establish a set of criteria that will further provide focus and funding for integration of UAS's into the NAS by identifying and developing additional capabilities necessary to further enhance flight safety of UAS's operating in the NAS. General Atomics Aeronautical Systems, Inc. is a member company in the UAV National Industry Team (UNITE) and supports this approach.

The following list provides a few of the projects that should be addressed in the national program.

1.) Detect See and Avoid (DSA)

A project should be pursued to complete development of at least one high potential candidate DSA system, integrate it into a UAS, flight test it and certify the system. This would include conducting a series of simulations of all various collision scenarios, verification of the simulations with a subset of flight missions, and provide the standards for all DSA manufacturers to adopt. NASA now has a Predator B aircraft that could be used as a flight test aircraft. In addition to use on unmanned aircraft, DSA systems could probably eliminate or reduce mid-air collisions if integrated into most general aviation and commercial aviation aircraft, since the potential for mid-air collisions is not unique to UAS.

2.) Command, Control and Communications (C^3)

Predator and Predator B UAS's are equipped with standard or equivalent aviation radios, navigation, and flight control systems. In addition, a data-link connects the pilot controls on the ground to the aircraft in flight. Two types of data-links are used, a line-of-site data link and a satellite data-link for beyond-line-of-sight operations. A national standard secure data-link system that can accommodate the growth of UAS aviation which will probably permeate all sectors of aviation should also be developed. National infrastructure issues such as frequency spectrum, link security, and data-link certification need to be addressed for the longer term. It is possible that a national terrestrial communication (voice) system that connects ground control stations directly to ATC controllers via a secure telecommunications network could be a future solution. NASA, FAA, FCC, and industry should be directed by Congress to work collaboratively to plan for and implement the necessary projects with funding provided as appropriate by the USG.

3.) Auto-land System

Predator and Predator B UAS are landed under direct pilot control and when required, automatically by auto-land systems that utilize differential GPS. The US Army requires all take-offs and landings to be automatic. The US should develop requirements for UAS's to conduct automatic landings without pilot intervention such as in the case where landings must be conducted during a loss of data-link. At some point alternate airports in remote locations should be identified where approaches and landing can be conducted by UAS when failed data-links are experienced.

What should be considered in the short term is to certify, designate, and activate auto-land solutions for UAS's at enough airports around the nation to facilitate the needs of this growing arm of aviation.

In summary, UAS standards do not exist for unmanned aircraft as a specific category. GA-ASI as a company has used existing federal aviation regulations, standards, and commercial best practices as guidelines in the design, manufacturing, and operations of UAS. This practice has enabled GA-ASI to gain over 180,000 hours of successful flight operations on five continents and has provided a solid basis for rapid development of standards. Categorizing unmanned aircraft is a recommended first step that will help segregate and simplify the work of creating standards for UAS's. It will permit current national priority UAS operations, such as operations on our southern border, to continue for Predator and Predator B. This class of UAS is equipped with aviation instruments and equipment necessary to conduct IFR operations in Class A airspace. The Congress should mandate that FAA, NASA, and industry develop a comprehensive road-map for integrating UAS's into the NAS by category. This should be a national program to start critical projects needed for UAS technology development, infrastructure roll-out, regulations, and standards. Critical projects such as detect-see-and-avoid systems, C^3, and auto-land should be initiated immediately and funded as part of the plan. Unmanned aviation is a vital and expanding part of US aviation and it is not only important that the US maintain world leadership in this new technology but that aircraft of this type be used without restrictions to support the US war-on-terrorism and border protection.

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Statement of Andrew V. Cebula
Executive Vice President
Government Affairs

Aircraft Owners and Pilots Association

Before the

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
AVIATION SUBCOMMITTEE
U.S. HOUSE OF REPRESENTATIVES

The Honorable John L. Mica, Chairman
The Honorable Jerry F. Costello, Ranking Member

Concerning

Unmanned Aerial Vehicles in the National Airspace System

March 29, 2006

Good morning, my name is Andy Cebula, Executive Vice President, Government Affairs for the Aircraft Owners and Pilots Association (AOPA), an organization representing more than 406,000 pilots and aircraft owners – more than two-thirds of all active pilots in the United States. AOPA members are general aviation pilots who use their aircraft in the same way you use your personal automobile for business, personal transportation and recreation.

Thank you Chairman Mica and Ranking Member Costello for holding this very timely hearing on Unmanned Aerial Vehicles (UAVs). There are important safety issues associated with the operation of UAVs in the United States National Airspace System (NAS) that are of great concern to the members of AOPA.

AOPA is here today requesting the Subcommittee to reinforce the Federal Aviation Administration's (FAA) responsibility for the safety of the nation's airspace. We appreciate the action taken by this Subcommittee to have language included in H.R. 4437, The Border Protection, Anti-terrorism, and Illegal Immigration Control Act of 2005 that ensures the FAA retains the authority to oversee, regulate and control the safe and efficient use of airspace in the United States.

Since the Wright Brothers ushered in the age of powered (manned) flight over 100 years ago, safety of flight has been a top priority. Pilots take seriously the responsibilities associated with operating an aircraft. As aviation evolved from a handful of aircraft in the early 20th century, to more than 230,000 aircraft sharing the skies today – the air traffic system also evolved to maintain a high degree of safety and efficiency. From no regulations in 1903 to strict regulatory oversight under the FAA, pilots fly in accordance with regulations that have served us well, as evidenced by the fact that the United States has the safest aviation system in the world.

With the exception of UAVs, there isn't an aircraft operating in today's NAS that has not complied with strict Federal Aviation Regulations (FARs) governing its certification and maintenance. And again, with the exception of UAV operators, there isn't a pilot operating today that has not undergone rigorous pilot certification training and testing.

Pilots also comply with very strict FAA general operating and flight rules as outlined in the Federal Aviation Regulations (FARs), including the FAA's important see and avoid mandate. These regulations provide the historical foundation of the FAA regulations governing the aviation system.

The problem the FAA faces is the fact that UAVs challenge this historic foundation because they operate unlike any other aircraft in the airspace system – by remote control.

This has become a significant issue recently, primarily because security agencies have now begun to operate these unregulated UAVs in the National Airspace System - before the FAA has had an opportunity to enact regulations. These UAV operations have resulted in large-scale flight restrictions while subverting progress toward regulations and proper integration of the vehicles into the airspace system – a situation that must not continue. Flight restrictions prohibit flights within a specific area of airspace defined by ground references and are in effect for stated dates and times. The use of flight restrictions for UAVs are inefficient, unfairly restrict other airspace users, and are the wrong approach to addressing the important operational and safety issues created by UAVs.

If the FAA doesn't take action to address operational issues, unregulated operations will continue to proliferate. As it stands today, other agencies will continue challenging FAA's authority for aviation safety and the control of airspace, or press the FAA for huge airspace restrictions.

The general aviation community as a whole has heightened concerns about airspace restrictions in the post 9/11 aviation world. It seems like federal agencies are quick to request (and often receive) airspace restrictions for just about any operation or reason. Adding UAV Temporary Flight restrictions (TFRs) to the already substantial list of ongoing Presidential Movement TFRs, stadium TFRs, Disney TFRs, the Washington ADIZ, and several DOD TFRs would be the worst-case scenario for the aviation system.

The concern about airspace restrictions is justified if we look at recent history. In February 2006, despite strong objections from AOPA, the FAA - at the request of Customs Border Patrol (CBP) – established a "temporary" flight restriction (TFR) along the United States-Mexico border in Arizona and New Mexico for UAV operations. In effect from 5 p.m. until 8 a.m., the 340 nm-long corridor, 15-nm wide in most places, is to prevent a CBP UAV from colliding with other civilian aircraft. But this TFR hardly seems "temporary." It's scheduled to be in effect until December 31 and will likely be renewed next year. We also understand that CBP has purchased a second UAV and the FAA is considering expanding the restriction to encompass the entire Mexican border along Texas.

From the perspective of AOPA members, for all the wrong reasons, the FAA continues to restrict airspace. First flight restrictions were used for unnecessary "security related" reasons, and now for UAV flights operating with no regulation. It is important that agencies understand airspace restrictions do not work and subvert the long-term operational integration of UAVs into the aviation system. Large blocks of sterilized airspace for UAV operations is the worst possible outcome for everyone.

AOPA objects to the existing TFR and certainly does not want to see it expanded. Members are experiencing problems with the current TFR. Here are a few quotes AOPA members in Arizona and New Mexico shared with us about the expansive restrictions:

- "This is an area of high terrain. Airplanes must fly quite high to be in contact with Prescott radio and Hermosillo to report crossing the border. It would be easy to "bust" the TFR."
- Living in NM, this is another restricted airspace adding to numerous and extended airspace restrictions that are already in place
- "I fly monthly to Mexico performing volunteer mercy flights. I use the airspace along the TFR, it will hinder our volunteer efforts…"
- "There are mountain ranges between the Phoenix area and Bisbee, Arizona. To safely navigate the route at night presents a less than desirable ceiling on the route."

AOPA believes that the use of 'temporary' large-scale flight restrictions for yearlong UAV operations is not appropriate and the FAA needs to fully explore the alternatives available to allow CBP (or any other agency for that matter) to secure our borders without impacting the aviation community. In preparation for the hearing, AOPA surveyed its members on the issue of UAV operations. The overwhelming majority rejected the notion of flight restrictions, preferring that the FAA certify UAVs for operations in the nation's airspace.

Pilots have safety concerns that must be addressed by the FAA before UAV operations should be considered. Some of these are technical and some regulatory including:

- The inability of UAVs to see and avoid manned aircraft;
- The inability of UAVs to immediately respond to ATC instructions;
- The absence of testing and demonstrations that UAVs can operate safely in the same airspace as manned aircraft; and
- The need to certify UAVs to same level of safety as manned aircraft.

Because of the lack of regulations and standards, the FAA should not even consider allowing the general operation of UAVs in the NAS until all of the safety and operational issues are resolved. It is necessary and proper that the FAA first develop UAV policies, minimum qualifications and standards for UAV operations.

FAA standards are critical because of the fact that UAVs encompass such a broad spectrum of vehicles. The sizes range from wingspans of several feet to more than 200 feet with weights of 5 pounds to 20,000 pounds. For example the Boeing Condor weighs 20,000 pounds, carries 12,000 pounds of fuel and cruises at a speed of 200 knots. Compare that to the commonly flown Cessna 172, which weighs 2300 pounds and cruises at a speed of 120 knots. In fact, the first thing that FAA must do is to provide a definition of what constitutes a UAV.

To be clear the reference to UAVs is not the "model" aircraft community. The popular pastime of flying small-scale model aircraft for recreation is a different category of use and should be separated from the other UAV categories. Guidance on their operations is provided through an Advisory Circular (AC) that defines model aircraft operations and recommended practices. However, this AC is woefully out of date and must be updated.

There are essentially three categories of UAV applications; Department of Defense, Department of Homeland Security/law enforcement, and commercial uses. The FAA has in place for DOD a policy governing UAV operations that does not involve temporary flight restrictions. Instead, DOD uses existing Special Use Airspace (SUA) and other mitigations such as chase planes, and ground spotters for its UAV operations. Other than flight restrictions, the FAA has not implemented any policies for regulating non-DOD UAV uses.

AOPA has been involved in this issue since 1991, when the FAA tasked an Aviation Rulemaking Advisory Committee (ARAC) with developing UAV guidance. While the FAA had a goal of publishing an NPRM in 1992, this never occurred.

Fast-forward to 2004, when because of growing concerns, AOPA asked FAA to address the UAV issue by creating a working group under the auspicious of the RTCA industry-government advisory group. In fact AOPA's Senior Director of Advanced Technology co-chairs this committee. The group brings together the manned and unmanned aircraft community for the purposes of developing standards for the safe introduction of UAVs into the airspace system.

Our recent experience with a sheriff's department in North Carolina underscores the importance of immediate action because of the confusion that exists over the operation of UAVs. Gaston County announced it would be using a UAV for law enforcement, up to altitudes of 1,000 feet, unaware of the potential impact this would have on the airspace system. It took AOPA contact with officials at the FAA who eventually intervened to prevent this potentially hazardous situation from occurring.

Another example was featured in the November 28, 2005, edition of the Washington Post spotlighting a start-up company called Aero View International, who is using UAV technology for agricultural purposes. The article provided detailed pricing and sent potential customers to their Web site (www.aeroviewinternational.com) for more information. Without regulations, how would such a company comply with today's complex rules and best practices for the operation of aircraft in the NAS? Even though they indicate that the UAV flies below 500 feet, one of the nation's 18,000 landing facilities may be nearby and the UAV may be a safety hazard, unbeknownst to them. The FAA must take the lead in ensuring that commercial UAV operations are safe for all airspace users.

In conclusion, the FAA has jurisdiction and should assert its authority for the safety and operating efficiencies of the nation's airspace. That authority must be exercised expeditiously to prevent the implantation of UAV TFRs at the request of other agencies. Instead, unmanned aircraft and their operation should be certified to the same level of safety as piloted aircraft. Their operation should not have a negative impact on general aviation and should not require specially designated airspace for their operation.

AOPA's fear is if the FAA does not assert its authority, we could be back here in front of you next year because of a tragic accident between a UAV and a manned aircraft. We don't want that to happen. That's why the FAA must accelerate its process of regulating UAV operations, making UAVs a part of the system instead of allowing them to continue to operate outside of the regulations.

AOPA appreciates the opportunity to testify on this important safety issue and looks forward to working with the members of the Subcommittee as UAV regulations are developed.

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May 1, 2006

Honorable John L. Mica
Chairman
Committee on Transportation and Infrastructure
Subcommittee on Aviation
2251 Rayburn House Office Building
Washington, DC 20515

Re: Response to UAV questions

Dear Chairman Mica:

On behalf of more than 408,000 members of the Aircraft Owners and Pilots Association (AOPA), thank you for inviting AOPA to testify on March 29, 2006, on Unmanned Aerial Vehicles (UAVs). AOPA appreciates your efforts to address the challenges of integrating UAVs into the National Airspace System (NAS). This correspondence addresses your specific questions outlined in a letter dated April 6 seeking clarification of the issues as a follow-up to our testimony.

UAV Questions and AOPA Responses

What was the outcome of the 1991 Aviation Rulemaking Advisory Committee (ARAC) tasked with developing UAV guidance?

AOPA Response: To date, the research conducted by the ARAC committee has not led to specific guidance being developed by the FAA. Here's a brief overview of the working group effort:

- The first UAV Working Group met November 13, 1991. The specific FAA task was to "*Develop a Notice of Proposed Rulemaking (NPRM) that effectively deals with UAV issues.*"

- In June 1992, the UAV Working Group meeting clarified the rule's purpose by stating in its minutes that, "*The intent of the regulation will be to ensure UAV's can operate safely within the National Airspace System without presenting an undue hazard to other air traffic or to persons and property on the ground.*" The minutes also noted that a final rule would be completed by 1996.

- In May 1993, the FAA halted their work on the rulemaking effort. Meeting minutes indicate that, *"The FAA stated, in light of the issues realized by the group, they did not have enough historical or current information to support rulemaking actions. They did, however, believe an advisory circular (AC) on UAVs was warranted and would assist the FAA in acquiring the information required to support future rulemaking action."*

Why, in your opinion did the FAA not meet its goal of publishing an NPRM in 1992?

AOPA Response: There were several factors that led to the termination of the rulemaking effort. First, the technologies were not developed that enabled UAVs to operate without negative impact on manned aircraft. The situation today is similar, however, it is possible that the technology is closer to being a reality. Second, there were no standards for certification of UAVs, mirroring the situation we find ourselves in today. Lastly, the demand for operational approval of UAVs was negligible with UAV use in commercial activities in the conceptual and planning phase of development. And finally, the FAA determined that with limited resources, addressing UAV operations was not a priority program.

Can the FAA and industry piggyback off any of the work accomplished at that time or is it too dated?

AOPA Response: It is unclear whether the UAV working group research and recommendations could be utilized in today's planning for today's UAV activities, as the work has never been published. The UAV industry has grown from a concept in 1991 to a reality in 2006. AOPA strongly believes that UAV regulations are long overdue, and the FAA must pursue regulatory actions immediately.

The recent crash of a Customs and Border Patrol Predator B UAV aircraft is a good illustration of what can go wrong when operating a UAV. Media reports indicate that it did not crash land in a preprogrammed location. And, in the case of the Predator, the level of sophistication and redundancy is significantly higher than other UAVs. Without both operational approvals and certification standards, UAVs will continue to generate concerns for the manned aircraft community. Similar regulatory oversight is required for all other aircraft, and AOPA has found no basis for UAVs to be excluded from these requirements.

You indicated that unregulated and illegal UAV operations are occurring right now in the NAS. Can you provide specific examples?

AOPA Response: Based on discussions with individuals in the aviation community, numerous UAVs are in use by private individuals for commercial purposes such as aerial photography, power line and pipeline inspection, reconnaissance and other operations. Anecdotal evidence indicates that there are commercial UAV operations occurring around the country. This is illustrated by the attached list of Web sites advertising such UAV services all over the United

States. In reviewing these Web sites, we found no evidence to suggest that the FAA has approved these operations.

At the hearing, the FAA testified that non-Federal UAV operators gain access to the National Airspace System (NAS) by obtaining an experimental certification, and that two such certificates had been issued. It appears to AOPA that these applications for "experimental" certification are voluntary and not based on any regulatory requirement.

Because the commercial operations are unregulated, the FAA has no data on where they are operating or the potential impact on the safety of manned aircraft. Despite the fact that these services are openly offered, the FAA has not required that operators and UAVs be certified or follow regulations airborne operations, weather minimums, or any of the other guidance normally associated with commercial aircraft operations.

AOPA remains concerned that without regulation and operating authority, UAV operators may not have the necessary training, aeronautical knowledge, and operational experience necessary to ensure that the UAV operation can be conducted safely without impacting other manned aircraft operations.

What do you suggest the FAA do about this?

AOPA Response: AOPA recommends that the FAA immediately issue regulatory guidance addressing minimum training, aeronautical knowledge, and operational experience necessary for pilots of UAVs to operate commercially. And, the FAA should immediately issue regulations that govern the safe operations of UAV in NAS. Without standards, UAVs have the potential to impact the safety of manned aircraft.

In preparation for the hearing, AOPA surveyed its members and the overwhelming majority indicated that they oppose the use of flight restrictions (including temporary flight restrictions, like the ones on the southern border) to "regulate" UAV operations. AOPA members believe that the FAA should instead certify UAVs for operation in the NAS.

Pilots have safety concerns that must be addressed by the FAA before UAV operations should be permitted in the NAS. AOPA members indicated the following are the top four concerns they have about UAVs:"

- The inability of UAVs to "see and avoid" manned aircraft;
- The inability of UAVs to immediately respond to ATC instructions;
- The absence of testing and demonstrations that UAVs can operate safely in the same airspace as manned aircraft; and
- The need to certify UAVs to the same level of safety as manned aircraft.

Because of the lack of regulations and standards, the FAA should not allow general operation of UAVs in the NAS until all of the safety and operational issues are resolved.

Thank you for the opportunity to provide additional information regarding UAVs. We hope that you find this information helpful. If you would like additional information, please do not hesitate to contact me.

Sincerely,

Andrew V. Cebula
Executive Vice President
Government Affairs

Attachment

Listings of UAVs Operating for Commercial Purposes

Associations promoting the use of UAVs for Commercial Purposes

http://www.rcapa.net/

The following RCAPA Web site link provides a list of commercial aerial photography companies by state.

http://www.rcapa.net/aerial-services.htm

Businesses that use UAVs for Commercial Purposes in Maryland and Delaware

http://www.carlettoaerialphotography.com/

http://www.hawkap.com/

Businesses that promote UAVs for other commercial applications.

http://www.uav-applications.org/services/airspace.html

Sampling of businesses that manufacture and sell UAVs

http://www.miraterre.com/

http://rotomotion.com/index.htm Rotomotion has over 20 deployed UAV systems

http://neural-robotics.com/

OPENING STATEMENT OF
THE HONORABLE JERRY F. COSTELLO
AVIATION SUBCOMMITTEE

UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM
MARCH 29, 2006

- I want to thank Chairman Mica for calling today's hearing on *Unmanned Aerial Vehicles and the National Airspace System.*

- Mr. Chairman, this is a very timely hearing as we begin to grapple with current and future demands placed on our nation's air traffic control system. There are new operators that are starting to compete for use of our national airspace system (NAS), including both governmental and commercial operators of unmanned aerial vehicles. Unmanned Aerial Vehicles, or UAVs, come in all shapes and sizes – from as little as four pounds or as much as 100,000 pounds -- and may be programmed to work autonomously or by computer operator.

- UAVs are currently being used for military, law enforcement, homeland security, firefighting, weather prediction and tracking purposes. According to a recent *Aviation Week and Space Technology* article, the UAV market is expected to be worth $7.6 billion through 2010, with the majority of UAVs being purchased by the U.S. As with any emerging aviation industry, this Subcommittee must ensure that it is receiving the proper federal safety oversight without discouraging development.

- The increasing use of UAVs in the NAS represents several challenges for the Federal Aviation Administration (FAA) and the aviation community. Of paramount importance is safety. The FAA is the sole authority charged with controlling the safe and efficient use of the national airspace. It is my understanding that adequate "detect, sense and avoid" technology that will enable UAVs to avoid other aircraft in the NAS is years away.

- Safety must be the FAA's top priority as it makes decisions regarding UAV airworthiness and integration of these operations into the NAS. I am pleased that Nick Sabatini, FAA Associate Administrator for Aviation Safety, is here today to talk about the agency's efforts in the short term to ensure the safety of UAVs that currently fly in the NAS, as well as the long term safety implications of fully integrating these vehicles with other commercial uses in our airspace.

- The Departments of Defense and Homeland Security -- the two primary government users of UAVs – must also work in concert with the FAA to ensure both the safety of UAVs operating in the NAS, and that our military and homeland security needs for UAV operations are being met. Today, we have representatives from both the DOD and the Customs and Boarder Protection of DHS to share with us their agencies' efforts in this regard.

- I also look forward to hearing from our witnesses on the second panel regarding future commercial applications of UAVs, the challenges and faced by this emerging industry, as well as some of the potential procedural and technological solutions that will enable the full integration of these UAVs in the NAS.

- Thank you once again, Mr. Chairman, for holding this hearing. I look forward to hearing from our witnesses.

TESTIMONY ON BEHALF OF THE

UAV NATIONAL INDUSTRY TEAM "UNITE"

TO

THE HOUSE AVIATION SUBCOMMITTEE

TRANSPORTATION AND INFRASTRUCTURE COMMITTEE

MARCH 29, 2006

MICHAEL HEINZ

EXECUTIVE DIRECTOR "UNITE"

TESTIMONY ON BEHALF OF THE UAV NATIONAL INDUSTRY TEAM "UNITE" TO THE HOUSE AVIATION SUBCOMMITTEE TRANSPORTATION AND INFRASTRUCTURE COMMITTEE MARCH 29, 2006

Thank you for this opportunity to provide an industry perspective on the important issue of integrating unmanned aircraft systems (UAS) into the national airspace system (NAS). I speak today on behalf of the UAV National Industry Team (UNITE). UNITE is an industry alliance, comprised of six US-based UAS manufacturers, which has the primary goal of opening the NAS to safe and routine operations of unmanned systems.

When the first manned airplane took flight at Kitty Hawk just over a century ago, it would have been difficult for even the most imaginative futurist to predict the impact that manned aviation would have on military power, global economic growth, and human endeavor. Military operations in WWI served as the catalyst for maturing hobby-shop aircraft into useful ones. However, it was not until Lindbergh's trans-Atlantic flight that the full potential of manned aviation for civil applications and commercial commerce started to emerge.

Likewise, it took several decades of use in military operations for initially primitive UASs to come of age. Today, a variety of unmanned systems have become indispensable to commanders at all echelons in the performance of critical missions. The value of UASs in military operations is now undeniable and the trend toward greater reliance is irresistible. So, as we see history repeating itself, military operations have served as the crucible of maturation for UASs, as they did for manned aircraft. UASs are now on the threshold of unleashing the same influence in civil and commercial markets that manned aviation exerted 80 years ago.

For example, it is quite easy to envision a future in which UASs, unaffected by pilot fatigue, provide 24/7 border and port surveillance to protect against terrorist intrusion. Envision a future in which UASs, without endangering pilots, safely operate closely to hazardous areas to provide improved warning and situational awareness of potential disasters. Or, in which UASs are deployed rapidly in disaster relief operations to fill communications needs while terrestrial systems are incapacitated. A future in which human knowledge of the earth and the atmosphere is expanded by means of UASs capable of operating in conditions too dangerous or too fatiguing for manned systems. Or, in which commercial space-based telecommunications are economically complemented by means of long endurance UASs operating in near-space, or new commercial vistas are opened by means of minimally manned operations made possible by UAS autonomous systems and technologies. Other examples are limited only by our imagination. Just as that imaginative futurist a century ago could not have foreseen the full potential of manned aviation, we know there is great potential for unmanned systems, but cannot predict with any accuracy how that potential will unfold.

However, we do know the potential cannot be unleashed until we first solve the challenge of operating UASs safely and routinely in the NAS. Currently, the FAA allows temporary and restricted operations of UASs in civil airspace through the COA process, or through an Experimental Certificate (EC), or by carving out Temporary Flight Restricted (TFR) corridors. The COAs and ECs impose procedural constraints, such as chase aircraft or ground observer who must be within visual range of the UAS and which negate the inherent advantages of unmanned systems. For the promise of UASs to be fulfilled, we must find a way to gain routine "file and fly" access to the NAS, with no compromise to safety.

There can be no doubt that safety is the key issue and challenge to routine access. The FAA is charged with the responsibility of ensuring the safety of the NAS. It must continue to impose restrictions on UAS access until a body of evidence is developed which proves that UASs are airworthy, can operate with an acceptable level of safety within the NAS, and do no harm to other users of the NAS or to the air traffic system. This body of evidence requires a combination of technology development, systems development, simulation, experimentation, flight demonstration and standards definition to guide the development of informed policies, rules, and regulations. The FAA has fully embraced the goal of integrating UASs safely into the NAS and has incorporated this objective into the Administrator's Flight Plan. To this end, the FAA has recently established a dedicated UAS program office. However, the FAA cannot do this job alone – nor can any other USG agency, nor can industry. The job requires multi-agency collaboration and a government/industry partnership.

The committee may well ask why it is so important to open the airspace to UAS operations now. Why not just let market forces and the regulatory process take their natural courses? Several near-term mission needs dictate the urgency of action. In fact, government agencies like Customs and Border Patrol are already deploying UASs into the NAS for border security. However, the DHS need for UAS operations for border protection cannot be achieved on a sustainable basis through continued proliferation of TFRs. With hurricane season just a few months away, FEMA may need expedited approval to fly UASs to support disaster mitigation and relief. While the military services conduct the bulk of their operational missions in the theatre of conflict, they have needs to conduct training missions in CONUS that require more routine flights in the NAS. Likewise, the National Guard has needs to operate missions within CONUS that are difficult to satisfy within the current basing plan. The demand for the use of UASs to satisfy national security and disaster response missions will continue to grow. Responding to this demand will require nationally coordinated action to ensure that the mission needs of all stakeholders can be satisfied expeditiously.

In addition, there are US aviation leadership issues driving the sense of urgency. The US has always been the leader in aviation technology and applications. This leadership position has contributed directly to US national security, economic growth, global commerce, and quality of life for its citizens. According to data in the "Century of Aviation Reauthorization Act," the "total impact of civil aviation on the United States economy exceeds $90 billion annually and accounts for 9 percent of the gross national product and 11 million jobs in the national workforce." While even the most zealous UAS advocate will not claim similar contributions, a robust civil/commercial market for UASs within the next 15 years is quite feasible. On the military side, this growth potential is reflected in the latest QDR that identifies 45% of the strike force will be accomplished by unmanned aircraft.

This market potential has not gone unnoticed by Europe and other established and emerging aviation centers throughout the world. In Europe, the Framework Program (FP) is the European Union's (EU) main instrument for funding research and development, including activities related to airspace management and aerospace technology. UASs have received respectable funding (millions of Euros) under recent FPs, including FP5 (2005), FP6 (2006) and FP7 (2007).

As part of the FP5 activity, the EU launched a thematic network named UAVnet to advance UASs for civilian purposes. Under the Advisory Council for Aeronautics Research in Europe (ACARE), the funded intent is to produce "a world-class European aeronautics industry that leads in global markets for aircraft, engines and equipment" – and yes this includes UASs. The Eurocontrol SESAR (Single European Sky ATM Research) project has UAS activities embedded to harmonize rules for the operation of UASs in European airspace; and interoperability requirements for manned and unmanned civilian/military flight data exchange. The Innovative Future Air Transport System (IFATS) project, funded under FP6 links UAS technology to the next generation of "autonomous aircraft" and can be applied to the civilian, military and homeland security manned and unmanned markets.

The UK has realized that they need a national UAS program whereby government and industry can address the complex issues of flying UASs in controlled and uncontrolled civilian airspace. This program, "Autonomous Systems Technology Related Airborne Evaluation & Assessment (ASTRAE)" is a public, private partnership including their best minds from government, industry, academia, armed forces and regional development boards (state-like economic development teams). ASTRAE was launched in 2005 and is currently funded at approximately $50 million.

The ASTRAE program is similar in many respects to the NASA Access 5 Project. Three years ago, NASA leadership had the foresight to launch the Access 5 program to tackle many of the tough technology and procedural issues necessary to turn the vision of "file and fly" UAS access to the NAS into reality. The project acted as the catalyst for bringing all stakeholders together in a collaborative environment and received national and international acclaim as a model for effective government/industry partnership. Indeed, it was the model on which the European initiatives are now based. Unfortunately, due to a reshaping of NASA aeronautics direction, the Access 5 project was recently terminated. The US now lacks a similar mechanism for bringing government and industry together to work collaboratively on an integrated plan for achieving the important shared objective of safe and routine UAS operations in the NAS. The lack of an US integrating initiative, at the same time that Europe forges ahead with public-private initiatives raises concerns about sustained US leadership.

US industry is eager to ensure that it remains in a leadership position as the market for civil and commercial UASs starts to emerge and as the military use of UASs continues to grow. However, since industry cannot apply for COAs, it is currently disadvantaged by the inability to conduct industry-sponsored flight tests. FAA has responded by issuing two Experimental Certificates (ECs) that allow a single tail number of a UAS to operate under restricted conditions. While ECs are a great step forward, industry ultimately needs more flexible and timely flight test access to the NAS to operate within the short development cycles that are typical of UASs.

To summarize, there are urgent needs to operate UASs routinely in the NAS. Tight controls are placed on access to the NAS until evidence can be provided that UASs can operate with an acceptable level of safety within the NAS. This evidence requires the interaction of technology development, system development, safety analysis, simulation of UASs in the NAS and with ATC, flight tests and demonstrations, and certification standards. The evidence must form the basis for rules, regulations, and procedures that enable unique capabilities of unmanned systems while also ensuring that manned and unmanned systems can operate safely while sharing the same airspace and the same air traffic control system. There is work being done in all of these areas, but the work is not integrated through a single initiative. There is no single USG agency that has the charter, authority and expertise in all of these areas to take charge. Industry wants to be a partner in this endeavor, and is looking for a means to work effectively with all of the USG agencies and with Academia to achieve shared objectives.

To effectively deal with this urgent national need, UNITE makes the following recommendations:

First, develop a national initiative that aligns the interests of all stakeholders and defines a logical sequence of work to generate the evidence necessary to support policy and rulemaking decisions. The initiative should build on work accomplished to date. Short term emphasis is on ensuring that DoD and DHS can conduct critical missions and that industry can expeditiously flight test new products. Mid term focus should be on gaining safe and routine access to the NAS. And long term focus should be on the integration of UASs into the Next Generation Air Transportation System.

Second, define an organizational construct within which all relevant government agencies, industry and academia can participate in a collaborative environment, but in which one agency is assigned to lead and integrate the overall effort or each major element of the initiative.

Third, provide the federal funding necessary to implement the initiative through the designated lead agency or agencies.

Thank you once again for this opportunity. Industry looks forward to a participative relationship with government to solve this pressing national priority.

Response to Subcommittee on Aviation

Committee on Transportation and Infrastructure

Chairman John L. Mica Letter, dated April 6, 2006

UAV National Industry Team (UNITE)

May 1, 2006

UNITE

Question # 1

You state in your testimony that tight controls are placed on access to the NAS and that evidence is needed to support the safe operation of UAVs in the NAS. What type of tests/research must be conducted to gather sufficient evidence to support policy and rulemaking decisions so that UAVs can be safely integrated in the NAS?

Issues associated with the safe integration of UASs with the NAS cover a broad spectrum, from those requiring technology developments to those that are purely procedural in nature. Therefore, a combination of research and test methods will be the most cost effective approach for addressing all issues underlying policy and rulemaking decisions. The methods will include technology R&D, system level integration and verification, software validation, simulation, analysis, and flight demonstrations. The selection of the specific research tasks and the preferred methods for each first requires a clear consensus among the users, developers, regulators and standards-setting organizations on the precise definition of the issue or barrier and agreement on what might constitute equivalent or acceptable level of safety for a UAS relative to a manned system. Arriving at such consensus is complicated by the broad variety of UASs, from the small hand-held systems to the very large systems, with different classes of UASs perhaps requiring a different integration solution, test approach and set of rules/procedures. Also complicating the picture are the different time horizons of interest, from near-term issues associated with streamlining COAs to the longer term issues associated with routine file and fly operations.

There are already many efforts underway to understand the issues, develop technologies and define standards. Examples include detect, sense and avoid technology development by DoD; air traffic flow and control simulations of UASs in the NAS by NASA; and MASPS and MOPS developments by RTCA. Also, roadmaps for defining the issues and approaches have been developed or are in development by several USG agencies, including FAA, OSD and the military services. However, there is no single overarching roadmap that integrates these various efforts into a comprehensive and coherent set of objectives, tasks, and milestones with clearly defined responsibility and authority for each element of the plan. Developing such a roadmap should be the first task in the national initiative, which UNITE recommended in its testimony to the Subcommittee.

This task would include the collection of inputs from all stakeholders on the needs, technologies, rules and standards that need to be developed; the work that has already been done or is in process that could contribute to satisfying these needs; the gaps that still need to be filled; the work (tasks) that would be required to fill the gaps; and the USG agency that is best qualified to lead or perform each task. The stakeholder community that should be involved in developing this roadmap should include federal agencies that have mission needs for UAS operations in the NAS (*Users*), including OSD, the military services, FEMA, CBT, NASA, NOAA, etc.; federal agencies and FFRDCs that are developing the subsystems and systems that will satisfy these mission needs (*Developers*), including DARPA, military labs and SPOs, MITRE, etc.; the FAA as the *Regulator* and *Operator* of the NAS; the organizations that establish the *Standards* to which the UASs will be certified, including RTCA, ASTM, etc.; and the industry associations that represent the companies that will develop and certify the UAS systems and subsystems, including AIA, UNITE, AUVSI, etc.

Without the benefit of this integrated roadmap, but based on work accomplished by the NASA Access 5 project before its termination, UNITE makes the following suggestions regarding research and testing that would substantially add to the evidence base for addressing UAS/NAS integration issues, provide the basis for policy and rulemaking decisions, and mature required systems/subsystems to a ready-for-certification level. These suggestions are organized into four categories: (1) detect, sense and avoid, (2) command, control and communications (C3), (3) ATM/traffic flow, and (4) other issues. It should be noted that these suggestions deal only with the objective of gaining routine file and fly operations. Near term issues associated with satisfying federal agency mission needs through the COA process and satisfying industry needs to conduct company sponsored flight testing of new or improved UASs are not addressed. Also, in general, the suggestions deal with the medium to large classes of UASs and not the unique characteristics of small to micro UASs. It is expected that these suggestions can be substantially improved in both depth and breadth through the recommended road mapping exercise described above.

Detect, Sense and Avoid (DS&A)

The need to meet the "see and avoid" requirements of 14 CFR Part 91.1131 is generally regarded as the most challenging issue for safe and routine UAS operations in the NAS. Since there is no onboard pilot to "see" other aircraft or objects (e.g., gliders, balloons), satisfying this requirement involves not only an appropriate subsystem technology solution and system integration with a vehicle flight control system, but also an interpretation of equivalent or appropriate level of safety for autonomous systems that detect but do not "see".

The DS&A system will include a sensor or set of sensors to perform the "detect" function and software embedded in the UAS mission computer to translate sensor inputs to flight control command outputs to perform the "avoid" function. The sensor subsystem must be capable of not just detecting objects that may represent a potential collision hazard, but also provide range, altitude, bearing and closure rate inputs to the pilot and flight computer. The avoid subsystem software must be capable of determining the probability and timing of a potential collision on the basis of this information and alert the pilot in command of the collision potential. If necessary, it must be capable of autonomously selecting an appropriate maneuver to conform to 'right of way' rules in part 91.113, and autonomously command the flight control system to execute the maneuver. The subsystem will be considered as flight critical and will need to undergo rigorous verification and validation (V&V) for certification.

DoD has funded DS&A technology developments for a number of years. Prototype and experimental systems have been developed to roughly a TRL of 4-5. Some limited flight experiments to characterize the performance of some of the systems have also been conducted. This work is valuable and can serve as the basis for continued subsystem maturation and system level integration and V&V. To provide a sound basis for certification standards as well as to mature candidate DS&A subsystems to a ready-for-certification technology integration level, UNITE suggests a research program that involves analysis/requirements definition, laboratory integration, flight testing in an operationally relevant environment and V&V of common open system software modules.

The laboratory integration will require a Systems Integration Laboratory (SIL) capable of operating DS&A hardware and software in the loop in real time with high fidelity emulation of "threats" and with high fidelity interfaces to vehicle subsystems. To ensure that the integration is applicable to different classes of UASs and not limited to specific UASs, flight control interfaces and UAS dynamic characteristics should be generalized for small, medium and large classes of UAS. The SIL activities should be used to verify end-to-end performance of candidate DS&A subsystems as integrated with different classes of UAS under a variety of environmental conditions and collision threats. Specifically, miss distance, as a function of various environmental conditions under both pilot commanded and autonomous operations, should be characterized.

Further advancement would then require system level integration and flight tests in an operationally relevant environment. There are several candidates for flight test platforms. Perhaps the most appealing approach would be the use of an "optionally manned aircraft" (OMA) that would have a pilot on board for safety purposes as testing is conducted with manned aircraft of various sizes and signatures approaching on collision paths at various aspect angles. The added benefit of this approach would be the direct comparison the detect capability of the DS&A system versus the see capability of the pilot under various weather, lighting and approach conditions to determine "equivalent" level of safety. This flight test program should be followed by rigorous V&V of common open system software modules (that is, modules that are independent of specific UAS implementation) to mature the subsystem to a ready-for-certification status.

<u>Command, Control and Communications (C3)</u>

A UAS consists of a UA, a control station and the C3 links between the UAV and the pilot in command at the control station. Regulations and standards for voice communications between the pilot in command and air traffic controllers for a UAS should be adequately and appropriately covered by existing equipment TSOs and operational standards for manned systems. However, there are currently no regulations for the pilot in command to control and receive status from the UA.

There are a number of issues that need to be addressed in developing these regulations and standards. These include safe operations of the UA under lost link conditions; link availability, quality and latency required for positive control; assured security of the link; and frequency spectrum allocation. The technology to support both line of sight (LOS) and beyond line of sight (BLOS) C3 solutions generally exists. The technical challenges tend to be UAS specific integration issues associated with size, weight and power constraints (particularly for smaller UASs), antenna placement and performance to ensure connectivity and signal strength with satellites (for BLOS) or control station receivers (for LOS), and the C3 system redundancy (dual or triplex) to achieve availability and reliability requirements. Perhaps the most challenging technical issue is not associated with the communications equipment, but with the autonomous contingency management software to ensure safe and predictable operations of the UA under inevitable lost link or high latency conditions.

There are excellent modeling and simulation tools available to analyze the C3 issues identified above. Thus, in contrast to the technologically intensive approach suggested for DS&A, UNITE suggests an approach for C3 that is based primarily on analysis and simulation. Simulation efforts initiated under the Access 5 project (but largely unfinished at project termination) to evaluate C3 bandwidth, latency, availability, reliability, quality and security capabilities and to develop appropriate specifications and standards provide an excellent starting point for the work that needs to be completed. The simulations need to be expanded to provide an end-to-end evaluation capability from pilot command to vehicle response, under varied operational, environmental and degraded performance conditions. Validation of the simulations will be required, probably through flight testing of actual systems under controlled conditions. The simulations should define realistic performance standards based on currently achievable subsystem and system capabilities.

The simulations should also define acceptable procedures for ensuring safe and predictable operations when the UA is not under positive control of the pilot. The autonomous software in itself is not particularly challenging and many UASs already operate autonomously. However, the V&V of the autonomous software for certification represents a technical challenge because of the large number of permutations of environmental, operational, and degraded performance conditions to which the software would need to be tested. It is further suggested, therefore, that an effort to V&V open system common software modules to a ready-for-certification basis be conducted.

ATM/Traffic Flow

There are a number of issues associated with integrating UASs, which have flight performance and operational characteristics that vary considerably from those of manned commercial and general aviation aircraft. For example, with some exceptions, UASs typically cruise at speeds considerably less than manned systems. The response of UASs, particularly smaller ones, to wake turbulence may also be quite different. Also, the missions performed by UASs may involve long periods of "dwell" over areas of interest, as opposed to most manned missions, which transit directly from point A to point B. These differences may impact the traffic flow within the NAS and the standards for safe separation. To address this issue, simulations of typical UASs in the air traffic control system should be conducted to understand and develop safe separation standards and other operating standards or procedures. The simulations initiated on the Access 5 project provide a good starting point. The simulations should be complemented as necessary with flight tests of different classes of UAS to validate the simulation results and to provide inputs to the simulations that require empirical derivation.

Other Issues

Among the other issues that must be addressed are pilot qualification standards and system safety. The pilot-in-command of a UAS must be capable of meeting requirements equivalent to those described in 14 CFR 91.3. However, minimum qualification and medical standards are not identified for UAS operations. Initially, these minimum standards will likely be based on each UAS having a dedicated IFR-rated pilot. Over the long term, however, this requirement ignores the capabilities of some current UASs (and most future UASs) to operate fully autonomously, with the pilot-in-command not actually "flying" the UAS, but monitoring UAS operations and intervening only when necessary through a computer input device. These autonomous operations offer the potential for multiple UASs to be controlled by a single pilot, which changes the economics of UAS operations and opens the market for economically attractive commercial ventures. To address these pilot qualification issues, both in the near term and over the longer term, the knowledge and skills for the pilot-in-command need to be assessed. This assessment was initiated under the Access 5 project, but needs to be continued. Pilot-in-the-loop simulations in which UASs are controlled within the ATC under various levels of autonomy and under various levels of degraded performance would prove to be quite valuable in supporting these assessments.

Finally, routine UAS operations within the NAS present potentially new and/or different hazards and risks than those of manned systems. A comprehensive system safety analysis is required to identify these unique hazards and risks and to make recommendations for safe operations, procedures and certification standards.

Summary

The DS&A issue is the most technologically challenging. Subsystem technology maturation, system level integration in a real-time high fidelity SIL, flight testing in operationally relevant environments, and autonomous avoidance software V&V are suggested as important research/testing for this area. The suggested approach for the C3 issue relies primarily on simulation and analysis. However, flight-testing to validate the simulation results and V&V of the autonomous software that will control the UAS during lost link conditions are also considered important. Simulation of UAS operations in the ATM system is the suggested approach to understand traffic flow issues and determine standards for safe separation. Analysis, as supplemented as necessary by simulation, is recommended for other issues, such as system safety and pilot qualifications.

In addition to these suggestions, UNITE believes there would be great benefit to "graduation exercises". These exercises would consist of end-to-end operations that would require all players to participate and all standards and procedures to be exercised, from filing the flight plan to successful mission completion. These exercises could be conducted for operationally relevant scenarios, such as file and fly deployment of a UAS for a disaster relief operation or for border/port monitoring without TFRs.

Finally, we would like to reiterate that we believe these suggestions can be greatly improved, in both breadth and depth, by means of a national road-mapping initiative. This initiative would involve all relevant federal agencies, industry and academia in defining the needs, the work required to meet the needs, and tasks, milestones and resources required to complete the work.

UNITE

Question # 2

Do industry-wide standards exist for the manufacturing and operations of unmanned aircraft? If not, what is industry's plan to develop common standards?

Industry-wide standards for manufacturing and operations of UASs do not currently exist. From a manufacturing standpoint, it is expected that, with few exceptions, the standards already in place for manned aircraft will be applicable and appropriate for unmanned aircraft.

In 2005, the Aerospace Industries Association (AIA) published "The Future of Aerospace Standardization", and this report set about "examining aerospace standardization systems, processes, and organizations; defining requirements for standards and standards systems to support continued and future growth of the aerospace industry; and setting forth recommendations for ensuring the optimum standards infrastructure for aerospace". This document provides an excellent framework to evaluate the standards requirement for UASs.

Following this publication's release, the AIA Board of Governors chartered the Strategic Standardization Forum for Aerospace (SSFA), to create and sustain a strong partnership between stakeholders (industry, government, standards developers, and customers) to enhance the development, delivery, management, and utilization of aerospace standards.

The SSFA has now embarked upon identifying the "big picture framework" for UAS standards and has received input from RTCA, ASTM, SAE, and other standards developers. This work is scheduled to be an ongoing activity to inventory the existing standards for relevance to UASs, identify the relative maturity of those standards, complete a gap and risk analysis, and identify how best to recommend when and where appropriate standards for UASs are needed.

For operational standards, the RTCA Inc, has a mission to "advance the art and science of aviation and aviation electronic systems for the benefit of the public; and has the objective to develop consensus recommendations regarding the contemporary aviation issues while functioning as a Federal Advisory Committee to the FAA".

RTCA has established Special Committee 203 (SC-203) at the request of the Aircraft Owners and Pilots Association (AOPA) and the Federal Aviation Administration (FAA). The committee will initially focus on developing recommendations that will assure the safe operation of UASs within the NAS.

The initial Terms of Reference (TOR) for SC-203 called for three initial products to be generated: (1) Minimum Aviation System Performance Standards (MASPS) for Unmanned Aircraft Systems, (2) MASPS for Command, Control and Communications (C3) Systems for UASs, and (3) MASPS for Detect, Sense and Avoid (DS&A) Systems for UASs. The FAA has recently challenged RTCA to accelerate development of Minimum Operational Performance Standards (MOPS) for C3 and DS&A subsystems as well as the MASPS.

Industry, including UNITE, is actively engaged with RTCA to define the plan for developing these standards and will work to ensure appropriate levels of support from subject matter experts within industry are available for this important initiative.

It must be recognized that this RTCA initiative, nor other initiatives being executed by other standards developers (see SSFA comment above), does not substitute for the work that must be accomplished to provide the basis for certification and the maturation of ready-for-certification subsystems that was discussed in our response to question #1. Indeed, the quality of the MASPS and MOPS will benefit from the parallel conduct of the technology, system development and simulation work described in that response. As with most developments of this nature, the best products result from the iteration of top down (performance standards) and bottom-up (subsystem development and design standards) efforts as they both progress.

The AIA SSFA activities and those of RTCA, ASTM, SAE and other standards developers are all "work in progress". Industry, including UNITE, will continue to work with the established aerospace trade associations (AIA, AUVSI), the various standards bodies, the FAA, and other government agencies to determine which standards are necessary for UASs to safely and routinely fly in the NAS and to deliver them in the appropriate manner.

SENIOR DEMOCRATIC WHIP

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Eddie Bernice Johnson
Congress of the United States
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Eddie Bernice Johnson

Opening Statement for the Honorable Eddie Bernice Johnson
House Subcommittee on Aviation
Unmanned Aerial Vehicles (UAVs) and the National Airspace System
Wednesday, March 29, 2006 – 2167 RHOB

Thank you Mr. Chairman.

I want to thank you and Ranking Member Costello for holding this hearing this morning on the issue of Unmanned Aerial Systems.

Without question, the usage of unmanned vehicles in the areas of surveillance and reconnaissance missions has proven to be an invaluable tool in the missions of our military.

The U.S. military has demonstrated that UAV development serves a cost-effective answer to a number of modern military needs.

In addition to UAV deployment by the U.S. military, the Congress has also called for the usage of UAVs to support homeland security other law enforcement-related missions.

Now it appears that there are various segments within the commercial aviation industry interested in utilizing UAVs in the National Airspace System.

Obviously, this type of demand for UAVs begs the questions that if commercial usages of UAVs are permitted, how do we as policymakers ensure that the necessary safeguards are in place for the protection of public safety?

It is my understanding that FAA has identified two primary safety issues with regard to UAV operation in the commercial aviation industry:

1. The need for UAV command and control redundancies should a disruption in communication arise; and

2. The need for reliable "detect and avoid" capability so that UAVs can sense and avoid other aircraft.

I welcome our witnesses this morning and look forward to gaining additional insight into whether or not the FAA feels expanding commercial UAV usage is a good idea, and if so, what are ~~there~~ their plans to address safety and oversight issues as they relate to UAVs?

Thank you.

STATEMENT OF MAJOR GENERAL MICHAEL KOSTELNIK, ASSISTANT COMMISSIONER FOR THE BUREAU OF CUSTOMS AND BORDER PROTECTION OFFICE OF AIR AND MARINE, BEFORE THE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION, ON UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM

March 29, 2006

Good morning, Chairman Mica, Congressman Costello, and Members of the Subcommittee. It is my pleasure to be with you today to discuss the future of the unmanned aerial vehicles (UAVs) program in protecting our borders and ensuring our national security. This issue is of enormous importance, since the use of UAVs can significantly enhance our ability to protect our borders. The Bureau of Customs and Border Protection Air and Marine (CBP A&M) is keenly aware of the safety concerns surrounding the program and is proud to be working with the Federal Aviation Administration (FAA), the Coast Guard, the Department of Defense, and the Department of the Interior to implement the best action plan for this vital equipment.

After years of military use, the Department of Homeland Security (DHS) announced the first sustained civilian use of UAVs on June 25, 2004. The aircraft were then used to strengthen the Arizona Border Control Initiative (ABCI). The FY 2005 and FY 2006 Appropriations to the Custom and Border Protection and Science and Technology Directorate contained funding sufficient to acquire a complete system consisting of two aircraft. One UAV has been acquired and the other is scheduled to be delivered this summer; the FY 2007 request contains $10.3 million for the UAV program. Using successes already achieved as a guide, CBP A&M is looking toward long-term program needs and is constantly working to build a strong and safe program.

Sections 5101 and 5201 of the Intelligence Reform and Terrorism Prevention Act of 2004 directed the Secretary of Homeland Security to develop a comprehensive plan for the systematic surveillance of the Southwest Border by UAVs. Under the direction of former Secretary Ridge, CBP established an initial operating capability in September 2005 with the delivery of a Predator B UAV. As UAVs are most effective at night, CBP considers the optimum mission scenario for a UAV to be a 14-hour day, sunset to sunrise, 6 days a week. The UAV currently in CBP's possession is operating in a Temporary Flight Restricted (TFR) Zone from 5:00 p.m. to 7:00 a.m.

With a northern land border that is 4,121 miles long with 430 official ports of entry and an untold number of illegal crossing places and a southern land border that is 2,062 miles long with 30 official ports of entry and an untold number of illegal crossing places, we need additional technology to supplement manned aircraft surveillance and current ground assets to ensure more effective monitoring of United States territory, adjacent to our neighbors' non-maritime territory. Electro-Optical sensors now exist that would allow UAVs to fill a gap in current land border surveillance. Those sensors have the ability to identify small objects from high altitudes in a variety of weather conditions (although EO/IR sensors are adversely effected by bad weather). Acquiring better sensors would provide CBP with the opportunity to fly in positive control airspace. That would increase the safety of the flights since operating in positive control airspace would allow the UAV to be segregated away from general aviation aircraft operating under visual flight rules and to operate in airspace where all aircraft are totally controlled by and required to communicate with Air Traffic Control.

UAVs are also an economical choice for surveillance. The Predator B costs $6.8 million. By contrast, a P-3 aircraft costs significantly more to acquire and operate. Aerostats, which are unmanned, helium-filled blimps that are tethered to the ground, represent a fixed alternative to traditional UAVs, though a geographically limited one. Already fielded for both military and civilian use, aerostats match some of the appealing qualities of the UAVs: low cost, elevated sensor capabilities, and lengthy loiter times. They do not, however, provide the same opportunity for ground control or large areas of coverage. With the capability to fly for more than 30 hours without refueling, UAVs have a significant advantage over manned aircraft in some circumstances and the possibility for extended coverage regions, unlike aerostats, which is important for successful border surveillance. The Predator B aircraft, with its man-in-the-loop, brings its operator into the mission area "virtually", providing unique mission capability for an unmanned system.

It is fair and prudent to address a wide variety of safety of flight issues that UAVs present to flight in controlled airspace intermingled with manned aircraft. As this emerging technology is still relatively new - particularly for domestic use, valid safety issues have been raised and need to be addressed. CBP has been flying the Predator B since late September 2005, and to date operations have been incident-free. A 2005 study from the Massachusetts Institute of Technology stated in its abstract, "It is in the public interest to achieve the full benefits of UAV operations, while still preserving safety through effective mitigation of risks with the least possible restrictions."[1] The Predator B that CBP operates contains a redundant system to ensure lower accident rates. This redundant system works on all levels, from sensors to the flight computer, and provides a triple-check system to protect the vehicle and others in the airspace. CBP tested several UAV systems during ABCI in 2004 and 2005. A contract was competitively awarded to General Atomics for the Predator B because of its ability to meet DHS requirements.

The Predator B is also programmed with a Lost Link (flight control) function to allow the aircraft to autonomously and automatically execute link recovery actions to maximize opportunity to recover link. This function is implemented within the triplex flight computer and therefore has the same integrity as the flight critical elements. In the event of protracted loss of link, the aircraft is flown autonomously via Emergency Mission waypoints to a safe loiter area while changing transponder

[1] Weibel, Roland E. and Hansman, R. John, "Safety Considerations for Operation of Unmanned Aerial Vehicles in the National Airspace System," p. 3 (March 2005).

codes and eventual set down in a predetermined area. In this manner, safe containment is maintained in the event that the multiple data links fail. The vehicle also has failure management functions that prevent aircraft flyaway outside of the assigned operating areas. During FAA review and approval, this functionality was regarded as pivotal to safety when mitigating the effect of highly improbable, but worse case, scenarios.

The mission control officer must maintain awareness of forecasted, reported, and prevailing weather along the Lost Link route of flight at prescribed altitudes by all available means. The mission control officer must input Lost Link plans before flight and update as necessary and must continually update minimum fuel to account for weather hazards such as cloud layers, icing, and turbulence.

Pilots are held to a very high standard as well. They are all FAA instrument rated and maintain currency by flying a minimum of 200 UAV logged flight hours. In addition, pilots must successfully complete an annual oral and written examination and an annual check flight evaluation. All pilots are trained to handle the most critical emergencies that a UAV can face, including engine or generator failure at takeoff and in flight, engine over-heating, nose camera failure, ground control station rack or monitor failure, and smoke and fire in a ground control station.

CBP A&M uses established procedures and agreements to conduct real time coordination with the FAA for the launch of law enforcement aircraft on exigent missions. An FAA liaison is permanently assigned to the Air and Marine Operations Center (AMOC) to further facilitate any non-standard situations that may arise, which are not addressed in the existing written guidance. AMOC has electronic access to FAA flight plans, radar data, and communications to all FAA air traffic facilities. CBP A&M operators use this connectivity to coordinate law enforcement air operations with FAA. The FAA is currently developing guidelines and will undoubtedly practice the utmost caution when determining regulations for these aircraft to become a part of our airspace on a daily basis.

CBP A&M is an active member of the FAA tasked RTCA Special Committee 203, which is gathering data to develop standards, crucial to moving forward with the integration of UAVs into the National Airspace System (NAS). CBP A&M is committed to working with the FAA and other organizations by providing lessons learned to ensure the safety of the NAS.

While UAVs are not the panacea for all mission types and will not replace manned aircraft in most of our current missions, they do provide unique capabilities that will make them force multipliers for our border surveillance and interdiction missions.

CBP A&M is committed to supporting our mission – "preventing terrorists and terrorist weapons from entering the United States, while also facilitating the flow of legitimate trade and travel." As one of the agencies responsible for protecting our borders, we take the responsibility seriously. We are committed to working with

Congress and with relevant Federal agencies to keep our borders – as well as our National Airspace System – safe.

Mr. Chairman, this concludes my prepared remarks and I would happy to answer any questions you may have. Thank you for your time.

QUESTIONS FOR THE RECORD

"Unmanned Aerial Vehicles & the National Airspace System"
House of Representatives
Committee on Transportation and Infrastructure
Subcommittee on Aviation
March 29, 2006

QUESTION:
How much expansion of Unmanned Aircraft (UAs) into the National Airspace System would you need to better accomplish your missions?

RESPONSE: Currently, CBP is operating an Unmanned Aircraft Systems (UAS) within the confines of the National Airspace System (NAS) in an area called a Temporary Flight Restriction (TFR). This TFR, located in southern Arizona and southern New Mexico, is approximately 344 miles wide, west to east. The TFR's southern boundary is located on the Arizona/Mexico border and is nominally 15 miles deep (south to north). This TFR is located in an altitude stratum between 14,000' and 16,000' above sea level. The border security mission being flown by the UA places it overhead the most critical area, which is just north of the border with Mexico.

In southern Arizona the majority of the TFR is coincidental with military Special Use Airspace (SUA). The current TFR's depth of approximately 15 miles was a distance agreed to with the military to provide minimal impact to their operations. Border Patrol agents usually operate within 25 miles of the border where they are authorized to operate on private property without a warrant. This 25-mile boundary along the border would also be the preferred limit to operate the UA.

Sensors currently on board the UA restrict its use within the altitude stratum designated in the TFR. As further acquisitions to the UA program occur, more advanced and sensitive sensors are being considered. These sensors will allow the UAs to operate at a higher altitude, preferably above 18,000.

Expansion of the UAV operations into the National Airspace System (NAS) could conceivably overlay the contiguous United States border inward to approximately 25 miles and outward over territorial waters.

QUESTION:
The DOD and FAA have a long-established working relationship and clearly understand each other's roles and responsibilities. The CBP is new to this process. What is your understanding of the FAA's role and responsibility with regard to UAS operations in the NAS?

RESPONSE: CBP's use of the UA is ground breaking because it is the first agency granted a Certificate of Authorization (COA) by the FAA to operate within a TFR. FAA has recently established a new office, Unmanned Aircraft Office (AIR-160), to handle the integration of UA operations into the NAS. The interagency Joint Planning Development Office (JPDO) is developing a plan for the Next Generation Air Transportation System (NGATS). The comprehensive plan will address many elements of the future NAS including an expected increase in the number of requests for UA flights into the NAS but expects these queries from government, military, and private entities.

QUESTION:
Do you have any information on the cost savings CBP expects to achieve in utilizing UASs along the border?

RESPONSE: If the cost savings referenced in the question relates to replacement of agents (human assets) or air operations costs, then there is a fundamental misunderstanding about the value of the UAs in enhancing border security. UAs operations will certainly pay off in terms of additional seizures and arrests but the ultimate value of that is likely not completely quantifiable. Any cost savings generated by the use UAs have not yet been clearly delineated and this is particularly true when assessing agents with UAs. Additionally, while UAs may lead to some savings in air operations costs, it will likely not have a significant impact on overall personnel costs. It is important to remember that although UAs may detect traffic that agents may not otherwise see, UAs do not interdict and apprehend – those actions require Agents. Consequently, UAs do not, and should not, replace human assets. However, the UA has proven to be an invaluable "force multiplier" on the border. With limited CBP personnel stationed and deployed temporarily there, the UA has been able to investigate sensor activations where some have resulted in the discovery of grazing cattle or non-UDAs. This has alleviated the Border Patrol from dispatching agents to an area where they would not have been needed and has allowed for their utilization at other locations.

Since the UA is a new asset in CBP's aircraft inventory, we are not able at this time to quantify the cost savings or comparisons to other aircraft systems that CBP operates, e.g., maintenance costs, fuel costs, etc. However, we are able to compare the operations themselves against those of manned aircraft. A UA is capable of being deployed for a 14-hour mission, whereas multiple manned flights or aircraft may be required to cover the same mission time frame (except for the P-3). Being constrained in a small amount of airspace, as in the TFR, and in a near constant loitering orbit, is fatiguing on a pilot of a manned aircraft. As the groups of suspected aliens move north from the border, the UA may sometimes loiter for hours while coordinating with ground forces and manned aircraft for an interdiction.

The UA is but one part of an operational system, with manned aircraft being another. A UAS augments air-supported interdiction operations with increased surveillance and loitering time aloft. While manned aircraft will always be required to respond to threats that are identified by the UAS, the benefits of this system are readily apparent -- from October 1, 2005 to April 25, 2006, the UAS flew 886 hours in support of the Border Patrol, assisting in the arrest of 2309 undocumented aliens and seizure of 8,267 pounds of marijuana.

CBP will be able to provide the requested information in the future as the program develops and comparisons are made to manned aircraft that would have been used in its place.

Opening Statement of Rep. Kenny Marchant
Committee on Transportation and Infrastructure
Aviation Subcommittee
Hearing on Unmanned Aerial Vehicles (UAVs) and the National Airspace System
March 29, 2006

Thank you for holding this hearing today, Chairman Mica, on this very timely topic. I am a strong advocate for the use of UASs for both civil and military applications. The possibilities for this burgeoning field of technology are many, yet operating UAVs in the National Air Space poses some interesting challenges. First and foremost, it is imperative for the industry to develop reliable safety mechanisms on UAVs to diminish the possibility of accidents. As the FAA has said, one of the technologies which must be innovated, tested and proven are the "see and avoid" technologies, which we will hear more about later in the hearing from our witnesses. Some may think this kind of technology is far off in the future. However, it may be closer than you think.

In the last few years I have joined with several of my fellow Members of the Texas delegation to provide appropriations support for the Navy RDT&E activity that is developing one of these "see and avoid" technologies. In fact, the Navy is currently working with a company in my District, Geneva Aerospace, to develop this critical enabling technology, and they have already met with much success. This is just one way in which I am working with some of Texas' fastest growing technology companies to support the continued development of the exciting field of Unmanned Aviation.

Thank you Chairman Mica and I look forward to hearing the testimony.

Testimony of
Jay C. Mealy, Programs Director
Academy of Model Aeronautics
before the
Committee on Transportation and Infrastructure
Subcommittee on Aviation
U. S. House of Representatives
Regarding
Unmanned Aerial Vehicles and the National Airspace System

Good afternoon Chairman Mica, ranking Member Costello, and Members of the Aviation Subcommittee. My name is Jay Mealy and I am Programs Director for the Academy of Model Aeronautics, Inc. (AMA), (Academy), a nationally recognized membership organization exempt from federal income tax under section 501 (c) (3) of the Internal Revenue Code of 1986. On behalf of the Academy and our members I would like to thank you for this opportunity to represent the sport of aeromodeling and am personally honored to be before you today.

Background

The Academy of Model Aeronautics has been in existence as a separate entity since 1936 and has grown to represent more than 170,000 members nationwide who participate in the sport of building and flying model aircraft. Prior to 1936 we were part of the National Aeronautics Association (NAA) through which we were represented to the world governing body of sport aviation: the Fédération Aéronautique Internationale (FAI). Since our establishment we have represented our members to the FAI directly.

The Academy charters over 2500 clubs and sanctions more than 2000 flying events annually, the largest of which is the National Aeromodeling Championships. This competition is hosted every year at the International Aeromodeling Center, which is co-located with our Headquarters, in Muncie, Indiana, during the month of July and traditionally involves over 1200 participants, their families, and spectators.

We are also responsible for supporting our national teams, representing the United States in world aeromodeling competitions, and hosting numerous world competitions in this country on a regular basis. These programs and activities have established the United States as a recognized leader in the sport of aeromodeling.

The Academy's mission as a world-class association of modelers is focused on promotion, development, education, and advancement of modeling activities. The Academy provides leadership, organization, competition, communication,

protection, representation, recognition, education, and scientific/technical development to modelers.

The Academy is also dedicated to model aviation as an educational tool for the formal classroom as well as informal afterschool clubs, activities, and camps. Through an active educational outreach program the Academy supports classroom teachers and leaders of community groups who wish to infuse topics of math, science, and technology with engaging aviation activities. The AMA seeks to introduce young men and women to the art and craft of aeromodeling as well as increase their ability to make informed decisions as future citizens of a changing and increasingly complex world.

Since our inception we have worked closely with local, state, and federal agencies to establish and ensure the high level of professionalism and safety that our members exhibit, and the general public has come to expect, in a sport as beneficial as building and flying model aircraft. The sport spans all socioeconomic boundaries and brings together families, friends, communities, and even countries in an atmosphere of camaraderie, competition, education and recreation. Building and flying model aircraft develops such important life skills as creativity, patience, goal setting, and perseverence, no matter what age it is entered into. Aeromodeling allows participants to experience pride in accomplishment, helps develop a spirit of teamwork, and has inspired many notable contributors to the success of our nation, not only through aviation but through other vocations and avocations as well.

The Academy has established a long and cooperative working relationship with such government agencies as the Federal Communications Commission (FCC), the Federal Aviation Administration (FAA), the Department of Defense (DOD), and the Transportation Security Administration (TSA), to name a few. These relationships and interactions have demonstrated the valuable resources and talents possessed by the Academy and the Academy's willingness to utilize those resources and talents in meaningful resolutions to provide for the preservation of this sport for the benefit of future generations. Our successes in such endeavors have been essential in providing the opportunity to be before you today representing the sport of aeromodeling.

In 1972 the Academy realized the need for guidelines for modelers. "FAA was interested in the fact that AMA had a proposed safety code which could be utilized as a set of standards for addressing the operation of model aircraft within the National Airspace System"(1) and that is when the original National Model Aircraft Safety Code was adopted-an historic event. It has evolved into the following document included for your review.

(1) AMA Board minutes, February 12, 1972

Official
Academy of Model Aeronautics
National Model Aircraft Safety Code
Effective January 1, 2006

GENERAL

1. A model aircraft shall be defined as a non-human-carrying device capable of sustained flight in the atmosphere. It shall not exceed limitations established in this code and is intended to be used exclusively for recreational or competition activity.
2. The maximum takeoff weight of a model aircraft, including fuel, is 55 pounds, except for those flown under the AMA Experimental Aircraft Rules.
3. I will abide by this Safety Code and all rules established for the flying site I use. I will not willfully fly my model aircraft in a reckless and/or dangerous manner.
4. I will not fly my model aircraft in sanctioned events, air shows, or model demonstrations until it has been proven airworthy.
5. I will not fly my model aircraft higher than approximately 400 feet above ground level, when within three (3) miles of an airport without notifying the airport operator. I will yield the right-of-way and avoid flying in the proximity of full-scale aircraft, utilizing a spotter when appropriate.
6. I will not fly my model aircraft unless it is identified with my name and address, or AMA number, inside or affixed to the outside of the model aircraft. This does not apply to model aircraft flown indoors.
7. I will not operate model aircraft with metal-blade propellers or with gaseous boosts (other than air), nor will I operate model aircraft with fuels containing tetranitromethane or hydrazine.
8. I will not operate model aircraft carrying pyrotechnic devices which explode or burn, or any device, which propels a projectile of any kind. Exceptions include Free Flight fuses or devices that burn producing smoke and are securely attached to the model aircraft during flight. Rocket motors up to a G-series size may be used, provided they remain firmly attached to the model aircraft during flight. Model rockets may be flown in accordance with the National Model Rocketry Safety Code; however, they may not be launched from model aircraft. Officially designated AMA Air Show Teams (AST) are authorized to use devices and practices as defined within the Air Show Advisory Committee Document.
9. I will not operate my model aircraft while under the influence of alcohol or within eight (8) hours of having consumed alcohol.
10. I will not operate my model aircraft while using any drug which could adversely affect my ability to safely control my model aircraft.
11. Children under six (6) years old are only allowed on a flightline or in a flight area as a pilot or while under flight instruction.
12. When and where required by rule, helmets must be properly worn and fastened. They must be OSHA, DOT, ANSI, SNELL or NOCSAE approved or comply with comparable standards.

RADIO CONTROL

1. All model flying shall be conducted in a manner to avoid over flight of unprotected people.
2. I will have completed a successful radio equipment ground-range check before the first flight of a new or repaired model aircraft.
3. I will not fly my model aircraft in the presence of spectators until I become a proficient flier, unless I am assisted by an experienced pilot.
4. At all flying sites a safety line or lines must be established, in front of which all flying takes place. Only personnel associated with flying the model aircraft are allowed at or in front of the safety line. In the case of airshows or demonstrations a straight safety line must be established. An area away from the safety line must be maintained for spectators. Intentional flying behind the safety line is prohibited.
5. I will operate my model aircraft using only radio-control frequencies currently allowed by the Federal Communications Commission (FCC). Only individuals properly licensed by the FCC are authorized to operate equipment on Amateur Band frequencies.
6. I will not knowingly operate my model aircraft within three (3) miles of any preexisting flying site without a frequency-management agreement. A frequency-management agreement may be an allocation of frequencies for each site, a day-use agreement between sites, or testing which determines that no interference exists. A frequency-management agreement may exist between two or more AMA chartered clubs, AMA clubs and individual AMA members, or individual AMA members. Frequency-management agreements, including an interference test report if the agreement indicates no interference exists, will be signed by all parties and copies provided to AMA Headquarters.
7. With the exception of events flown under official AMA *Competition Regulations* rules, excluding takeoff and landing, no powered model may be flown outdoors closer than 25 feet to any individual, except for

the pilot and the pilot's helper(s) located at the flightline.

8. Under no circumstances may a pilot or other person touch a model aircraft in flight while it is still under power, except to divert it from striking an individual.
9. Radio-controlled night flying is limited to low-performance model aircraft (less than 100 mph). The model aircraft must be equipped with a lighting system which clearly defines the aircraft's attitude and direction at all times.
10. The operator of a radio-controlled model aircraft shall control it during the entire flight, maintaining visual contact without enhancement other than by corrective lenses that are prescribed for the pilot. No model aircraft shall be equipped with devices which allow it to be flown to a selected location which is beyond the visual range of the pilot.

FREE FLIGHT

1. I will not launch my model aircraft unless I am at least 100 feet downwind of spectators and automobile parking.
2. I will not fly my model aircraft unless the launch area is clear of all individuals except my mechanic, officials, and other fliers.
3. I will use an effective device to extinguish any fuse on the model aircraft after the fuse has completed its function.

CONTROL LINE

1. I will subject my complete control system (including the safety thong where applicable) to an inspection and pull test prior to flying. The pull test will be in accordance with the current *Competition Regulations* for the applicable model aircraft category. Model aircraft not fitting a specific category shall use those pull-test requirements as indicated for Control Line Precision Aerobatics.
2. I will ensure that my flying area is clear of all utility wires or poles and I will not fly a model aircraft closer than 50 feet to any above-ground electric utility lines.
3. I will ensure that my flying area is clear of all nonessential participants and spectators before permitting my engine to be started.

SPECIALIZED SUPPLEMENTAL SAFETY
CODES, STANDARDS AND REGULATIONS
RADIO CONTROL COMBAT (#525)
GENERAL RADIO CONTROL RACING (#530)
GIANT SCALE RADIO CONTROL RACING (#515-A)
GAS TURBINE OPERATION (Note: Special waiver required) (#510-A)
These special codes and appropriate documents may be obtained either from the AMA Web site or by contacting AMA Headquarters.

In addition, and as an example of the cooperation and joint effort between the Academy and the FAA, an Advisory Circular (AC), "Model Aircraft Operating Standards," was created in July 1972 designated AC 91-34, and later revised in June 1981 as AC 91-57 for the purpose of outlining and encouraging voluntary compliance with safety standards for model aircraft operators. A copy of the current document is also included for your review.

Contained on page 5:

AC 91-57

DATE June 9, 1981

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: *MODEL AIRCRAFT OPERATING STANDARDS*

1. PURPOSE. This advisory circular outlines, and encourages voluntary compliance with, safety standards for model aircraft operators.

2. BACKGROUND. Modelers, generally, are concerned about safety and do exercise good judgement when flying model aircraft. However, model aircraft can at times pose a hazard to full-scale aircraft in flight and to persons and property on the surface. Compliance with the following standards will help reduce the potential for that hazard and create a good neighbor environment with affected communities and airspace users.

3. OPERATING STANDARDS.

a. Select an operating site that is of sufficient distance from populated areas. The selected site should be away from noise sensitive areas such as parks, schools, hospitals, churches, etc.

b. Do not operate model aircraft in the presence of spectators until the aircraft is successfully flight tested and proven airworthy.

c. Do not fly model aircraft higher than 400 feet above the surface. When flying aircraft within 3 miles of an airport, notify the airport operator, or when an air traffic facility is located at the airport, notify the control tower, or flight service station.

d. Give right of way to, and avoid flying in the proximity of, full-scale aircraft. Use observers to help if possible.

e. Do not hesitate to ask for assistance from any airport traffic control tower or flight service station concerning compliance with these standards.

R.J. VAN VUREN
Director, Air Traffic Service

Initiated by: AAT-220

Purpose

I am before you today to speak on behalf of the AMA and its members to preserve our privilege to operate in the National Airspace System - a system which is being asked to make room for the burgeoning Unmanned Aerial Vehicle (UAV) community and the vehicles they are creating for commercial and military purposes. It is not the intent of the Academy to in any way impede such development, evolution, and acceptance, and we are fully aware of the market and utility of such vehicles in enhancing the lives of us all. We do, however, note that because of the superficial similarities between model aircraft and UAVs the potential does exist to look at them as one group which would be completely inappropriate. They may look the same, but they are definitely different and that difference is not in their appearance but grounded solidly in their intended uses.

I have included the definition of a model aircraft and operator; please see below:

- The Academy of Model Aeronautics (AMA) defines a model aircraft and its operation as follows:

A non-human-carrying device capable of sustained flight in the atmosphere, not exceeding the limitations established in the Official AMA National Model Aircraft Safety Code, exclusively for recreation, sport, and/or competition activities.

The operators of radio control model aircraft shall control the aircraft from the ground and maintain un-enhanced visual contact with the aircraft throughout the entire flight operation. No model aircraft shall be equipped with devices that would allow for autonomous flight.

As can be determined from these definitions, the focus of the AMA is on recreation, sport, and competition activities that are available to model aviation participants, and our 70 years of overseeing this sport speaks highly of the ability of the AMA and its members to continue to operate effectively in a cooperative manner with the related governmental and non-governmental agencies. Our purpose and the purpose of our sport sets us apart from the UAV community, and even the general aviation community, but our remarkable track record of safe operations during that 70 years, involving thousands of participants throughout this country speaks volumes about our ability to continue to self-regulate our sport.

Though it may be true that UAVs evolved from model aircraft, like any other evolutionary sequence the root entity maintains its own identity as the newly evolved example progresses on a different search for its own identity. Model airplanes may have been a huge contributing factor in the development of UAVs, but model airplanes are still model airplanes, fulfilling their intended purpose (recreation, sport, and competition) as they have for decades. UAVs, on the other hand, are the relatively new entity, just beginning to discover their reasons for being, their purpose, and their place in the grand scheme of things. They are different and completely separate from model aircraft.

Our request to this committee is that model airplanes be permitted to continue operating within the National Airspace System, as we have for more than 70 years, as we commit to tirelessly working with all pertinent government agencies, in particular the FAA, as we always have, to guarantee the safe and sound operation of model aircraft in this country. We request that model aviation not be innocently sucked into a black hole of regulation, a place in which, based on its long and successful history, it does not deserve to be.

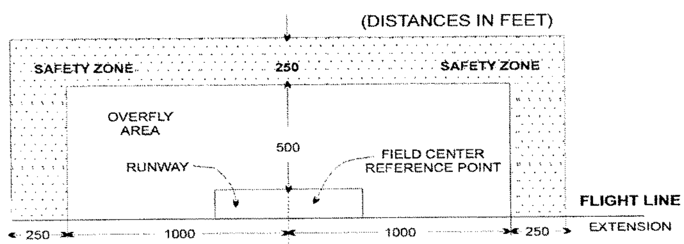
Thank you for your time, understanding, and consideration in this very important matter.

Response by
Jay C. Mealy, Programs Director
Academy of Model Aeronautics
To the question posed by
Subcommittee on Aviation
Regarding
Unmanned Aerial Vehicles and the National Airspace System

Question: In your testimony you note that "...because of the superficial similarities between model aircraft and UAVs the potential does exist to look at them as one group which would be completely inappropriate. They may look the same, but they are definitely different and that difference is not in their appearance but grounded solidly in their intended uses." However, from a safety perspective, both model aircraft and UAVs are capable of causing property damage, as well as death or injury to the flying public and people on the ground. How would you respond to this concern?

Response: Though it may be true that model aircraft and UAVs are capable of causing property damage, as well as death or injury to the flying public and people on the ground, the reason why such occurrences have not been an issue in the 70-plus years of model-aircraft activity is that the environment in which models are flown is very effectively controlled, not only by the "National Model Aircraft Safety Code" (contained within my original testimony) but by the physical limitations of the pilots and aircraft.

The geographic layout of a typical radio-control model-flying facility is such that there exists a well-defined "runway," "overflight area," and a "safety zone" defining the boundaries of the overflight area. The diagram below is a typical field layout. It must be understood, however, the types of models flown, topography, and other factors result in many possible configurations employing varying distances other than those listed. This defined area is for flight operations only and is kept free of unprotected individuals, vehicles, and structures. In addition, models flown in this well-defined area do not create trespass violations with neighboring property owners.



All flight operations are required to be performed within the defined boundaries of the flying facility, and the distances from the pilot are established as continuous, unenhanced visual contact with the aircraft by the pilot (provided within my original testimony as definition of model aircraft and its operation).

As for model operations where full-scale aircraft are a concern, Advisory Circular 91-57 is adhered to. In addition, it is strongly encouraged by the Academy of Model Aeronautics to utilize observers and monitor any frequencies applicable to the area in which model operations are occurring. In certain instances, where altitudes greater than 400' AGL may be achieved, the controlling agency for that area is notified and proper NOTAMS are issued.

OPENING STATEMENT OF
THE HONORABLE JAMES L. OBERSTAR
AVIATION SUBCOMMITTEE

UNMANNED AERIAL VEHICLES AND THE NATIONAL AIRSPACE SYSTEM
MARCH 29, 2006

- I want to thank Chairman Mica and Ranking Member Costello for calling today's hearing on *Unmanned Aerial Vehicles and the National Airspace System.*

- Mr. Chairman, commercial aviation is on track to exceed 1 billion passengers by 2015. At the same time, other operators are also vying for use of our national airspace system (NAS), including both governmental and commercial operators of unmanned aerial vehicles. Unmanned Aerial Vehicles, or UAVs, come in all shapes and sizes – from as little as four pounds or as much as 100,000 pounds -- and may be programmed to work autonomously or by computer operator.

- UAVs are increasingly being used for military, law enforcement, homeland security, firefighting, weather prediction and tracking purposes. According to a recent *Aviation Week and Space Technology* article, the UAV market is expected to be worth $7.6 billion through 2010, with the majority of UAVs being purchased by the U.S. As with any emerging industry, we must ensure that it is receiving the proper federal safety oversight without discouraging development.

- The increasing use of UAVs in the NAS represents several challenges for the Federal Aviation Administration (FAA) and the aviation community. First among these challenges is <u>safety</u>. The FAA is the sole authority charged with controlling the safe and efficient use of the national airspace. It is my understanding that adequate "detect, sense and avoid" technology that will enable UAVs to avoid other aircraft in the NAS is years away.

- Safety therefore must be the FAA's top priority as it makes decisions regarding UAV airworthiness and integration of these operations into the NAS. To that end, I am very pleased that Nick Sabatini, FAA Associate Administrator for Aviation Safety, is with us today to talk about the agency's efforts in the short term to ensure the safety of UAVs that currently fly in the NAS, as well as the long term safety implications of fully integrating these vehicles with other commercial uses in our airspace.

- It is also incumbent upon the Departments of Defense and Homeland Security -- the two primary government users of UAVs – to fully engage and work with the FAA to ensure both the safe operation of these vehicles in the NAS, and that our military and homeland security needs for UAV operations are being met. Today, we have representatives from both the DOD and the Customs and Boarder Protection of DHS to share with us their agencies' efforts in this regard.

- As to other potential commercial applications of UAVs, I look forward to hearing from our witnesses on the second panel regarding some of the challenges faced by this emerging industry as well as some of the procedural/technological solutions that will enable the full integration of these UAVs in the NAS.

- Thank you once again, Mr. Chairman, for holding this hearing. I look forward to hearing from our witnesses.

Recommended Legislative Priorities for Commercial Unmanned Aviation

Presentation
to the House Committee on Transportation and Infrastructure
Subcommittee on Aviation
29 March 2006

Robert C. Owen
Embry-Riddle Aeronautical University

Members of the Committee and other's attending this session, first let me say that I am honored to be here. Effective Congressional oversight and legislative action will be a vital element of America's success and leadership in the realms of unmanned aviation (UA), specifically, and unmanned systems in general. I look forward, therefore, to Congress' increasing engagement in this important issue.

If I may impose on you just for a moment, I want to explain Embry-Riddle Aeronautical University's interest in unmanned aviation. Riddle consists of two residential campuses at Daytona Beach, Florida, and Prescott, Arizona, as well as an extended campus delivering courses at over 130 sites globally. As the world's only university centered on aviation, we take a broad interest in anything that has to do with building aircraft, conducting and supporting flight operations, and managing aviation business. This interest extends to unmanned aviation, of course. Currently, we are addressing UA through a 30+ member, multi-discipline Faculty Consortium, of which I am the Chair, and through a variety of engineering, flight test, human factors, air traffic and flight simulation, and policy development.

Contents

- Things to Know
- Legislative Priorities
- The message: Congress should become more proactive now, not later

Given the generally undeveloped understanding of unmanned aviation as a policy and economic issue, particularly in the commercial realm, I intend today only to lay out a few important "truths" of *commercial* unmanned aviation for your consideration, and to suggest two of what I consider the most important legislative priorities springing from those truths. Taken together, I anticipate that these points will make the case that the time for more active congressional involvement is now, not later.

Things to Know

Things to Know

- Thousands of *small* commercial unmanned aerial systems (CASs) already in operation

crop dusting	search/rescue
fisheries	ecology
security	real estate
law enforcement	etc.

- Many operating w/o regulation and insurance
  - No regulatory coverage
  - No vehicle, operator, operational standards
  - The above makes insurance difficult to impossible

First, it is important that we all understand that commercial unmanned operations are a present reality. Private and commercial operators are flying thousands of unmanned aerial vehicles (UAVs) and systems (UASs) *and making money* in this country and around the world. I list a few application areas on this slide for illustration. But, there literally are hundreds of applications for these systems, and creative people are finding new ones every day.

The problem in this country is that there is no body of law or regulation that enables the conduct of routine, safe, and profitable unmanned commercial flight. While the FAA's Advisory Circular 91-57 *Model Aircraft Operating Standards* covers the flight of recreational model aircraft, neither it nor any other document allows people to fly similar or more sophisticated aircraft for pay. If, for example, I use a 3-pound, radio-controlled aircraft to photograph my house for fun, AC 91-57 makes that a legal operation. If, on the other hand, I use the same aircraft on the same flight, to photograph my neighbor's house for $10, I am operating outside the bounds of regulatory approval.

I have spoken to several small UAS operators about this issue, and all say that this absence of regulatory permission presents them with the choice of not operating at all, or operating without insurance and in violation of the basic rule that you can't fly unless the FAA says you can fly.

Things to Know

- "Low-end" systems probably most viable commercially in near term
  - Many already in operation
  - Line-of-sight control regime relatively cheap
  - Small size reduces civil risk
  - Least interference with existing air traffic
  - "Adjunct" pilots least expensive

Virtually all of the systems operating commercially today are low-end systems. What I call "low end systems" are based on small aircraft, often only a few pounds in weight, controlled directly by operators maintaining visual, line-of-sight, contact with their aircraft and their operating environments. The control systems they utilize may be automated, manual, or semi manual and involve minimal pilot flight skills and aviation knowledge.

As the bullets to this slide indicated, their advantages include a relatively cheap control system costing from a few hundred to a few thousand dollars, a small size that allows even uninsured operators to take the risk, and operating patterns that usually don't require flying more than a few hundred feet above the ground, well below normal air traffic. Not often recognized, is the economic benefit of their operation by what I call "adjunct pilots." Adjunct pilots fly UAVs in the same way that you and I use our personal computers, as an adjunct to our primary job, not as the focus of our professional endeavors. So, apart from some minimal training, our sporadic employment as computer operators does not represent a major cost factor in measuring the productivity of the machines.

Things to Know

- "High-end" systems least viable commercially in the near term
  - None in routine *commercial* operation
  - Barriers
    - Lack of permissive regulation
    - Beyond line-of-sight control is expensive
    - Larger size increases civil risk, insurance
    - Significant interference with existing traffic
    - "Dedicated" pilots tend to be expensive

In contrast, no high-end UASs have entered the civil government or commercial markets on a routine basis. By "high end" I mean systems that tend to be large, perhaps tons in weight, and, most importantly, that operate outside of the visual range or even beyond the electronic horizon of the operator. There certainly have been many experimental explorations of the utility of high-end UASs in areas ranging from border patrol to environmental surveillance.

But, so far at least, they have attracted minimal long-term interest from civil operators and have booked no orders from operators planning to use them in U.S. airspace, at least to my knowledge.

The current barriers to applying high-end UAS to commercial operations are profound. Most importantly, the absence of permissive regulation makes it impossible for operators to put them into the national airspace routinely or predictably. Also, their control infrastructures, whether terrestrial- or space-based, repeaters are expensive. The size of these systems represent significant risks to other aircraft and people on the ground, resulting in high insurance costs. Last, the "flight" and support crews of these high-end systems normally are more expensive than the crews of manned aircraft doing equivalent missions.

Things to Know

- Regulatory focus has been on high-end systems so far
  - Reflects immediacy of military and manufacturer concerns
  - Does not facilitate most obvious path to commercial development

As I believe this panel is aware already, the focus of UA regulatory development has been on high-end systems. This focus on so-called Medium- and High-Altitude-High-Endurance (MALE and HALE) systems, such as Predator and Global Hawk has made sense, given the immediate interest of the military and the major manufacturers providing its unmanned aerial systems. But, from a commercial perspective, this focus is ironic, since it serves realms of UA that are least likely to be viable economically on a *large scale and in the near term*, and ignores the low-end realm that has become economically active despite the neglect.

Things to Know

- We know little about the Commercial UA business case
  - No common language for commercial evaluations
  - Lack of regulation = great cost uncertainties
  - Manufacturers and operators hording information

Now, I'm throwing around the term "economic viability" somewhat loosely here, since there exists no authoritative, easily available body of information on this subject. At least in the course of my two-years of study of commercial UA, I have found no compendium of papers, journal series, public study, or equivalent that examines the commercial characteristics of unmanned aviation rigorously. I have found bits and pieces of information about system costs, reliability and safety statistics, and sensor capabilities, but nothing comprehensive. To the extent that open-source studies exist, they usually argue simplistically that increased automation of UAS control systems will reduce or eliminate crew overheads which, along with improvements in vehicle reliability and FAA regulation, will allow UASs to penetrate commercial markets broadly and deeply.

The absence of a common analytical language about things like the categories of commercial UA operations and cost calculations also hinders rigorous discussions of their economics and business attributes.

Likewise, we need some regulator decisions on things like control system, crew member, and safety standards to provide a basis for making creditable calculations of costs and profits.

Last, and this is my pet peeve as an academic, most manufactures hold their cost, reliability, capabilities, and other informational cards pretty close to their proprietary chests. I understand their motives, but they need to be a little more forthcoming, if they want to build the foundations of general knowledge that will allow large communities of customers to identify UA as an attractive realm of investment.

Legislative Priorities

If we had the time today, I could provide a much longer list of commercial UA regulatory requirements. But, knowing full well that you will be "hooking" me in a minute or so, I'll limit myself to suggesting two general priorities I hope you will bear in mind.

Legislative Priorities

- Accelerate the entry of UA into the national airspace and economy
  - Initiate GAO study on requirements?
  - Establish Government-Industry-Academic Tiger Team
  - Include (emphasize?) low-end operations
- Meanwhile, accelerate FAA's process for granting UAV flight Certificates of Authorization

Above all else, I would encourage the Congress to take action now to accelerate the entry of UA into the national airspace and economy.

The next step in the process might well be to charter a GAO and/or other studies to (1) summarize the insights gained so far through existing studies by ACCESS-5, the Radio Technical Commission for Aeronautics, the ASTM, and other organizations, and to make appropriate recommendations for the economic, operational, and certification categorizations of UA.

This also would be a good time to pull together a relatively compact "tiger team" of government, industry, and academic thinkers to provide a summary assessment of near term legislative and regulatory requirements, and perhaps draft language, to ease military and civil operations in the national airspace and to promote the development of commercial UA.

The requirements of low-end commercial operators should receive some priority in all this, since they are the ones champing at the bit to get into business, at least openly.

Meanwhile, Congress needs to encourage the FAA to streamline and energize its process for granting certificates of authorization for military and commercial operations under appropriate restrictions. Right now, the FAA's reticence at authorizing UA operations is probably the industry's number 1 grievance. Indeed, I recently spoke to the president of a successful UAS manufacturing company, who said that the first clause of his business plan was to "seek business only where the FAA isn't." That has to change.

Legislative Priorities

- Charter a Federal "Knowledge Manager"
  - There is imminent need
  - Functions
    - Serve as Center of Expertise for Gov't users
    - Advise and support civil UA analysis, experimentation, operations
    - Mobilize government, academic, commercial, military discourse
    - Champion American leadership

Second, and based on my discussions with a number of private and governmental practitioners in this field, Congress needs to charter a Federal "Knowledge Manager" for Commercial Unmanned Aviation. The role of this Knowledge Manager will be to provide a single Office of Primary Responsibility for advising and supporting other civil agencies moving into UA activities, overseeing and in some cases funding research and development of relevance to civil and commercial operators, and encouraging the public dissemination of useful information and knowledge.

There is a imminent need for such a Knowledge Manager. Federal and state agencies ranging from the Department of Homeland Defense to the Highway Patrol are interested and unevenly engaged in exploring the application of UA to their missions. But, they do not have a single source of objective and comprehensive advice and support available to them within the government to help them make effective and efficient decisions about applying UA to their tasks.

A Knowledge manager would provide such a source of support. By performing the functions I've listed here on the slide, it would increase the confidence and decrease the costs of integrating UA into the civil realm and, thereby, indirectly assist with its integration into the commercial realm.

I personally do not have a clear idea of where such a Knowledge Manager should reside, but I would think that NASA, the FAA, the Department of Transportation, or the Department of Commerce would be obvious candidates. I would be honored to be part of the process making that determination or otherwise assisting with the development of American unmanned aviation in any way that I can.

Thank You

With that, let me thank you all again for the privilege of voicing my views and concerns in such lofty environs, and I am prepared to field any further questions you might have. Thank you.

EMBRY-RIDDLE
AERONAUTICAL UNIVERSITY

Aeronautical Science Department
600 S. Clyde Morris Blvd.
Daytona Beach, FL 32114-6012
386-226-6852

Congressman John L. Mica
Chairman, Subcommittee on Aviation
Committee on Transportation and Infrastructure
U. S. House of Representatives
Washington, DC 20515

April 28, 2006

Dear Congressman Mica:

Thank you for the honor of answering the questions on UAV operations that you put to me in your letter of April 3, 2006. I offer the following brief answers to those questions. Above all else, I would like to emphasize the main point in my March 29 briefing to the Aviation Subcommittee; that the issue of commercializing unmanned aviation is complex and requires the establishment of an independent "Knowledge Manager" within the civil government to ensure its access to comprehensive and objective analysis of unmanned aviation's many issues.

Question 1: *Do you know what the DOD's unmanned aerial systems safety record is in terms of accidents, incidents, near misses and loss of aircraft. I understand that this is not a classified document.*

While the DOD is best placed to answer this question comprehensively, it is fair to say that the UAS accident rate is two to three orders of magnitude greater than it is for manned systems, depending on which unmanned system one examines and to which category of manned aviation—military, commercial, and general—one compares it. As an indication of the gulf between unmanned and manned safety rates, I have attached data drawn from the Air Force Safety Center's public web page. As this data indicates, the Air Force's overall major accident rate was 1.49 major (class-A) accidents per 100,000 flight hours in 2005, while the Predator's accident rate was 609 accidents per 100,000 hours, and the Global Hawk's was 0. The Predator's 2005 accident record is an anomaly, however, probably due to the exigencies of operating under the pressures of combat. Over the life of the system, its accident rate actually has been about 21 class-A accidents per 100,000 hours. I believe that further study of the smaller UASs operated by the Army and the Marines would reveal that their accident rates tend to be higher.

In itself, this data illustrates the safety challenge facing unmanned aviation, but it is far from conclusive. A full analysis of the current state and future trends in UA safety would be a major study; one that Congress should consider chartering. In the absence of such a comprehensive study, it is still reasonable to say that "the UA safety record is bad, but improving steadily and at times rapidly" and that "the commercial significance of UA's current and future safety performance is not well understood, but probably will involve different metrics of acceptability than those of the military."

Question 2: *It is believed that the development of "sense and detect" technology will allow the use of UASs in the NAS with significant savings over manned aircraft. What is your position on this prediction?*

My sense is that this prediction, particularly its economic aspect, is way ahead of the data. While technology likely will provide the capability for UAS operators to detect and avoid other manned and unmanned aircraft operating under positive air traffic control, it is clear at this time that there will be other, uncontrolled "threats" to consider, and it is not clear that the detection and avoidance of either controlled or uncontrolled threats will be cheaper than simply putting a pilot or pilots on the aircraft.

Safe navigation in the National Air Space involves the visual and electronic detection and avoidance of other aircraft by pilots and controllers (in the case of aircraft participating in positive control), AND such things as aircraft flying under visual flight rules and not in contact with air traffic control, birds, dust devils, balloons, objects and people on runways, towers and other obstacles that might or might not be listed on current charts and/or data bases, and so on. In my own career, I have dodged numerous aircraft, anticipated unforcasted wind shears by watching aircraft landing ahead of me, dodged coyotes, pigs, and deer, narrowly missed a 12-year-old boy riding his bicycle down the centerline of a runway, and a host of other things. The aviation world is full of hazards that will not show up on radar or other electronic means of air traffic control.

Moreover, the cost of the communications bandwidth needed to provide see-and-avoid capabilities equivalent to those available to a pilot will be expensive. From my conversations with specialists, I have learned that the bandwidth to control a Predator, which has very limited sense-and-avoid capabilities, can run between a few hundred dollars per hour to $20,000.00 per hour, depending on overall demand at the time of service. Considering that an entry-level commercial pilot earns about $25-$45 per flight hour and a senior airline captain might make around $150-$200 per hour, bandwidth cost will be a major business-case hurdle for the UAV manufacturing industry to overcome.

Question 3: *In the short term, are there real cost savings associated with using UASs instead of manned aircraft? How about in the long term?*

As implied in the answer to question 2, the economic competitiveness of a particular UA application will hinge on the size and cost of the aircraft employed and the type of control regime used. Missions relying on line-of-sight control, in which the pilot directly observes the aircraft to control it and avoid traffic and other in-flight hazards, are much less expensive to conduct than those requiring the establishment of ground relay stations or the use of satellite bandwidth to fly the aircraft over-the-horizon. Small aircraft obviously cost less than big aircraft. More importantly, if the cost of replacing a $200,000 light plane is a $5 million Predator, then the UAV industry has a problem.

At the moment, civil and private operators are flying hundreds of smaller UAVs utilizing line-of-sight control. Typically, these operators fly their aircraft at very low altitudes, outside of FAA controlled airspace, and never more than a mile or so (usually much closer) from their pilots. These operations have proven practical and cost effective in a host of areas, such as crop dusting and surveillance, fisheries surveillance, law enforcement, real estate, environmental mapping and surveillance, search and rescue, and so on. Their cost effectiveness springs from several factors, including; low initial cost of acquisition, independence from expensive communications and control systems, and episodic employment by minimally trained operators as adjuncts to their core activities.

In some circumstances, line-of-sight systems could be flown in controlled airspace, but at significantly increased cost of operation. For example, the use of a UAV to enhance security operations around airports, harbors, and populated areas likely would require their operation within the lateral and vertical boundaries of different classes of controlled airspace. In such cases, the aircraft likely would have to be equipped with transponders, Global Positioning System navigation equipment, and possibly with autopilots and "automatic-return" equipment. Their operators also would have to maintain direct contact with air traffic control and have the professional knowledge and skills to operate their aircraft legally and safely in the presence of other traffic. Assuming that the professional pilot skills required by these unmanned operations were equivalent to those required to operate a light aircraft or ultralight in the same air space, then their chief economic advantage would derive from their lower acquisition and operating costs.

Currently, once UAV operations move beyond visual line-of-sight and especially beyond the electronic horizon from the pilot or base facility, their costs become prohibitive commercially. As mentioned above, the costs of ground relay stations and/or satellite bandwidth immediately outweigh the costs of simply sending out a manned aircraft with a pilot and the same sensors on board. Additionally, since the pilot skills required for beyond line-of-sight UAS operations likely will be equivalent to operating manned aircraft, the unmanned option probably won't offer savings in labor costs. Given the fact that young commercial pilots often will fly light aircraft for a pittance, in order to build the flight time required for hiring by the airlines, it even may be that "professional" UA pilots will demand higher wages than "young-and-hungry" pilots trying to position themselves for future advancement. From my own research, I have noted that one private Predator operator pays its pilots about $70K per year, while a young commercial pilot graduating from this university would fly an aircraft of similar performance characteristics for $25-30K, and gladly too.

These numbers, I think, explain why no commercial operator is flying medium or large UAVs routinely beyond visual range, except perhaps in a maritime or extremely high altitude environment, and there are or have been only a few civil experiments in such operations to support such things as forest fire fighting and border patrol. Even in those civil experiments, the costs of using medium, over-the-horizon UAVs have far outweighed those of the manned alternatives.

It is not clear when or if engineers and regulators will overcome the *commercial* handicaps of UAVs operating in controlled air space and/or beyond-line-of-sight. Enthusiasts for the future of commercial aviation argue that quantity production of these systems, and advances in automated vehicle and air traffic control technologies will make them competitive with manned systems over the next one or two decades. Perhaps--but such sanguine predictions run headlong into several countervailing considerations. First, it may be that the very technologies that enhance the economic performance of UAVs will enhance the economic performance of manned systems, perhaps even more. Second, if or when NAS and beyond-the-horizon commercial UA operations become competitive and safe enough to be insured, there still will be some non-technical and non-economic issues to deal with. The public may or may not grant social and political "permission" for UA operators to fly over their heads. Those charged with maintaining the safety of aviation in general, may decide that an aircraft loaded with automated flight technologies may be even safer with one or two pilots on board. We almost are in that position now, given the latent capabilities of the modern flight management systems on commercial and even some general aviation aircraft. Also, aviation interest groups, such as the Aircraft Owners and Pilots Association, may resist routine introduction of UA into the National Air Space, perhaps for perceived safety problems or because safe UA operations may require light general aviation pilots to install new equipment in their aircraft or to fly under positive control more often or even all the time.

In summary then, private and civil operations by small UAVs under line-of-sight control or flying well clear of controlled air space are a present reality. The government, therefore, should be working now to establish the body of standards, regulations, and laws needed to ensure their safe, legal, and economically sound *commercial* operation. Whether or not beyond-line-of-sight commercial operations by larger UAVs will become a significant feature of commercial and civil activities in the future remains largely unknown at this time. The issue is important and deserves attention by Congress, industry, and academe.

With that, Congressman Mica, let me say "thank you" again, and I remain ready and eager to assist in the exploration and development of this promising realm of commercial and civil endeavor in any way I can. Thank you.

Robert C. Owen, PhD
Professor

Attachment

General USAF Aircraft Accident Rates
Compared to Predator and Global Hawk Rates

General USAF Aircraft Accident Rate
http://afsafety.af.mil/sef/stats/usaf4705.html

	NON-	CLASS A		CLASS B		DESTROYED		FATAL			
YEAR	RATE	#	RATE	#	RATE	#	RATE	PILOT	ALL	HOURS	CUM HRS
FY00	0	23	1.13	85	4.17	14	0.69	3	7	2,036,757	266,548,512
FY01	0	24	1.16	70	3.39	21	1.02	6	9	2,067,104	268,615,616
FY02	0	35	1.47	69	2.90	19	0.80	10	22	2,379,188	270,994,804
FY03	0	31	1.29	71	2.96	22	0.92	6	10	2,396,105	273,390,909
FY04	0	27	1.18	77	3.35	11	0.48	6	13	2,295,953	275,686,862
FY05	0	32	1.49	89	4.15	11	0.51	3	12	2,142,803	277,829,665
TOTAL	8	26865	9.67	11410	4.11	13689	4.93	6872	15913	277,829,665	

RQ-1 Predator Accident Rates
http://afsafety.af.mil/SEF/stats/aircraft/q1mds.html

	CLASS A		CLASS B		DESTROY	DESTROY		Cum
YEAR	#	RATE	#	RATE	A/C	RATE	HOURS	HOURS
2000	1	24.32	1	24.32	1	24.32	4111	13988
2001	3	46.37	1	15.46	3	46.37	6470	20458
2002	3	9.94	0	0.00	3	9.94	30190	50648
2003	2	7.91	0	0.00	2	7.91	25288	75936
2004	4	14.31	0	0.00	2	7.16	27949	103885
2005	6	609.14	0	0.00	5	507.61	985	104870
LIFETIME	**23**	**21.93**	**2**	**1.91**	**20**	**19.07**	**104870**	

RQ-4 Global Hawk Accident Rates
http://afsafety.af.mil/SEF/stats/aircraft/rq4mds.html

		CLASS A	CLASS B		DESTROY	DESTROY	
YEAR	#	RATE	#	RATE	A/C	RATE	HOURS
2000	1		0		0		0
2001	0	0.00	0	0.00	0	0.00	0
2002	2	167.50	0	0.00	2	167.50	1194
2003	0	0.00	0	0.00	0	0.00	451
2004	0	0.00	0	0.00	0	0.00	0
2005	0	0.00	1	0.00	0	0.00	0
5 YR AVG	**0.4**	**121.58**	**0.2**	**60.79**	**0.4**	**121.58**	**329.0**

Comparison of Accident Rate Trends Between Several Categories of Aircraft

Roland E. Weibel, *Safety Considerations for Operation of Different Classes of Unmanned Aerial Vehicles In the National Air Space System*, Thesis, MIT, 2005

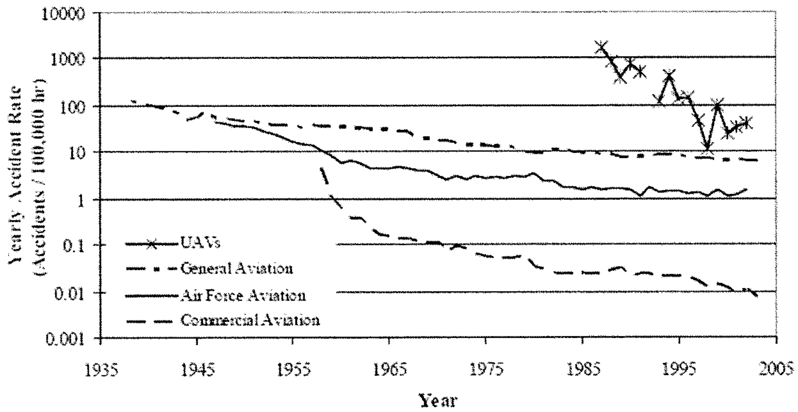


Figure 3: Comparison of Accident Rate Trends between Several Categories of Aircraft

OFFICE OF THE SECRETARY OF DEFENSE
1480 DEFENSE PENTAGON
WASHINGTON, DC 20301-1480

DOD
POLICY BOARD
ON FEDERAL AVIATION

27 April 2006

The Honorable John L. Mica
Chairman, Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives
Washington DC 20515-0001

Dear Mr. Chairman:

I greatly appreciate the opportunity you provided me to articulate the views of the Department of Defense Policy Board on Federal Aviation regarding Unmanned Aerial Vehicles and the National Airspace System during the hearing before your Subcommittee on 29 March 2006. The subsequent correspondence from your office provided additional questions for the record. The enclosed answers are provided.

1 Attachment
Response

Sincerely,

GERALD F. PEASE, JR.
Executive Director

Committee: U.S. House of Representatives on Transportation & Infrastructure
Subcommittee on Aviation
Hearing Date: March 29, 2006
Hearing: Unmanned Aircraft Systems (UAS) and the National Airspace System (NAS)
Member: Congressman Mica
Witness: Mr. Pease

Question 1

Question: What is your understanding of the FAA's role and responsibility with regard to UAS operations in the NAS?

Answer: The FAA's role and responsibilities with regard to UAS operations in the system include:

1. Safety. The FAA must ensure that all airspace requirements are clearly identified and stated and that the policies and procedures developed to integrate UA into the mix of manned and unmanned daily operations, while not only meeting today's level of safety but serving to also enhance and improve it.

2. Customer support. The FAA must support all users and potential users of the NAS. With respect to UA, this includes providing regulations, policies, and procedures that support *safe, timely and routine* access to the NAS.

Question 2

Question: The NASA Access 5 project had originally developed a detailed plan of work; and, in the last year, revised it to reflect recent developments and needs of the DoD and industry. Is this revised joint planning effort funded; if not, should the federal government or industry be providing funding to continue this work? If the federal government, which agency should be funding the work?

Answer: Access 5, a national project sponsored by NASA and Industry with participation by the FAA and DoD, was chartered to introduce high altitude long endurance (HALE) civil unmanned aircraft systems (UAS) for routine flights in the National Airspace System (NAS). Access 5 commenced in May 2004 and was slated to run for five years. The project received initial funding from NASA with guarantees of support from the UAS industry. NASA funding for Access 5 has recently been realigned and the project was closed out on 22 Feb 06. In my opinion, Access 5 had correctly defined the organizational relationships, any future effort of this type should again be funded by the federal government in structured consultation with industry, but focused on the near-term UA users - the DoD and the Department of Homeland Security (DHS), not commercial applications, and include initiatives for small UAS operations. The government should have the lead role in developing policy, regulation, technology and certification requirements. The primary governmental agencies leading the effort should include:

Committee: U.S. House of Representatives on Transportation & Infrastructure
Subcommittee on Aviation
Hearing Date: March 29, 2006
Hearing: Unmanned Aircraft Systems (UAS) and the National Airspace System (NAS)
Member: Congressman Mica
Witness: Mr. Pease

1. NASA for technology development,
2. FAA for standards and procedures, and
3. DoD for defense-unique technology, technology sharing, and flight test support

STATEMENT OF NICK SABATINI, ASSOCIATE ADMINISTRATOR FOR AVIATION SAFETY
FEDERAL AVIATION ADMINISTRATION
BEFORE THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION ON UNMANNED AIRCRAFT ACTIVITIES,
MARCH 29, 2006.

Chairman Mica, Congressman Costello, Members of the Subcommittee.

I am pleased to appear before you today to discuss a subject that serves to remind us that the future is now. The development and use of unmanned aircraft (UAs) is the next great step forward in the evolution of aviation. As it has throughout its history, FAA is prepared to work with government and industry to ensure that these aircraft are both safe to operate and are operated safely. The extremely broad range of UAs makes their successful integration into the national airspace system (NAS) a challenge, but certainly one worth meeting. To meet this vital need, the FAA has established an Unmanned Aircraft Program Office which has the expressed purpose of insuring a safe integration of UAs into the NAS.

At the outset, you must understand that UAs cannot be described as a single type of aircraft. UAs can be vehicles that range from a 12-ounce hand launched model to the size of a 737 aircraft. They also encompass a broad span of altitude and endurance capabilities. Obviously, the size of the UA impacts the complexity of its system design and capability. Therefore, each different type of UA has to be evaluated separately, with each aircraft's unique characteristics being considered before its integration into the NAS can be accomplished. FAA is currently working with both other government agencies and private industry on the development and use of UAs.

The number of government agencies that want to use UAs in support of their mandate is increasing. In addition to the Departments of Defense (DoD) and Homeland Security (DHS), the Department of Interior (DOI), the National Oceanic and Atmospheric Administration (NOAA) and state and local governments are all interested in increasing their use of UAs for a range of very different purposes. The certification of UAs by government agencies in the NAS is considered a public aircraft operation, the oversight for which falls outside the scope of the FAA. These public operations are, however, required to be in compliance with certain federal aviation regulations administered by the FAA and the FAA is and must be involved to ensure that the operation of these aircraft do not compromise the safety of the NAS. FAA's current role is to ensure that UAs do no harm to other operators in the NAS and, to the maximum extent possible, the public on the ground.

In working with government agencies, the FAA issues a certificate of authorization (COA) that permits the agency to operate a particular UA for a particular purpose in a particular area. In other words, FAA works with the agency to develop conditions and limitations for UA operations to ensure they do not jeopardize the safety of other aviation operations. The objective is to issue a COA with terms that ensure an equivalent level of safety as manned aircraft. Usually, this entails making sure that the UA does not operate in a populated area and that the aircraft is observed, either by someone in a manned aircraft or someone on the ground. In the interest of national security and because ground observers were not possible, the FAA worked with DHS to facilitate UA operations along the Arizona/New Mexico border with Mexico. In order to permit such operations, the airspace is segregated to ensure system safety so these UA flights can operate without an observer being physically present to observe the operation. The FAA is working closely with DHS to minimize the impact of the segregation methods on other aviation operations. Such operations include DoD training missions, general aviation and commercial operations. In the past two years, the FAA has issued over 50 COAs. With the steadily expanding purposes for which UAs are used and the eventual stateside redeployment of large numbers of UAs from the theater of war, the FAA expects to issue a record number of COAs this year.

FAA's work with private industry is slightly different. Companies must obtain an airworthiness certificate by demonstrating that their aircraft can operate safely within an assigned flight test area and cause no harm to the public. They must be able to describe their unmanned aircraft system, along with how and where they intend to fly. This is documented by the applicant in what we call a program letter. An FAA team of subject matter experts reviews the program letter and, if the project is feasible, performs an on-site review of the ground system and unmanned aircraft, if available. If the results of the on-site review are acceptable, there are negotiations on operating limitations. After the necessary limitations are accepted, FAA will accept an application for an experimental airworthiness certificate which is ultimately issued by the local FAA Manufacturing Inspection District Office. The certificate specifies the operating restrictions applicable to that aircraft. We have received 14 program letters for UAs ranging from 39 to over 10,000 pounds. We have issued two experimental certificates, one for General Atomics'

Altair, and one for Bell-Textron's Eagle Eye. We expect to issue at least two more experimental certificates this year.

Each UA FAA considers, whether it be developed by government or industry, must have numerous fail safes for loss of link and system failures. Information must be provided to FAA that clearly establishes that the risk of injury to persons on the ground is highly unlikely in the event of failures or loss of link. Like everything else having to do with UAs, the methods that link the aircraft with ground control can be as simple as frequency line of sight or as complex as multiple ground and satellite paths making up a functional connection. If the link is lost, it means the aircraft is no longer flying under control of the pilot. Because FAA recognizes the seriousness of this situation, we are predominantly limiting UA operations to unpopulated areas. Should loss of link occur, the pilot must immediately alert air traffic control and inform the controllers of the loss of control link. Information about what the aircraft is programmed to do and when it is programmed to do it is pre-coordinated with the affected ATC facilities in advance of the flight so that FAA can take the appropriate actions to mitigate the situation and preserve safety.

The COA and Experimental Airworthiness Certificate processes are designed to allow a sufficiently restricted operation to ensure a safe environment, while allowing for research and development until such time as pertinent standards are developed. They also allow the FAA, other government agencies, and private industry to gather valuable data about a largely unknown field of aviation. The development of standards is crucial to moving forward with UAs integration in the NAS. FAA has tasked the RTCA, an industry led federal advisory committee to FAA, with the development of a Minimum Aviation System Performance Standard (MASPS) for sense and avoid, and command, control and communication. These standards will allow manufacturers to begin to build certifiable avionics for UAs. It is expected that the MASPS for avionics will take three to four years to develop. Until there are set standards and aircraft meet them, UAs will continue to have appropriate restrictions imposed. In addition, the FAA is working closely with DoD and DHS to collaborate on the appropriate approach to certification standards.

Because of the extraordinarily broad range of unmanned aircraft types and performance, the challenges of integrating them safely into the NAS continue to evolve. Urgent future ground surveillance needs must be balanced with the ongoing air transportation operations. The certification and operational issues described herein highlight the fact that there is a missing link in terms of technology today that prevents these aircraft from getting unrestricted access to the NAS. Currently there is no recognized technology solution that could make these aircraft capable of meeting regulatory requirements for see and avoid, and command and control. Further, some unmanned aircraft will likely never receive unrestricted access to the NAS due to the limited amount of avionics it can carry because of weight, such as transponders, that can be installed in a vehicle itself weighing just a few ounces. Likewise, the performance difference with surrounding air traffic can present challenges. Some UA operate in airspace used primarily by jet aircraft that can fly at twice their speed, thus complicating the control of the airspace.

FAA is fully cognizant that UAs are becoming more and more important to more and more government agencies and private industry. The full extent of how they can be used and what benefits they can provide are still being explored. Over the next several years, when RTCA has provided recommended standards to the FAA, we will be in a position to provide more exact certification and operational requirements to UA operators. As the technology gap closes, we expect some UAs will be shown to be safer and have more access to the NAS. The future of avionics and air traffic control contemplates aircraft communicating directly with one another to share flight information to maximize the efficiency of the airspace. This could certainly include some models of UA. Just as there is a broad range of UA, there will be a broad range of ways to safely provide them access to the NAS. Our commitment is to make sure that when they operate in the NAS, they do so with no denigration of system safety

In our history, FAA and its predecessor agencies have successfully transitioned many new and revolutionary aircraft types and systems into the NAS. Beginning in 1937, we completed the U.S. certification for the first large scale production airliner (the DC-3), then went on to certify the first pressurized airliner (the Boeing B-307 in 1940), civil helicopter (Bell 47 in 1946), turboprop (Vickers Viscount in 1955), turbojet (Boeing 707 in 1958), as well as the supersonic transport (Concorde in 1979), and the advance wide-body jets of today (Boeing 747-400 in 1989). It seems appropriate that, as we begin a new century and new millennium, advances in aviation technology present us with another addition to the fleet with great potential - unmanned aircraft.

Mr. Chairman, FAA is prepared to meet the challenge. We will continue to work closely with our partners in government, industry and Congress to ensure that the National Airspace System has the ability to take maximum advantage of the unique capabilities of unmanned aircraft.

This concludes my prepared remarks. I will be happy to answer your questions at this time.

5/12/06

FAA RESPONSE TO QUESTIONS FOR THE RECORD FROM CONGRESSMAN JOHN L. MICA COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE SUBCOMMITTEE ON AVIATION FOLLOWING THE MARCH 29, 2006 HEARING ON UNMANNED AERIAL VEHICLES

Questions for Nicholas Sabatini, Federal Aviation Administration Associate Administrator for Aviation Safety

1. When does FAA anticipate issuance of guidance and later regulations on unmanned aerial systems? What will the standards cover? (aircraft, maintenance, training, powerplant, etc.?) How long will the process take? Is there a way to expedite the process?

Response: The development of guidance and regulations for Unmanned Aircraft Systems (UASs) will be an evolving process, taking several years, and must be based on in service experience and data. It is important to understand that guidance will be developed on an incremental basis. For example, when sufficient safety analysis has been completed, guidance will be issued on small UASs. This guidance could conceivably dictate that a UAS that weighs below a certain amount, operating at or below a certain speed and in an unpopulated area, away from airports, and below a certain altitude can operate with minimal oversight from the FAA.

Standards development is required for all areas of UAS technology, including the airframe design, maintenance and operating procedures, pilot and controller training, propulsion, ground equipment, pilot qualifications, and medical requirements. The FAA is currently reviewing all existing regulations to determine if there are existing standards that can be applied to UASs. If so, this will expedite the process to a degree.

2. What is the FAA's recommendation on how to get UAVs integrated into the NAS in the short term? Is there any consideration of a phased approach or interim solution that will allow limited UAV expansion into the NAS?

Response: The FAA recommends the continuation of the Certificate of Authorization (CoA) process for public aircraft and, with appropriate safety limitations, the experimental airworthiness certification process for civil unmanned aircraft (UA) for research and development, training and marketing applications. As the aircraft and the associated technology mature and sufficient data are gathered to support certain operations, we should be able to approve operations that we do not approve today. We are working on the development of standards on which to base a more routine UAS certification process in the future. We hope these future standards, once adopted by the FAA, will both reflect industry consensus and describe a set of minimum requirements that UA designers and manufacturers will be able to use in the normal FAA certification process. The standards development process is expected to take from 3 to 5 years.

3. When a "sense and avoid technology" vendor believes their technology is available, what is involved with getting it certified and how long will it take?

Response: Detect, sense, and avoid (DSA) is one of the most critical performance capabilities of a UAS. Once the standards are developed with industry at RTCA Special Committee 203 and the FAA accepts the standards, a vendor will know the minimum acceptable requirements for the certification of their DSA avionics. Lacking these standards/requirements, an applicant may apply for certification of a technology, but it would have to be in conjunction with a viable UAS operator or designer. Without such a partnership, the FAA would not be able to make an operational evaluation. A timeline for certification is difficult to predict because standards do not exist.

4. It is our understanding that the FAA has issued new guidance that requires a company to apply for an Experimental Aircraft Certificate for a particular UAV before it can flight test that new product. Some companies have suggested that FAA should develop an equivalent of a "company Certificate of Authorization" to allow them to conduct private operations in a remote area for multiple aircraft models or families of aircraft. What are your thoughts on this suggestion?

Response: The requirement for an aircraft company to obtain an Experimental Airworthiness Certificate prior to test flight is not a new requirement. It has been a longstanding policy for several decades. Due to the uniqueness of not having a pilot onboard the aircraft, the FAA has added the requirement for a system safety analysis, which is to be conducted by the applicant prior to the issuance of the certificate. The lack of maturity of the technology necessitates a conservative approach. The restrictions imbedded in the certificate are intended to prevent any injury or loss of life on the ground.

The FAA has considered a "company Certificate of Authorization" previously and has determined that until we have more experience with the technology, the FAA needs to be directly involved with each CoA to ensure public safety. We are considering other options and will share those with this subcommittee as they progress.

5. The safety record of these UASs operated by DoD is an important consideration in deciding how to safely integrate UASs into the integrated NAS with manned aircraft. Therefore, what is the DoD unmanned aerial systems safety record, in terms of loss of communication, loss of link, system failure, accidents, incidents, near misses, and/or loss of aircraft? I understand this is <u>not</u> classified information.

Response: This safety data belongs to the DoD and, regardless of classification level, should be released by DoD. The DoD alone could provide the data in a statistically meaningful manner and, being more familiar with the data, could assist in any analysis or respond more appropriately to further inquiry.

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HOUSE COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE

TESTIMONY OF

MR. DYKE D. WEATHERINGTON

DEPUTY, UNMANNED AIRCRAFT SYSTEMS PLANNING TASK FORCE

OFFICE OF THE UNDER SECRETARY OF DEFENSE

(ACQUISITION, TECHNOLOGY AND LOGISTICS)

BEFORE THE UNITED STATES HOUSE

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

SUBCOMMITTEE ON AVIATION

March 29, 2006

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HOUSE COMMITTEE ON
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TESTIMONY OF

MR. DYKE D. WEATHERINGTON

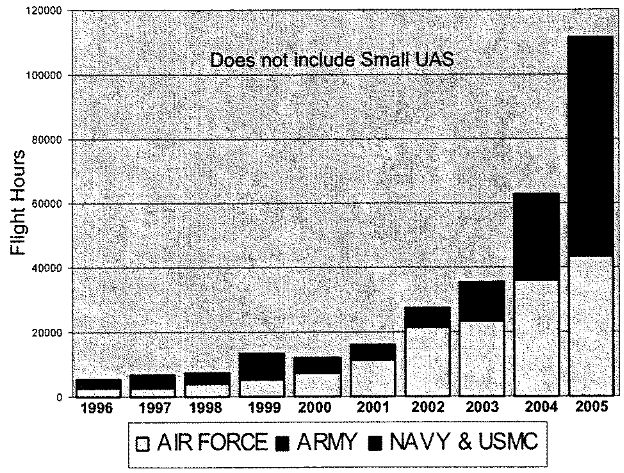
DEPUTY, UNMANNED AIRCRAFT SYSTEMS PLANNING TASK FORCE
OFFICE OF THE UNDER SECRETARY OF DEFENSE
(ACQUISITION, TECHNOLOGY AND LOGISTICS)

INTRODUCTION

Good afternoon Mr. Chairman, Mr. Costello, and Members of the Committee. I am the Deputy of the Unmanned Aircraft Systems Planning Task Force within the Office of the Under Secretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)). Oversight of unmanned aircraft systems (UAS) acquisition is one of my responsibilities, and that is why I am here today. I appreciate the opportunity to provide an overview of Department of Defense (DoD) UAS, and in particular our plan for the integration of these unmanned aircraft (UA) into the National Airspace System (NAS) and international airspace. The Department, using primarily ground-based radar to provide UA an equivalent level of safety as manned aircraft, has operated UA within the NAS without an incident resulting in death or injury since 1997.

DoD UAS are playing a major combat support role in both Operation IRAQI FREEDOM and Operation ENDURING FREEDOM. During the past year, UA operations supporting the Global War On Terror expanded dramatically, with tactical and theater UA flying over 100,000 hours. Figure 1 shows the UA flight hours flown by each Military Department. UAS are playing an ever increasing role in a wide range of DoD missions, including counter-insurgency operations, force and infrastructure protection, collection of vital intelligence, and strike of time-critical targets. UAS are also playing a vital role in homeland defense and domestic disaster relief operations, as well as supporting civilian agencies in other missions, including border security.

Figure 1.
DoD UAS Flight Hours (By Department, By Calendar Year)



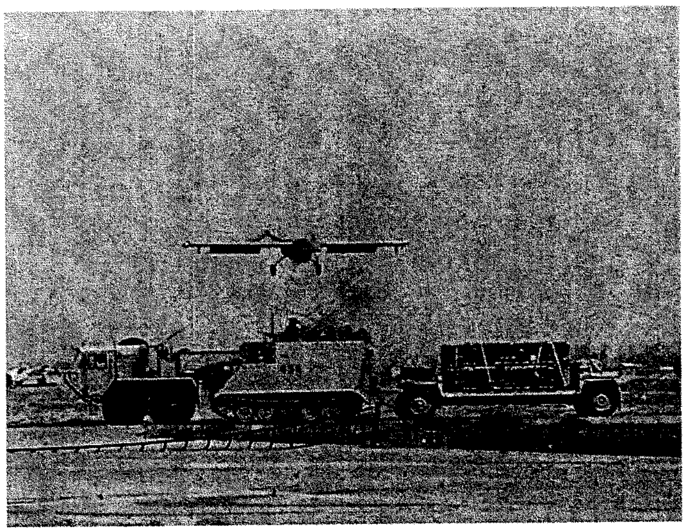
Today, the Military Departments have a force of over 2600 small UA and over 300 tactical and theater-level UA supporting military operations worldwide. This is noteworthy when one recalls that the Department operated only one UAS type in support of Operation DESERT STORM in 1991; and as late as 2000, we had less than 50 operational tactical UA systems. Tables 1, 2, and 3 provide information on the major types and numbers of DoD UA existing today, with the UA grouped based on similar performance and airspace requirements. It is important to note that UA come in a wide variety of sizes and with differing capabilities and performance characteristics, this is particularly important with respect to the focus of this hearing on airspace integration. The Raven, as shown in Figure 2, is one of the "small UAS" listed in Table 1. Small UAS are operated by one or two soldiers, hand- or bungee-launched, and are used primarily for situational awareness and force protection in the local area out to a range of 5 - 6 nautical miles (nm), at altitudes up to 1000 feet, and for up to 1 hour. They are usually battery operated, carry electro-optical or infra red cameras, and are similar in size and performance to remote-controlled (RC) model aircraft.

Figure 2. Raven Small UA

TABLE 1. DoD Small UAS (Weight < 10 lbs., Airspeed < 100 kts), as of Feb 1, 2006		
System	**Service/Command**	**Total Aircraft Inventory**
Pointer	Special Operations Command / Air Force	126
Raven	Special Operations Command / Air Force / Army	1776
Dragon Eye	Special Operations Command / Marine Corps	402
Force Protection Airborne Surveillance System	Air Force	126
BATCAM	Air Force	54
Swift	Special Operations Command	212
	Total	**2696**

The Shadow shown in Figure 3 is an example of the tactical UAS listed in Table 2. Tactical UA typically operate at ranges of up to 80 nm, at altitudes up to 5000 feet, at airspeeds

Figure 3. Shadow Tactical UA



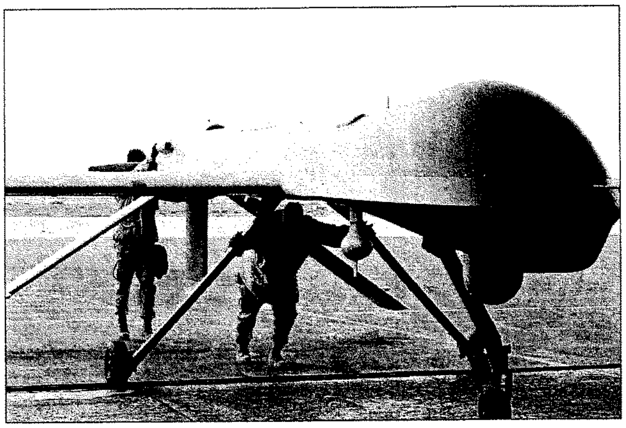
less than 120 knots, and for up to 5 hours; this group can be considered similar to manned ultra-lights in size and performance. They are typically operated from small airfields and carry electro-optical and infra red cameras, or other specified payloads.

TABLE 2. DoD Tactical UAS, as of Feb 1, 2006 (Weight < 500 lbs., Airspeed < 120 kts)

System	Service/Command	Total Aircraft Inventory
Pioneer	Navy / Marine Corps	34
Shadow 200	Army	140
Neptune	Special Operations Command	15
Tern	Special Operations Command	15
Mako	Special Operations Command	15
Tigershark	Special Operations Command	6
	Total	**225**

Theater-level UA are larger, for example the Predator A ((Figure 4) weighs 2400 pounds and Global Hawk (Figure 5) weighs 26,750 pounds. This class of UA generally operates beyond line of sight at altitudes ranging from 15,000 to 60,000 feet for up to 30 hours. The aircraft operate from established airfields, and if equipped with satellite communications can be

Figure 4. Predator A UA

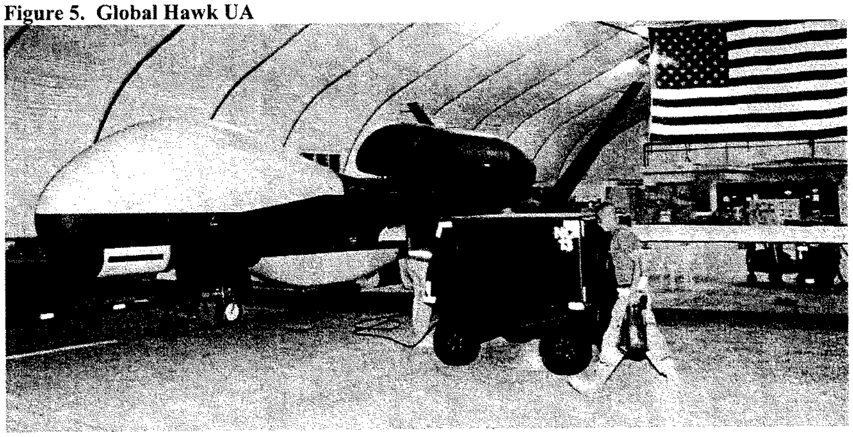


"piloted" by operators located in another country. They typically carry electro-optical and infra red cameras, radars, signals intelligence payloads, or a combination thereof.

TABLE 3. DoD Theater-level UAS, as of Feb 1, 2006

System	Service/Command	Total Aircraft Inventory
Hunter	Army	32
I-Gnat	Army	4
Predator A	Air Force	70
Predator B	Air Force	6
Global Hawk (Prototype)	Air Force	4
Global Hawk (Production)	Air Force	5
Global Hawk Maritime Demonstration	Navy	2
Fire Scout	Navy / Army	4
	Total	**127**

Figure 5. Global Hawk UA



OVERVIEW

Let me discuss the broad nature of UA systems, often referred to as "unmanned aerial vehicles (UAVs)." The term "UAV" puts emphasis on the air platform, ignoring the other essential components of an effective system – like the ground control station, the sensors and payloads, the communication links, and the data distribution infrastructure. We believe the term "unmanned aircraft systems" better captures the maturing nature of systems taken as a whole and have begun using this term, most notably in our update of the technology roadmap. This terminology encompasses the combination of components in the system, rather than focusing on a single element. It also properly identifies the airborne component as an *aircraft*, which is consistent with the Federal Aviation Administration's (FAA) view of these platforms.

In addition to the hardware components of UA systems, many other elements are essential to order our thinking, guide our engineering, and enable us to safely operate these systems. They include a systems architecture that allows data to be moved for a variety of uses, either a few miles or thousands of miles away. This architecture includes adequate spectrum and bandwidth for communication, airspace management and deconfliction, common data standards and formats to allow sharing and data fusion, deliberate contingency mission planning to deal with signal loss, common operating systems, and system interoperability. While most of these elements are not unique to unmanned systems, there are, in fact, distinct challenges in applying them to unmanned systems. Since cost is very important, all of these related elements, as well as the hardware components of the systems must be balanced with an eye on controlling system life-cycle costs, while maintaining a safe and effective system.

OVERSIGHT

In 2001, the USD(AT&L) formed the UAV Planning Task Force, now referred to as the UAS Planning Task Force, to provide oversight for all of the Department's major UAS acquisition programs and to provide guidance, as necessary, to maximize interoperability and commonality. Under my direction, the Task Force works with the Military Departments and Agencies to coordinate their acquisition planning, prioritization, and execution of UA system programs. During the past year, the Office of the Secretary of Defense (OSD) has been actively involved in molding the long-term Department vision for UAS with regular exchange of information with the Military Departments. We released a third edition in August 2005 of the *Unmanned Aircraft Systems Roadmap, 2005 – 2030* which provides guidance to ensure that Service-developed systems and capabilities support the Department's goals of fielding transformational capabilities, establishing joint standards, and controlling cost.

Of note, one of the top goals listed in the roadmap is to "foster the development of policies, standards, and procedures that enable safe, timely, routine access by UA to controlled and uncontrolled airspace." Appendix F of the roadmap is devoted to airspace integration and is based on our *Airspace Integration Plan for Unmanned Aviation*, released in November 2004. This was the first such Department-wide plan establishing top-level timelines to achieve the safe, routine use of the NAS by DoD UA.

AIRSPACE INTEGRATION PLAN

UA systems are increasingly being selected as materiel solutions to perform a wide variety of missions. The current capabilities support a broad range of user requirements, ranging from the bungee/hand-launched small UAS (such as Raven, Dragon Eye, and Pointer), through the tactical-level systems (such as Pioneer and Shadow), and up to the theater-level systems (such as Global Hawk). This expansive range of needs cannot be efficiently satisfied by a single UAS type. Rather, it results in tailored designs for specific operational capabilities and functions at each of the various levels, and also, differing airspace requirements.

Military UA have historically been flown for test and training in restricted airspace or operationally in war zones, and have thus largely been segregated from manned civilian aircraft. This is changing. The NAS is shared by all users, manned and unmanned, to support national defense, homeland security, and other civil and commercial operations. Unmanned aircraft must be integrated into the NAS while enabling safe, efficient, and effective operations. Since the September 11 terrorist attacks, airspace security has taken on increased priority, and the operation of DoD and Department of Homeland Security (DHS) UA in the NAS outside of restricted airspace is required for homeland defense, disaster relief support, and border security missions. During recent years, DoD UA have operated regularly along the Southwest Border in support of Border Patrol counter narcotic operations; and in 2005 the DHS operated DoD-contracted UA in support of the Arizona Border Control Initiative. In FY 2006 Congress, as requested by the President and proposed by the House and Senate, provided the DHS $10,180,000 for UA systems to be deployed between ports of entry on the Southwest Border for homeland security missions.

In order to integrate UA into the NAS, there are six key UAS-related regulatory and technology issues which must be addressed by DoD, to include: air traffic; airworthiness certification; aircrew qualification; see-and-avoid capability; command, control, and communications; and reliability. The *Airspace Integration Plan for Unmanned Aviation* details these issues and key drivers that must be addressed to achieve the goal of safe, routine use of the national airspace by DoD UA.

The general purpose of this plan is to outline the regulatory and technical infrastructure necessary for DoD to integrate military unmanned with manned flight operations in the NAS. Specific motivation for this goal can be seen by examining specific requirements of current military UA programs. These requirements include the capability for some UA to operate worldwide; and set significant new precedents for future UA operations in the NAS.

The Department's vision is to have "file-and-fly" access for appropriately equipped UA systems while maintaining an equivalent level of safety to that of an aircraft with a pilot onboard. For military operations, UA will operate with manned aircraft in and around airfields using concepts of operation that make on- or off-board distinctions transparent to air traffic control authorities and airspace regulators. The operations tempo at mixed airfields will not be diminished by the integration of unmanned aviation, and likely can be improved with procedures and technologies under development for UA. Positive aircraft control must be assured through secure communications and established procedures for UA operating in the NAS.

Certain guiding principles have been established in pursuit of this vision. These principles can be stated as follows:

- Do no harm – Avoid new initiatives, such as enacting regulations for the military user that would adversely impact the Military Departments' right to self-certify aircraft and aircrews, or air traffic control practices or procedures; or unnecessarily restrict civilian or commercial flights. Where feasible, provide a model to facilitate the adaptation of these regulations for civil use. This also applies to recognizing that "one size does NOT fit all" when it comes to establishing regulations for the wide range in size and performance of DoD UA.
- Conform rather than create – Integrate the existing Title 14 Code of Federal Regulations (CFR) (formerly known as Federal Aviation Regulations, or FARs) to incorporate unmanned aviation and avoid the creation of dedicated UA regulations as much as possible. The goal is to achieve integrated flight operations in the NAS.
- Establish the precedent – Although focused on domestic use, any regulations enacted will likely lead, or certainly have to conform to, similar regulations governing UA flight in International Civil Aviation Organization (ICAO) and foreign countries' airspace.

As mentioned earlier, the DoD and the FAA must address both technology and regulatory issues in order to reach the goal of "file-and fly." Within the Department, the DoD Policy Board on Federal Aviation provides policy and planning guidance for comprehensive airspace planning and coordinates directly with the FAA on DoD airspace related issues, while the Office of the USD(AT&L) provides oversight for technology development. I will now elaborate on specific key regulatory and technology issues related to integration of UA in the NAS.

DoD UA require safe, routine access to the NAS and international airspace for training and operations. In 1997 FAA and DoD agreed to allow DoD UA access the NAS using the Certificate of Authorization (COA) process. Current procedures, in accordance with FAA Order

7610.4, Chapter 12, Section 9, require an application for a COA to be filed with the FAA at least 60 days prior to operations for all UA operations outside of Restricted and Warning Areas, except procedures for non-joint DoD airfield operations will be as specified by DoD. COAs are typically issued for one-time events, are limited to specific routes or areas, and are valid for no longer than one year. In the case of Global Hawk a national COA was approved allowing NAS access with FAA coordination three working days in advance, but the COA must be re-approved annually. The FAA Order 7610.4 lists the circumstances that must be met in order to be granted a COA for operating in the NAS. Key requirements include a statement from the DoD proponent that the aircraft is airworthy and the proposed method to avoid other traffic, one that provides an equivalent level of safety, comparable to see-and-avoid requirements of manned aircraft. Methods to consider include, but are not limited to: radar observation, forward or side looking cameras, electronic detection systems, visual observation from one or more ground sites, monitoring by patrol or chase aircraft, or a combination thereof. Historically, DoD has relied primarily on ground-based radar for most UA operations within the NAS, and has done so without an incident resulting in death or injury since 1997. The COA process allows for DoD UA access to the NAS for events planned well in the future; however, it is insufficient to support unplanned operations. For example, DoD UA support for disaster relief in the wake of Hurricane Katrina was available, but not authorized. Instead small UA were attached to helicopter skids to provide some limited electronic collection capability. A significant number of DoD COA approvals have recently taken a full 60 days, or more, to be approved; and several critical DoD UAS programs are experiencing impacts from delays in COA approvals. Additionally, many UA industry members must rely on a DoD COA for access to the NAS. Over the last 20 years DoD was the only customer and the DoD COA provided adequate access to the NAS for industry; however, this is no longer the case. Industry also needs access to the NAS for independent development and demonstration of UAS to DoD and non-DoD customers.

While ground-based radar has been the primary means for providing the equivalent level of safety required for a COA approval; it has limitations and is not a long term solution. To mitigate radar limitations, DoD is developing "sense-and-avoid" technology organic to the UA that is at least as good as the human eye; i.e., an equivalent level of safety, comparable to see-and-avoid requirements of manned aircraft. Directly related to the technology development is the need for a standard to design and build to, and the need for data to measure the effectiveness of a given sense-and-avoid system. As a first step, the USAF Air Combat Command developed a functional-performance-requirements document to guide the design of a sense-and-avoid system. This document was, in turn, applied to the development of a civilian standards document: ASTM F 2411-04. As a next step, the Air Force Research Laboratory is now leading a UAS community team to turn the functional requirements into technical requirements for systems development. DoD plans to demonstrate optical systems in a sense-and-avoid role, applying available standards later this year. The FAA-endorsed RTCA Special Committee 203 is working to develop UAS-related standards, as well; however, the schedule does not support DoD requirements. With respect to measuring a sense-and-avoid system's effectiveness, modeling and simulation can be a valuable tool as it was in the initial determination of the effectiveness of the Traffic Alert and Collision Avoidance System for manned aircraft; however, the NAS airspace model needs to be updated and DoD UA sense-and-avoid models will need to be developed and validated.

Our *Airspace Integration Plan for Unmanned Aviation* discusses the regulatory and technology issues that need to be addressed to allow qualified UA to file-and-fly. It also recognizes that not all UA will likely be qualified to file-and-fly in all classes of airspace, and proposes three categories of UA:

- UA that comply with applicable sections of Title 14 CFR, Part 91, including the ability to see-and-avoid, would be qualified to file-and-fly. UA listed in Table 3 would be candidates for this category as technology matures.
- UA similar to light-sport aircraft and ultralights in size and performance and that can not fully comply with Title 14 CFR, Part 91, would still require a COA to operate in the NAS. Tactical UA listed in Table 2 would be candidates for this category.
- Small UA, those similar to RC model aircraft, would not require a COA if the operations met specific guidelines similar to those provided RC model aircraft operators. Small UA listed in Table 1 would be candidates for this category.

Standards and technology enabling UA to be qualified to file-and-fly are still being developed. Once the technology is developed and proven, regulatory changes will be required to allow UA to file-and-fly. Conversely, regulatory changes could allow small UAS to be operated more effectively outside of restricted areas in the NAS now.

In summary, DoD has safely accumulated hundreds of thousands of UA flight hours, many of which were in congested airspace in Iraq. DoD UA require routine access to the NAS outside of Restricted Areas for combat training, homeland defense and disaster relief operations; routine access that the current COA process does not accommodate. Changes to the current COA process can provide more routine, safe access to the NAS now while DoD and FAA work together to define and implement a long term plan for airspace integration for unmanned aviation. I believe that our *Airspace Integration Plan for Unmanned Aviation* is a good start to a long term plan. The Department's priorities for immediate action are:

1. Continue to work with FAA to approve all pending and future COA requests in a more efficient, expedited manner;
2. Work with FAA to provide greater flexibility for small UAS operations in the NAS; and
3. Work with FAA and other government agencies in the development of standards for sense-and-avoid capabilities.

CONCLUSION

The growth of UAS within the DoD has been dramatic and the DoD, as well as other organizations, have been challenged to adapt to this rapid growth. This technology provides the DoD, and likely other government agencies, with a powerful capability. All parties must work harder to maximize the effectiveness of UA operations in support of national security, and disaster support both at home and overseas without compromising safety. Today, most DoD and DHS UA operations in the NAS occur over very low population and airspace density environments, and our safety record clearly demonstrates that DoD UA do not pose a significant risk to the public, or are a hazard to safe airspace operations. Modeling and simulation of UA operations in the NAS could provide data to further substantiate the safety of current and planned UA operations, and the associated sense-and-avoid systems currently being developed.

Mr. Chairman, this concludes my prepared remarks. Again, thank you for the opportunity to express the Department's plan for integrating UAS into the NAS. I will entertain any questions you might have.

Summary of Basic Documents and Related Materials Being Returned

OSD-Legislative Affairs:	Classification:	OSDLA-Control No:	Date Received:
Document Control Record	Unclassified	20060046	April 7, 2006

Committee Number:	Hearing Dates:
0	March 29, 2006

Committee:
House Transportation and Infrastructure Committee/Aviation

Subject:
Unmanned Aerial Vehicles

Witness
No

OPR:	Committee Suspense Date:	Close Out Date:
AT&L	May 1, 2006	

Document Type:	Page Inventory:	Document Description:
Questions for the Record		QFRs for Mr. Weatherington (Mica 1,2,3,4)

Attention: Woodruff Lyons
Location:

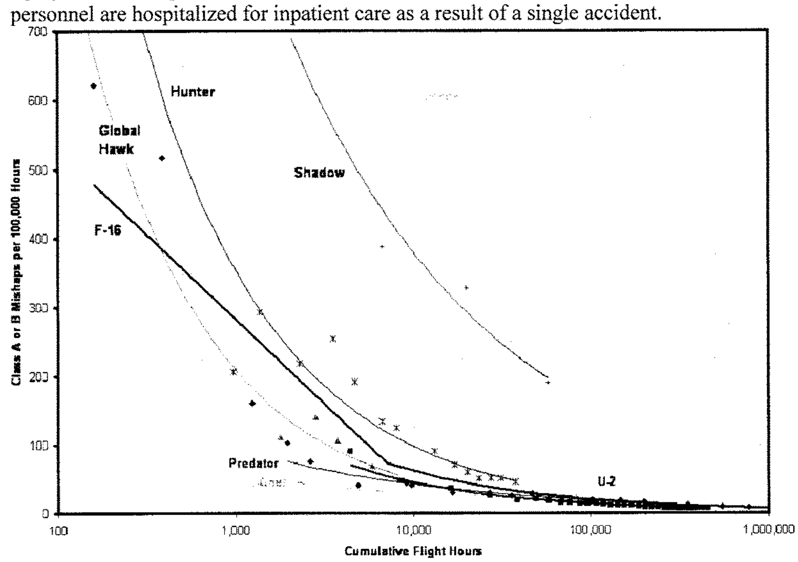
Receiving Officer Signature:__________________________ Date:____________

Committee: U.S. House of Representatives on Transportation & Infrastructure
Subcommittee on Aviation
Hearing Date: March 29, 2006,
Hearing: Unmanned Aircraft Systems (UAS) and the National Airspace System (NAS)
Member: Congressman Mica
Witness: Mr. Weatherington

Question 1

Question. What is the DoD Unmanned Aircraft Systems (UAS) safety record, in terms of loss of communication, loss of link, system failure, accidents, incidents, near misses and/or loss of aircraft?

Answer. Aviation safety is measured in terms of mishaps per 100,000 flight hours. The below graph shows DoD UAS and manned aircraft Class A mishap data (Class B for Shadow and Pioneer) for selected aircraft; flight hours are total flight hours, with the majority of the Unmanned Aircraft (UA) flight hours being logged on combat missions. The trends for unmanned and manned aircraft are comparable. None of the UA mishaps, combat related or otherwise, have resulted in injury or loss of life. Class A and B mishaps are defined as:
Class A: The resulting total cost of damages to Government and other property in an amount of $1 million or more; a DoD aircraft is destroyed; or an injury and/or occupational illness results in a fatality or permanent total disability.
Class B: The resulting total cost of damage is $200,000 or more, but less than $1 million; an injury and/or occupational illness results in permanent partial disability; or when three or more personnel are hospitalized for inpatient care as a result of a single accident.



Loss of voice communication with Air Traffic Control (ATC) is less frequent for UA than for manned aircraft; the operator of the UA is on the ground and can use phones. Loss of UA data link for extended periods of time is rare, and there are factors to prevent loss of link from resulting in mishaps - UAS have secondary control data links, UAS can be programmed to follow specific flight paths to specific points, and in the case of Global Hawk, it can land autonomously even with loss of link. There has only been one midair collision involving a DoD UA, and none in the National Airspace System (NAS). An expendable, 4 lb. Raven UA and an Army helicopter collided during combat operations in the United States Central Command's Area of Responsibility; the helicopter landed safely.

Specific data ***for DoD UAS CONUS operations for FY03-FY05*** has been provided by the Services through the Joint Staff. The below data is *only* for CONUS DoD UA operations.

1. Number of incidents resulting in loss of voice communications with Air Traffic Control for longer than 10 minutes.

Air Force: Zero.
Navy/ Marine Corps: Zero.
Army: Zero.

2. Number of incidents of complete loss of communications with the UA for longer than 10 minutes.

Air Force:

- Global Hawk: One, a Common Airborne Modem Assembly failure during descent at Edwards AFB, California. The UA landed autonomously without communications.
- Predator A: Zero.
- Predator B: Zero.

Navy/ Marine Corps: Zero.
Army: Zero.

3. Number of incidents of a significant systems failure resulting in the canceling of the mission and returning to base.

Air Force:

- Global Hawk: Empirical data is not available; however, the field operators have noted a few mission aborts due to equipment problems primarily in the testing environment.
- Predator: For FY05 there were 212 air aborts (17.7/month) out of over 3200 total sorties flown, and 116 air aborts to date for FY06 (19.3/month) out of over 1900 total sorties flown. Data prior to FY05 is not available.

Navy/ Marine Corps: Zero.
Army: Zero.

4. Number of incidents that resulted in a Class A or Class B mishap.

Air Force:

- Global Hawk: Zero Class A, 1 Class B.
- Predator A: 4 Class A, 1 Class B.
- Predator B: Zero Class A, zero Class B.

Navy / Marine Corps:

- Pioneer: Zero Class A, 8 Class B.

Army: 1 Class A, 15 Class B.

5. Number of incidents that resulted in the total loss of the aircraft.

Air Force:

- Global Hawk: Zero.
- Predator A: 2.
- Predator B: Zero.

Navy/ Marine Corps: Zero.

Army: 8.

6. Number of incidents that resulted in a near miss with other aircraft (< 500 ft separation).

Air Force:

- Global Hawk: Zero.
- PredatorA: 2.
- Predator B: Zero.

Navy/ Marine Corps: Zero.

Army: Zero.

Committee: U.S. House of Representatives on Transportation & Infrastructure
Subcommittee on Aviation
Hearing Date: March 29, 2006,
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Question 2

Question. Immediately following Katrina, did the DoD have an approved plan for the safe operation of UAS in the NAS when responding to natural disasters? Does the DoD have such a plan now?

Answer. When Katrina made landfall, several UAS were offered by the military to support a wide range of civil support missions, including search and rescue, disaster mapping, and route reconnaissance. DoD operates UA in NAS outside of military special use airspace in accordance with the Federal Aviation Administration (FAA) Order 7610.4, Chapter 12, Section 9, which requires a FAA approved Certificate of Authorization (COA). DoD components did not receive COA approvals from the FAA for UA operations in support of Katrina relief efforts, primarily due to lack of a fully developed Concept of Operations (CONOPS), to include coordination with the Federal Emergency Management Agency, FAA, and other government agencies. The DoD discontinued its attempts to provide UAS support on September 13, 2005.

The United States Northern Command (USNORTHCOM) has completed the initial draft of a UAS CONOPS which establishes procedures for integration of UA in support of homeland defense and civil support missions. The implementation of the CONOPS will be subject to FAA COA approvals and a request for DoD support from the Department of Homeland Security (DHS). Additionally, the Joint UAS Center of Excellence (COE) has been tasked by the Joint Staff to develop an overarching Joint CONOPS that will include all DoD UAS. This document is planned for a Joint Requirements Oversight Council review by December 31, 2006, for their endorsement, and should be signed by the Chairman of the Joint Chiefs of Staff in early 2007. USNORTHCOM is working with the JUAS COE in the development of this document with respect to civil support and homeland defense.

Committee: U.S. House of Representatives on Transportation & Infrastructure
Subcommittee on Aviation
Hearing Date: March 29, 2006,
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Member: Congressman Mica
Witness: Mr. Weatherington

Question 3

Question. Why does the DoD believe it needs to conduct surveillance operations and training exercises throughout the United States and outside of the military special use airspace? What does the DoD expect to accomplish?

Answer. Surveillance operations may be required for the DoD homeland defense mission (combat search and rescue, critical infrastructure assessment, maritime threat assessment, targeting, reconnaissance, battle damage assessment, communications relay), and to support the Department of Homeland Security (DHS) in their counter drug, disaster relief, and other homeland security missions (pre-event baseline assessment, damage assessment, search and rescue, communications relay, maritime interdiction). Training exercises normally can be conducted in military special use airspace; however, exceptions exist and will be more common as UA units, including National Guard, are based throughout the United States. Not all military installations have access to military special use airspace. With respect to UA surveillance operations and training exercises, DoD expects to accomplish homeland defense missions and support to the DHS in accordance with established guidelines and training to ensure that UA units maintain an appropriate level of readiness for real world missions.

DoD UA need to access the NAS and international airspace on a routine basis. Examples include:

<u>Small Unmanned Aircraft Systems (SUAS):</u> Large numbers of small UAS have been delivered to DoD units fighting the Global War on Terror. The aircraft are similar in size and performance to remote-controlled model aircraft, and have proven very effective for providing situational awareness to the soldier on the ground. Most of the systems are deployed, but will be returning to CONUS as units return home. The SUAS is backpack portable and does not need special infrastructure to operate. Units based at installations outside of military special use airspace will need to operate the SUAS to maintain proficiency.

<u>Global Hawk:</u> The Global Hawk flies at high altitudes (60,000 ft), has extremely long endurance (greater than 24 hours), and has a military requirement to conduct worldwide operations. The Air Force Global Hawk will begin operating regularly from Beale AFB, California between June and August 2006. There is not any restricted airspace at Beale AFB so the aircraft must be able to access the NAS to perform its mission and associated training. The Navy Global Hawk is operating from the Patuxent River Naval Air Station, Maryland and has similar requirements for access to the NAS outside of military special use airspace.

Predator: The Predator A and Predator B have the military requirement to be able to operate in the NAS and appropriate International Civil Aviation Organization classes of airspace worldwide to conduct its mission.

Fire Scout: The Navy Fire Scout UA will operate from the Navy's Littoral Combat Ship outside of military special use airspace.

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Question 4

Question. Does the DoD have a proposed sense and avoid solution? If so, does the system have the ability to avoid collisions with unmanned, "uncooperative" (no transponder) objects? (Towers, wires, birds, balloons) Is it effective in all weather conditions? When DoD's proposed system is certified for military use, will it meet FAA's strict requirements for use in the NAS?

Answer. The FAA has not yet defined its requirements for an unmanned aircraft sense and avoid (SAA) system. DoD is developing SAA technology to provide UA with the ability to autonomously avoid collisions with both cooperative and uncooperative objects with an Equivalent Level of Safety (ELOS) to the manned aircraft capability to see and avoid other aircraft. The SAA systems may exceed human capability in many areas such as detection range, attention, accuracy, etc. The current approach is to address the SAA issue with a platform centric approach. DoD UA programs that will need to file-and-fly in most classes of airspace include the Predator A UA, the Predator B UA, the Global Hawk UA, the Extended Range/Multi-Purpose UA, and the Broad Area Maritime Surveillance UA. While there is not a stand alone SAA program, there is a Joint UAS Integrated Product Team to coordinate ongoing and future Service efforts needed to integrate qualified DoD UA into the NAS. Development and certification of SAA systems is one of these efforts.

Current funded DoD SAA technology development efforts include:

The Air Force has funded an Advanced Technology Demonstration (ATD) under which the Air Force Research Lab will develop and demonstrate SAA technology and the Air Combat Command (ACC) will transition the technology to the Predator and Global Hawk UA systems. The technology to be demonstrated in this ATD is a passive electro-optical sensing system and maneuvering algorithms that can meet the requirements specified in the ACC SAA White Paper on SAA and the American Society of Testing and Materials (ASTM) 2411 SAA performance standard, as well as system specific requirements to enhance the transition of the technology to other UAS.

The Office of the Secretary of Defense plans to demonstrate that an autonomous SAA capability can be available within 2-3 years, refine the requirements (standards) for such a capability, and map the airworthiness certification process for SAA systems. Work is ongoing to develop an end-to-end, automated SAA system, evaluate that system's performance against the ASTM 2411 SAA performance standard, obtain certification of that system, and demonstrate the SAA system on an unmanned aircraft to the FAA later this year. This effort builds on Navy funded efforts.

Other SAA technologies being studied include acoustic sensing and Laser Radar (LADAR). The LADAR technology has been demonstrated in several experiments, the most highly developed of which is on the Defense Advanced Research Projects Agency's Organic Air Vehicle II program. The Army's Aviation and Missile Research Development and Engineering Center study of acoustic technologies has also shown this technology has the potential capability to detect other aircraft.

Automated collision avoidance and ground avoidance technology in development for manned aircraft also has potential for accelerating SAA technology development for UA.

STATEMENT FOR THE RECORD
INTEGRATION OF UNMANNED AERIAL VEHICLES (UAVs) INTO THE NATIONAL AIRSPACE SYSTEM (NAS)
United States House of Representatives, Transportation and Infrastructure Committee, Aviation Subcommittee

Statement of Honorable Richard F. Healing, P.E.; Former Member of the National Transportation Safety Board

Safe integration of UAVs into the NAS can, in addition to removing barriers against expanded use of UAVs for national defense and national security purposes, bring immense commercial and public benefits through reduced cost of operations, increased efficiency, and expanded mission capabilities. Using existing hardware and software technologies, it is possible to implement UAV integration without any compromise of safety of the NAS. The cost of a single UAV accident with loss of human life could set back the effort for decades.

In 1977, a helicopter in relatively new scheduled commercial passenger service crashed on the rooftop heliport of the Pan Am Building in New York City. Despite highly attractive benefits, commercial service from that heliport never resumed. The lesson is clear: a fatal crash at the beginning of a "new and different" type of operation can create the impression that the operation is "unsafe", causing a negative public reaction that can last for decades.

While most UAV use has been for military operations in restricted airspace, at least two significant events emphasize the need for deliberate focus on safe integration. The collision of a small UAV with a light observation helicopter in Iraq caused the helicopter to crash land, fortunately without serious injury to the crew. The helicopter was damaged and the UAV was destroyed. Another serious incident was a "near miss" between a large, wide body commercial passenger plane overtaking a UAV controlled from the ground by a remotely located operator who did not see the passenger aircraft approaching from behind. The incident highlighted the risk associated with having a remote ground based operator of the UAV, with limited ability to simultaneously "see" and react to all other aircraft in the vicinity. The near miss was compounded by the difficulty for the commercial pilots of seeing the small profile of the UAV they were overtaking in time to avoid this incident.

Similar to the initiation of helicopter service at the Pan Am Building in New York, introduction of UAVs into the NAS cannot afford any mistakes that result in a fatal accident. UAVs will have to avoid all manned aircraft, including balloons, parachutes, hang-gliders, and ultra-lights. It will be important to also consider use of parachute recovery in the event of complete power loss from any source, permitting a soft landing of the UAV, protecting its payload and the people in the area where it comes down.

To avoid the risk of a collision, the solution must be a system that provides the UAV with all the information necessary to detect and track any target in the area, understand whether or not there is threat of a collision, and autonomously take appropriate evasive action. The burden of avoiding a crash must be entirely placed on the UAV; and the technology to do that exists in various forms today. Integrating the right sensor packages, miniaturizing as necessary to fit the platform, and developing smart avoidance software – a "brain" - will enable safe integration of UAVs without placing a burden or cost on those presently using the NAS, including the general aviation (GA) community.

While an effective solution is technically feasible, there is no published UAV collision avoidance standard – a target toward which manufacturers can build the "detect, track & avoid" system. Presently, there is no expectation that a "standard" acceptable to the FAA will be entered into the FARs in the next few years, despite numerous industry-government teams working together on the requirements. Absent an urgent national security threat, the process could easily take as long as 8 to 10 years.

Lack of a standard should not be a barrier to developing the necessary "detect, track & avoid" system that exceeds the FAA's stated minimum acceptable requirements for avoiding a collision. Placing the burden of collision avoidance entirely on the UAV would allow integration without impacting the present users of the NAS. Commercial and GA aircraft should not have additional equipment costs, nor should they experience the need to deviate from their planned flight to avoid a UAV. Fielding such a capable system in the next two or three years is both possible and desirable because it will enable our country to realize the benefits that UAVs can bring for civil and commercial operations; and at the same time, remove barriers to broader use of UAVs for military and national security missions.