NEXTGEN: THE FEDERAL AVIATION ADMINISTRATION'S AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST CONTRACT

(110–80)

HEARING

BEFORE THE

SUBCOMMITTEE ON
AVIATION

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

OCTOBER 17, 2007

Printed for the use of the
Committee on Transportation and Infrastructure

U.S. GOVERNMENT PRINTING OFFICE

38–514 PDF WASHINGTON : 2007

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

JAMES L. OBERSTAR, Minnesota, *Chairman*

NICK J. RAHALL, II, West Virginia, *Vice Chair*
PETER A. DEFAZIO, Oregon
JERRY F. COSTELLO, Illinois
ELEANOR HOLMES NORTON, District of Columbia
JERROLD NADLER, New York
CORRINE BROWN, Florida
BOB FILNER, California
EDDIE BERNICE JOHNSON, Texas
GENE TAYLOR, Mississippi
ELIJAH E. CUMMINGS, Maryland
ELLEN O. TAUSCHER, California
LEONARD L. BOSWELL, Iowa
TIM HOLDEN, Pennsylvania
BRIAN BAIRD, Washington
RICK LARSEN, Washington
MICHAEL E. CAPUANO, Massachusetts
JULIA CARSON, Indiana
TIMOTHY H. BISHOP, New York
MICHAEL H. MICHAUD, Maine
BRIAN HIGGINS, New York
RUSS CARNAHAN, Missouri
JOHN T. SALAZAR, Colorado
GRACE F. NAPOLITANO, California
DANIEL LIPINSKI, Illinois
DORIS O. MATSUI, California
NICK LAMPSON, Texas
ZACHARY T. SPACE, Ohio
MAZIE K. HIRONO, Hawaii
BRUCE L. BRALEY, Iowa
JASON ALTMIRE, Pennsylvania
TIMOTHY J. WALZ, Minnesota
HEATH SHULER, North Carolina
MICHAEL A. ACURI, New York
HARRY E. MITCHELL, Arizona
CHRISTOPHER P. CARNEY, Pennsylvania
JOHN J. HALL, New York
STEVE KAGEN, Wisconsin
STEVE COHEN, Tennessee
JERRY MCNERNEY, California
LAURA A. RICHARDSON, California
JOHN L. MICA, Florida
DON YOUNG, Alaska
THOMAS E. PETRI, Wisconsin
HOWARD COBLE, North Carolina
JOHN J. DUNCAN, JR., Tennessee
WAYNE T. GILCHREST, Maryland
VERNON J. EHLERS, Michigan
STEVEN C. LATOURETTE, Ohio
RICHARD H. BAKER, Louisiana
FRANK A. LOBIONDO, New Jersey
JERRY MORAN, Kansas
GARY G. MILLER, California
ROBIN HAYES, North Carolina
HENRY E. BROWN, JR., South Carolina
TIMOTHY V. JOHNSON, Illinois
TODD RUSSELL PLATTS, Pennsylvania
SAM GRAVES, Missouri
BILL SHUSTER, Pennsylvania
JOHN BOOZMAN, Arkansas
SHELLEY MOORE CAPITO, West Virginia
JIM GERLACH, Pennsylvania
MARIO DIAZ-BALART, Florida
CHARLES W. DENT, Pennsylvania
TED POE, Texas
DAVID G. REICHERT, Washington
CONNIE MACK, Florida
JOHN R. 'RANDY' KUHL, JR., New York
LYNN A WESTMORELAND, Georgia
CHARLES W. BOUSTANY, JR., Louisiana
JEAN SCHMIDT, Ohio
CANDICE S. MILLER, Michigan
THELMA D. DRAKE, Virginia
MARY FALLIN, Oklahoma
VERN BUCHANAN, Florida

SUBCOMMITTEE ON AVIATION

JERRY F. COSTELLO, Illinois, *Chairman*

BOB FILNER, California
LEONARD L. BOSWELL, Iowa
RICK LARSEN, Washington
RUSS CARNAHAN, Missouri
JOHN T. SALAZAR, Colorado
DANIEL LIPINSKI, Illinois
NICK LAMPSON, Texas
ZACHARY T. SPACE, Ohio
BRUCE L. BRALEY, Iowa
HARRY E. MITCHELL, Arizona
JOHN J. HALL, New York, *Vice Chair*
STEVE KAGEN, Wisconsin
STEVE COHEN, Tennessee
NICK J. RAHALL, II, West Virginia
PETER A. DEFAZIO, Oregon
ELEANOR HOLMES NORTON, District of Columbia
CORRINE BROWN, Florida
EDDIE BERNICE JOHNSON, Texas
ELLEN O. TAUSCHER, California
TIM HOLDEN, Pennsylvania
MICHAEL E. CAPUANO, Massachusetts
DORIS O. MATSUI, California
MAZIE K. HIRONO, Hawaii
LAURA A. RICHARDSON, California
JAMES L. OBERSTAR, Minnesota
(Ex Officio)

THOMAS E. PETRI, Wisconsin
HOWARD COBLE, North Carolina
JOHN J. DUNCAN, JR., Tennessee
VERNON J. EHLERS, Michigan
STEVEN C. LATOURETTE, Ohio
FRANK A. LOBIONDO, New Jersey
JERRY MORAN, Kansas
ROBIN HAYES, North Carolina
SAM GRAVES, Missouri
JOHN BOOZMAN, Arkansas
SHELLEY MOORE CAPITO, West Virginia
JIM GERLACH, Pennsylvania
MARIO DIAZ-BALART, Florida
CHARLES W. DENT, Pennsylvania
TED POE, Texas
DAVID G. REICHERT, Washington
CONNIE MACK, Florida
JOHN R. 'RANDY' KUHL, JR., New York
LYNN A WESTMORELAND, Georgia
MARY FALLIN, Oklahoma
VERN BUCHANAN, Florida
JOHN L. MICA, Florida
(Ex Officio)

CONTENTS

U.S. House of Representatives
Committee on Transportation and Infrastructure

James L. Oberstar
Chairman

David Heymsfeld, Chief of Staff
Ward W. McCarragher, Chief Counsel

Washington, DC 20515

John L. Mica
Ranking Republican Member

James W. Coon II, Republican Chief of Staff

October 15, 2007

SUMMARY OF SUBJECT MATTER

TO: Members, Subcommittee on Aviation

FROM: Staff, Subcommittee on Aviation

RE: NextGen: the FAA's Automatic Dependent Surveillance-Broadcast (ADS-B) Contract

PURPOSE OF HEARING

At 2:00 p.m. on Wednesday, October 17, 2007, in Room 2167 Rayburn House Office Building, the Subcommittee on Aviation will hold a hearing to consider the Federal Aviation Administration's (FAA) Automatic Dependent Surveillance Broadcast (ADS-B) contract.

Background

In the U.S., Air Traffic Control (ATC) surveillance and aircraft separation services are provided by the use of primary and secondary surveillance radar (SSR) systems, and air traffic controllers who are directly responsible for ensuring adequate separation between aircraft receiving radar services.

Primary radar measures the range, bearing and velocity of a particular aircraft. It transmits a beam that is reflected by a target. This reflection forms a return signal that is translated into an aircraft position by ATC automation systems. Primary radar is a passive detection method that requires no special equipment aboard the aircraft. SSR systems consist of antennas, transmitters, and processors installed in ATC facilities, and radio transponder devices that are installed in aircraft. An SSR transmits interrogation pulses that elicit responses from transponders on board the aircraft. A transponder installed on the aircraft "listens" for the interrogation signal and sends back a reply that provides aircraft identification information. The aircraft is then displayed as a tagged icon on the air traffic controller's radar screen.

While radar technology has advanced over the last several decades, it has limitations. Most radars show where a target was a few seconds ago because they take time to receive return signals and update the controllers' displays. Additionally, radar occasionally has problems distinguishing airplanes from migratory birds and rain "clutter." Further, the accuracy of radar diminishes as the

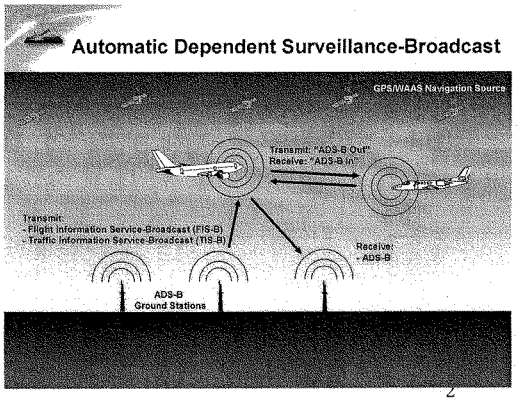
distance to the target increases. Moreover, both primary and SSR systems are large structures that are expensive to deploy and maintain; they also require the FAA to lease land for site installation.

The Department of Transportation (DOT) predicts up to a tripling of passengers, operations, and cargo by 2025. According to the FAA, to accommodate the projected level of traffic, more comprehensive surveillance in the national airspace system (NAS), including more radar sites in certain areas, would be necessary. However, the FAA also believes that even if more radar sites were commissioned, there are many areas in which radar coverage is not feasible, either geographically (e.g., mountainous areas) or in a cost-effective manner (e.g. remote areas). Therefore, the FAA has determined that the future of air traffic surveillance cannot be based solely on the use of radar, and it has initiated a transition to satellite-based surveillance, while maintaining a reduced radar network for back-up.

Automatic Dependent Surveillance – Broadcast (ADS-B) is the FAA's flagship program to transition to satellite-based surveillance. For the last few years, the FAA has tested and demonstrated ADS-B in Alaska (the "Capstone Program") and the Ohio River Valley ("Safe Flight 21"), and it recently signed a Memorandum of Agreement with the Helicopter Association International (HAI), helicopter operators and oil and gas platform owners in the Gulf of Mexico, to facilitate ADS-B implementation in the Gulf. Within the last 90 days, the FAA awarded a service contract to begin nationwide deployment of ADS-B and published a notice of proposed rulemaking (NPRM) mandating that aircraft operating in certain classes of airspace equip with ADS-B avionics by 2020.

Internationally, EUROCONTROL, a cooperative organization of 37 member states in Europe, is focused on developing a seamless, pan-European Air Traffic Management system -- The Single European Sky Air Traffic Research Project, commonly known as SESAR. In support of its objective, EUROCONTROL is considering a plan to install ADS-B ground broadcast transceivers in European areas that do not have adequate radar coverage. NAV Canada is deploying ADS-B in northern Canada to provide surveillance in the airspace over Hudson Bay where currently there is no radar coverage. NAV Canada anticipates having ADS-B in the rest of Canada as a replacement for, or complement to radar.

I. What is ADS-B?



Key elements of ADS-B include the Global Positioning System (GPS), aircraft avionics, and ground stations. ADS-B works by having aircraft avionics receive GPS signals and use them to determine the aircraft's precise position in the sky. Avionics then convert that position into a unique digital code and combines it with other data from the aircraft's flight monitoring system — such as the type of aircraft, its speed, its flight number, and whether it is turning, climbing, or descending. This position is accurate to within 3 feet

at any range, a vast improvement over the current 150 feet at 10 miles and 600 feet at 40 miles.

The code containing all of this data is automatically broadcast from the aircraft's avionics once per second. This broadcast is called "ADS-B Out" because the aircraft is broadcasting information out to other aircraft equipped to receive the data and ADS-B ground stations up to 200 miles away. "ADS-B In" refers to a properly equipped aircraft's ability to receive another aircraft's ADS-B Out information, as well as traffic information of non-equipped aircraft through the transition TIS-B capabilities described below. ADS-B In effectively enables aircraft to "see" other aircraft on flight deck displays.

ITT Corporation, the FAA's prime contractor for ADS-B, estimates that approximately 800 ground stations would be required to provide service for the entire the NAS. In turn, ground stations transmit this data to various "service delivery points" near TRACONs, en route centers and other facilities,[1] where automation systems process the ADS-B messages and generate air traffic displays for controllers, flow managers, and other personnel.

On October 5, 2007, the FAA published a NPRM that would mandate and specify performance requirements for ADS-B Out equipage by 2020. Equipage requirements would be tied to the class of airspace that an aircraft operates in. Generally speaking, the proposed rule would require ADS-B Out equipage for operation in Class A, B, and C airspace (high altitude airspace above 18,000 feet as well as airspace nearby congested and positive controlled airports), and in all airspace within 30 nautical miles (NM) of the busiest airports. FAA expects to publish the final rule in November 2009, and for aircraft to begin to equip shortly thereafter. The NPRM would not mandate aircraft to equip with ADS-B In.

To avoid frequency congestion, ADS-B transmissions will be broadcast over two frequencies. 1090 MHz Extended Squitter (ES) is the internationally agreed upon link for ADS-B, and will support operations by air carriers and high performance aircraft operating above 24,000 feet. 978 MHz Universal Access Transceiver (UAT) will be used primarily for general aviation (GA) aircraft flying at lower altitudes.

In addition to ADS-B surveillance services (referred to as "critical" services), the program will also provide two other ground-based uplink broadcast services (referred to as "essential" services) to aircraft equipped with ADS-B In. To enhance pilot situational awareness, Traffic Information Services-Broadcast (TIS-B) is a ground-based uplink report to pilots of proximate traffic that is under surveillance by ATC but is not ADS-B-equipped. For GA aircraft using UAT, Flight Information Services-Broadcast (FIS-B) is a ground-based uplink of flight information services (e.g. Notices to Airmen, Temporary Flight Restrictions, etc.) and weather data.[2]

---

[1] The FAA uses three types of facilities to control traffic: *Airport towers* direct traffic to the ground before landing and after takeoff within 5 nautical miles of the airport and about 3,000 feet above the airport. *Terminal Radar Approach Control Facilities (TRACONs)* sequence and separate aircraft in terminal airspace – i.e., as they approach and leave airports, beginning about 5 nautical miles and ending about 50 nautical miles from the airport and generally up to 10,000 feet above the ground. *En route centers* control aircraft in high-altitude en route airspace – i.e., in transit and during approaches to some airports, generally controlling air space that extends above 18,000 feet for commercial aircraft.

[2] UAT is intended to support applications for the general aviation user community that are not needed by air carriers because air carriers have weather radar, fly at high altitudes, and have other aeronautical links. Additionally, the 1090ES broadcast link does not support applications available from FIS-B, like weather and related flight information due to bandwidth limitations of the 1090ES link for transmitting the large message structures required by FIS-B.

The costs to equip commercial aircraft with ADS-B Out capability range from $32,000 to $175,000, depending on the age of the aircraft and its existing avionics. The additional costs to equip with ADS-B In, over and above ADS-B Out, range from $160,000 to $670,000; however, FAA officials estimate that most costs will be between $160,000 and $250,000.

For GA aircraft, average unit costs for UAT ADS-B Out range from $7,644 - $10,920, depending on aircraft type. Average unit costs for UAT ADS-B In and Out range from $10,444 - $29,770, depending on aircraft type. According to the FAA, costs will be reduced for aircraft that already have some portion of the required avionics (i.e. GPS, cockpit display), and costs are projected to be reduced by approximately 30% over time.

II. ADS-B Benefits

The FAA has described ADS-B as the "cornerstone" and "backbone" of the Next Generation Air Transportation System (NextGen), and "the future of air traffic control." The FAA clearly believes that ADS-B offers tremendous potential benefits to both the FAA and NAS users, estimating approximately $5 billion in benefits through 2035.

For the FAA, ADS-B may offer cost savings because it requires less ground-based infrastructure to maintain, refurbish, and replace. The FAA plans to keep primary radars in place as back up for the foreseeable future. However, ADS-B will enable the FAA to significantly reduce SSRs, while maintaining a network at high-density airports to ensure a back-up in case of a GPS outage. More specifically, FAA plans to reduce SSRs by almost 50 percent, from 365 to 190, between 2018 and 2024, resulting in an estimated $371 million in cost avoidance through 2035.

For NAS users, ADS-B could offer: better safety through enhanced pilot situational awareness, additional services (e.g. weather services) broadcast to the flight deck, and surveillance coverage to areas that are not now radar-accessible, as well as greater capacity and efficiency due to reduced separation and ultimately aircraft self-separation.

ADS-B has a number of technical characteristics that make it potentially more accurate than radar. First, GPS, from which the ADS-B Out transmission is derived, is inherently more accurate than radar, and unlike radar its accuracy does not change with distance. ADS-B transmits position reports once per second, whereas terminal radars generate reports once every 4 to 5 seconds and en route radars generate reports once every 10 to 12 seconds. Faster position reporting can improve the display of target movement as well as the performance of software applications that use target reports as input. Particularly important while managing traffic in the terminal environment, the one-second reporting also gives more accurate positioning data while one aircraft is turning. In addition, ADS-B receives data directly from transmitters, rather than passively scanning for input like radar, so it does not have a problem with clutter like radar. Greater accuracy could allow the FAA to reduce current separation standards of 5 NM in the en route environment and 3 NM in the terminal environment. Regarding aircraft self-separation, the FAA states:

> When properly equipped with ADS-B, both pilots and controllers will, for the first time, see the same real-time displays of air traffic. Pilots will have much better situational awareness because they will know where their own aircraft are with greater accuracy, and their displays will show them all the aircraft in the air around

them. Pilots will be able to maintain safe separation from other aircraft with fewer instructions from ground-based controllers.[3]

Yet despite ADS-B's potential, there are uncertainties regarding when significant tangible benefits can realistically be expected. First, FAA officials have noted that ADS-B is a relatively mature technology, stating that the "technology is not highly complex."[4] But according to the Department of Transportation Inspector General's (DOT IG) office, nationwide ADS-B implementation will in fact be a technically complex undertaking. For example, the FAA will need to significantly modify existing automation systems (e.g., controller displays, software, and related computer equipment) in both the terminal and en route environments. Currently, most automation systems do not process and display ADS-B information. If existing controller displays and related equipment are not modified, air traffic surveillance applications for ADS-B cannot be used.

In addition, many of ADS-B's anticipated benefits depend heavily on the willingness of NAS users to equip and vary based on the type of equipage. Even if the contractor does not slip from the FAA's deployment schedule, the FAA's NPRM would not require NAS users to equip with ADS-B Out until 2020. Moreover, some of the greatest potential long-term ADS-B benefits (e.g. advanced capabilities like self-separation) rely on ADS-B In, which would not be mandated by the FAA's NPRM at all.

Nevertheless, FAA officials state that in some areas where there is currently little or no surveillance coverage (e.g. the Gulf of Mexico), and therefore very large aircraft separation standards, there could be tangible user benefits as early as 2009. Further, some NAS users may equip early to take advantage of new broadcast services such as TIS-B, FIS-B, or additional services provided by the contractor. Further, FAA officials have suggested that the FAA could encourage equipage by providing preferred airspace routes at higher altitudes for properly equipped aircraft, like a high occupancy vehicle (HOV) lane in the sky. In addition, some have suggested that Congress could also provide subsidies, low-interest loans, or tax incentives to accelerate equipage and accompanying financial and safety benefits to the system.

III. The ADS-B Contract

On August 30, 2007, the FAA awarded a performance-based service contract for ADS-B services to a consortium led by ITT Corporation.[5] The total value of the contract, which has a number of options extending through 2025, is $1.86 billion. Segment 1 is a $207 million cost-plus incentive fee contract that requires the contractor to: begin deployment of ground infrastructure in early 2008; provide TIS-B and FIS-B broadcast services for FAA commissioning in November 2008; and achieve FAA ADS-B surveillance service commissioning by September 2010. If the contractor completes Segment 1 successfully, Segment 2 will be a fixed price contract with subscription charges that will require all ground infrastructure be in place, and services to be available where current surveillance exists, by the end of fiscal year 2013.

---

[3] Id.

[4] FAA Surveillance and Broadcast Services, *House Subcommittee on Aviation: Contract Briefing*, May 21, 2007.

[5] Also on ITT Corporation's team are: AT&T, Thales; WSI, Corp; Science Applications International Corporation (SAIC); PriceWaterhouseCoopers; Aerospace Engineering; Sunhillo; Comsearch; Mission Critical Solution (MCS) of Tampa; Pragmatics; Washington Consulting Group; Aviation Communications and Surveillance Systems (ACSS); NCR Corporation; and L-3 Avionics Systems and Sandia Aerospace.

Instead of adopting a more traditional acquisition strategy for ADS-B, whereby the FAA would own, operate, and maintain the system, the FAA has opted for a service contract approach, whereby the ITT team will build the ADS-B ground stations and own and operate the equipment. The FAA will pay subscription charges for ADS-B broadcasts transmitted to properly equipped aircraft and air traffic control facilities.

FAA officials believe that a service contract approach for ADS-B will reduce FAA costs by allowing the FAA to forego the expense of acquiring or leasing the land (and to forego associated environmental due diligence requirements) necessary to deploy the ADS-B ground infrastructure, as well as foregoing other acquisition, operating, and maintenance costs. The FAA estimates that a service contract would save the FAA approximately $820 million through 2035 versus a more traditional acquisition. The FAA also believes that a service contract will enable more rapid deployment of ground infrastructure. According to FAA, under a more traditional acquisition it would take until 2018 to complete NAS-wide deployment of ground infrastructure, which ITT expects to have deployed by the end of FY 2013 under the contract.

In addition, FAA officials believe that its approach provides more opportunity for private sector innovation that could result in new and improved services for users (and therefore greater incentives to equip) and even savings to the Government. For example, the contract enables the contractor to develop and sell "value added services" to NAS users and other customers. FAA officials have suggested that the contractor, subject to FAA approval, might develop more sophisticated weather services for NAS users, or it might sell air traffic data to airports or other customers that are interested in that data. A portion of the contractor's revenue from the secondary sale of these "value added services" will act as a rebate against the FAA's subscription fee, thus offering the potential for cost savings for the agency.

However, this approach may raise new management and oversight challenges for Congress and the FAA, since the contractor would not only own and operate the infrastructure, but would hold a competitive advantage, potentially even a monopoly, over new "value added services" provided over its infrastructure. Looking forward, Congress and the FAA may need to actively monitor this issue and, where appropriate, take measures that will ensure competition, quality service, affordable rates, and other consumer interests in the sale of these services. One such control included in the contract is the Performance Control Board. This Board has the approval responsibility of all value added services. Currently, the Board is comprised of FAA and ITT officials, and the agency has recently approached user groups and the stakeholder community for participation.

Some have suggested that there are inherent risks in allowing a private interest to own and operate such a critical piece of infrastructure, and that doing so will call for a heretofore unseen level of FAA oversight. Section 204 of the House-passed H.R. 2881, the *FAA Reauthorization Act of 2007*, would require the FAA to insert provisions into the contract that protect the Government's interest and ensure adequate safeguards are in place if the contractor is acquired by another firm, enters bankruptcy, or experiences performance problems. In fact, the FAA ADS-B contract does contain several such protection provisions, some of which, according to FAA officials, were included in anticipation of H.R. 2881. Examples of these protection provisions include:

- "Succession Plan"/"Performance Guarantee" - requires a succession plan with a major subcontractor (AT&T) ready and agreed to perform if the prime contractor (ITT) cannot.

- "Continuity of Services" - requires the contractor to perform for up to two years in order to assure a smooth transition to a new contractor in the event of the contractor's default, bankruptcy, or acquisition by another entity or other event jeopardizing the uninterrupted provision of services.

- "Incentives/Disincentives Regarding Contract Performance" - adjusts the subscription charges the FAA would pay if the required service levels are not met.

- "Novation and Change-of-Name Agreements" – stipulates that the contractor needs the FAA's permission before another entity may assume the contract and receive payments under the contract.

- "Ownership and Filtering of data" - specifies that the FAA controls access and distribution of data used in the ADS-B program.

- "Performance Control Board" – establishes a board comprised of FAA and the contractor personnel that provides for monthly monitoring of the contractor against specified performance metrics, review changes to the system, and mutually resolve disagreements.

WITNESSES

PANEL I

Mr. Vincent Capezzuto
Manager, Surveillance and Broadcast Services Program Office
Federal Aviation Administration

The Honorable Calvin L. Scovel, III
Inspector General
U.S. Department of Transportation

Mr. John Kefaliotis
ADS-B Program Director
Defense
ITT Corporation

Dr. Agam N. Sinha
Senior Vice President and General Manager
Center for Advanced Aviation System Development
The MITRE Corporation

Mr. Tom Brantley
President
Professional Airways Systems Specialists (AFL-CIO)

HEARING ON NEXTGEN: THE FAA'S AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST, ADS-B, CONTRACT

Wednesday, October 17, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON AVIATION,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:00 p.m., in Room 2167, Rayburn House Office Building, the Honorable Jerry F. Costello [Chairman of the Subcommittee] presiding.

Mr. COSTELLO. The Committee will come to order. The Ranking Member will be here momentarily, and I will go ahead and get started.

The Chair will ask all Members, staff and everyone to turn electronic devices off or on vibrate.

The Subcommittee is meeting today to hear testimony on NextGen: The FAA's Automatic Dependent Surveillance-Broadcast Contract that was recently entered into by the FAA.

Before we begin, I ask unanimous consent to allow a new Member of our Committee, Ms. Laura Richardson, to participate in the Subcommittee hearing. Hearing no objection, so ordered.

I will begin my opening statement and then recognize the opening statement by the Ranking Member or comments or remarks, and I see Mr. Hayes is sitting in for Mr. Petri.

I welcome everyone to the Subcommittee hearing today. A major part of the FAA's NextGeneration Air Transportation System Plan to transform our air traffic control system is the transition from a ground-based radar to a satellite-based surveillance system. Automatic Dependent Surveillance-Broadcast or ADS-B, as it is commonly known, is key to enabling technology for that transition.

Within the last 60 days, the FAA has taken two major steps forward with ADS-B. At the end of August, the FAA awarded a performance-based service contract valued at almost $1.9 billion to a consortium led by the ITT Corporation. The ITT team is required to build, own and operate a system that will provide nationwide ADS-B surveillance and broadcast services by as early as 2013. Earlier this month, the FAA published a notice of proposed rulemaking that would require aircraft operating in certain classes of airspace to equip with ADS-B Out avionics by 2020.

Over the last several months, the FAA has described ADS-B as the cornerstone and the backbone of NextGen and the future of our

air traffic control system. I agree that ADS-B is technology that holds enormous promise.

It is potentially much more accurate than radar which may help the FAA and airspace users utilize our airspace more efficiently. It can enhance safety by providing surveillance to areas that cannot be covered by radar and by granting pilots greater situational awareness. It may also enable the FAA to avoid hundreds of millions of dollars in costs by downsizing its ground-based infrastructure.

That said, reasonable expectations must be set about what relief ADS-B can realistically provide for the type of meltdown and record-setting delays our system has faced this summer. Unfortunately, the American people have been led to believe that the silver bullet solution for the gridlock that we saw this summer is a new satellite-based surveillance system.

The truth is ADS-B will not provide significant tangible benefits for several years and then only in conjunction with other NextGen technologies that are many years away from implementation now. It is time for the rhetoric to stop and for the Administration to start explaining all of the ifs and whens about ADS-B and the NextGen system.

Some have pointed out that ADS-B is a relatively mature technology that is not highly complex. We should not underestimate the technical challenges of building and integrating this new system into the NAS. As with any modernization program, there is clearly the potential for setbacks and slippage as far as implementation is concerned.

In addition, even if the ITT team meets the FAA's ambitious schedule for deploying ground infrastructure and services, how quickly ADS-B can deliver major benefits will be determined largely by how quickly users equip. The FAA's proposed rule does not mandate ADS-B by users until the year 2020.

Furthermore, some of ADS-B's most advanced applications and capabilities, like reduced separation and standards and aircraft self-separation, have received the most public attention. However, the FAA first needs to demonstrate that ADS-B performs as well as our current radar base system before these capabilities can seriously be considered. Moreover, some of these advanced capabilities require ADS-B In avionics which the FAA did not mandate in its proposed rule.

Given that, the FAA has advertised ADS-B as the future of the air traffic control system. Everyone should understand that the FAA has placed a tremendous amount of responsibility in the hands of the private sector.

Instead of adopting a more traditional acquisition strategy for ADS-B, the FAA had opted for a service contract approach whereby the ITT team will build the ADS-B ground stations and own and operate the equipment. The FAA will pay subscription charges for ADS-B broadcasts transmitted to aircraft and air traffic control facilities.

The FAA has estimated that its contracting approach will save the Government roughly $820 million over the next 30 years and cut about five years off of the deployment schedule. Regardless, I believe that there are inherent risks in this strategy. Both Con-

gress and the FAA must provide vigorous oversight over this contract.

With that, I again welcome all of our witnesses here today, and I look forward to hearing your testimony.

Before I recognize the Ranking Member, Mr. Petri, for his opening statement or remarks, I ask unanimous consent to allow two weeks for all Members to revise and extend their remarks and to permit the submission of additional statements and materials by Members and witnesses. Without objection, so ordered.

With that, the Chair recognizes the distinguished Ranking Member, Mr. Petri, for an opening statement or his comments.

Mr. PETRI. Thank you very much, Mr. Chairman, and I would like to join you in welcoming our panelists here today and also thank you for scheduling this hearing.

Two months ago, as you point out, the FAA awarded the long awaited ADS-B contract to the ITT Corporation and published a notice of proposed rulemaking on the system ground stations and equipage standards. These are two major milestones in the transition to a satellite-based surveillance air traffic control system, and I certainly would join in applauding all involved in the process.

The new system will improve safety by increasing positioning accuracy and, according to our Federal Aviation Administration, has great potential to increase our capacity to handle the potential three-fold increase in traffic that is projected over the next 20 to 30 years.

As we know, the transition to the new system will not be simple. I am glad we have the opportunity today to learn more about the contract itself, the contractor, ITT, and what role the new system will have in the effort to modernize our air traffic system.

Strong oversight, both internally at the FAA and here in Congress, will be critical to the success of the transition. A lot is riding on a smooth and hopefully uneventful transition to the new system. I look forward to our witnesses identifying some of the major issues associated with the transition and controls built into the contract to address those issues.

Input from the national airspace system users will also clearly be very important. After all, what good is a new surveillance system if it fails to serve the users' needs? To that end, I look forward to hearing how the FAA plans to utilize technical experts from the aviation community as they move ahead with the implementation and transition to the ADS-B system.

While I am pleased with the Federal Aviation Administration's progress so far, we have a long way to go before we achieve full NextGen. I look forward to working with the aviation community as we continue to move toward that goal. This new system is the first tangible step in the process, and let's make sure that we get it right.

I yield back.

Mr. COSTELLO. The Chair thanks the Ranking Member and recognizes the gentleman from Colorado, Mr. Salazar, who is going to enter a statement into the record and make brief remarks.

Mr. SALAZAR. I do want to thank you, Mr. Chairman.

I just wanted to thank the FAA for their forward thinking, and I just want you to understand that the State of Colorado is fully invested in the NextGen air system.

I am very concerned, however, about the air safety along the mountains and the ski country of Colorado. So I just want to make sure whenever we move forward and how we move forward, that we take into account the ski areas and the mountainous areas and Rocky Mountains area in general of this great Nation.

Thank you, Mr. Chairman. I appreciate your allowing me to make a few comments.

Mr. COSTELLO. I thank the gentleman, and the Chair now recognizes the gentleman from North Carolina, Mr. Hayes.

Mr. HAYES. Thank you, Mr. Chairman. I truly appreciate what you are doing here today.

I think sometimes you worry about my level of enthusiasm about this project being too high, for those of you in the audience who don't know, when the Chairman sees me coming.

We are going to be talking about ADS-B and how we need to have a different role here. The FAA has a great product to sell, another service to impose on folks.

When we get through this, my friend, Mr. Salazar, is going to get his plane back and he is going to make sure that he has ADS-B in it because he doesn't want to live without it. It can be that good if all the different components come together and make this thing work.

Mr. Scovel, we are glad to have you here today as the on-staff paid skeptic to make sure that we keep track of the things as managers and overseers that we need to do.

I want to be sure that every component of aviation, whether it is AOPA, NATCA, Vinny Capezzuto, the technicians, everybody sees, appreciates and invests in a cooperative, collaborative way in this system that can provide a tremendous boost in safety first but in convenience and a whole host of other things.

Don't be misled. This is not the answer to air traffic delays. It will be help, but again this is not the answer. Here, my enthusiasm comes from the fact that we have something here that the flying public and the airlines need to be on board and fully invested as quickly as possible. Implementation is the key.

There are 210,000 customers sitting out there, waiting to be sold. If we give them a high quality product at the lowest possible price, which competition ensures, then not at the day but at the beginning of the day, we are gong to have something that will dramatically improve safety, convenience and people will say, gosh, for once, the Government got it right.

Mr. Chairman, I got carried away. I yield back.

Mr. COSTELLO. The Chair thanks the gentleman.

Let me say both Mr. Hayes and Mr. Salazar have talked to me frequently about ADS-B, and they have some very interesting ideas and are strong supporters of getting the program moving forward and getting to the point of implementation, and I appreciate that very much.

The Chair will now introduce our witnesses in the order in which they are seated. Again, we welcome all of you here today. We have met in roundtable discussions with, I think, all of you in the past

more than once about ADS-B, and we are pleased to have you here in the Committee hearing.

First, let me introduce Mr. Vincent Capezzuto who is the Manager of the Surveillance and Broadcast Services Program Office with the FAA; the Honorable Calvin Scovel who is the paid skeptic, I have down here, Inspector General of the U.S. Department of Transportation; Mr. John Kefaliotis, who is the ADS-B Program Director, Defense with ITT Corporation; and Dr. Agam Sinha, who is the Senior Vice President and General Manager, Center for Advanced Aviation System Development with the MITRE Corporation; and Mr. Tom Brantley who is the President of the Professional Airways Systems Specialists.

Gentlemen, we welcome all of you here today and, as always, your full statement will be entered into the record. The Chair would ask you to summarize your statement in five minutes or less, and we will give Members the opportunity to ask questions.

With that, the Chair now recognizes Mr. Capezzuto.

TESTIMONY OF VINCENT CAPEZZUTO, MANAGER, SURVEILLANCE AND BROADCAST SERVICES PROGRAM OFFICE, FEDERAL AVIATION ADMINISTRATION; THE HONORABLE CALVIN L. SCOVEL, III, INSPECTOR GENERAL, U.S. DEPARTMENT OF TRANSPORTATION; JOHN KEFALIOTIS, ADS-B PROGRAM DIRECTOR, DEFENSE, ITT CORPORATION; DR. AGAM N. SINHA, SENIOR VICE PRESIDENT AND GENERAL MANAGER, CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT, THE MITRE CORPORATION; TOM BRANTLEY, PRESIDENT, PROFESSIONAL AIRWAYS SYSTEMS SPECIALISTS, AFL-CIO

Mr. CAPEZZUTO. Thank you, Chairman Costello and Congressman Petri.

At this point, I would like to show you a quick video that will illustrate how ADS-B functions.

Well, I thought I was going to show you a quick video.

Mr. COSTELLO. Now this was not covered under the ADS-B contract, was it?

[Laughter.]

Mr. CAPEZZUTO. It was not, and it is also not biting into my five minutes. We will just move on if that is okay.

Mr. COSTELLO. Very good.

Mr. CAPEZZUTO. Thank you again, Mr. Chairman, Congressman Petri and Members of the Subcommittee.

I am pleased to appear before you today to discuss the FAA's contract for Automatic Dependent Surveillance-Broadcast System or ADS-B, the cornerstone of NextGen. As the Director of Surveillance and Broadcast Services in the Air Traffic Organization at the FAA, I have responsibility for oversight of this performance-based contract.

ADS-B is a new service for the FAA and has the potential to transform the NAS. In order to develop this service, we have crafted an innovative and closely monitored contract with the ITT Corporation.

We appreciate the role that Congress has already played in developing this contract. In fact, our confidence in this contract is directly due to Congress' oversight and input as well as contributions

from other Government entities and participation by the gamut of other industry stakeholders such as the pilots, the airlines and the manufacturers, to name a few. We welcome the Members' continued oversight to help us manage the contract moving forward.

The ADS-B contract has scalability and flexibility which leads to greater service availability in the NAS.

ADS-B equipped aircraft receive satellite signals and transmit the aircraft's precise locations to air traffic controllers and pilots. Both pilots and controllers will, for the first time, be able to see similar real-time displays of air traffic. Pilots will know with greater accuracy where their own aircraft are, and the displays will show them all the aircraft in the air and on the ground around them.

In addition to improved safety in the sky, ADS-B can help reduce the risk of runway incursions. Additionally, ADS-B has the capability of increasing efficiency and capacity in the NAS which, in turn, helps to reduce the delay problem. With this technology, we will be able to provide services to the people and places that we never have before.

The scalability of ADS-B allows us to adapt the technology for a variety of purposes. The contract also gives us greater flexibility because it allows us to deploy the technology more rapidly and more easily than we could have on our own and in areas where we have never had radar.

General aviation pilots will have enhanced safety features in their cockpits. Pilots in Alaska will be able to navigate the rough terrain there more easily. Aircraft over the Gulf of Mexico will have greater flexibility to use different altitudes and have reduced separation minimums.

With the greater coverage and accuracy of ADS-B, we will be able to predict where aircraft are and we will be making the NAS that much more reliable.

The contract requires ITT to have the system ready for use by 2010 and expand coverage nationwide by 2013. The first stage of the contract is worth $207 million with options worth an additional $1.6 billion.

With a system as important as ADS-B and the price tag that comes with it, we want to make sure that we are working responsibly with the taxpayers' dollars. We are keenly aware of the risks inherent to new technology and new procedures, and we are safeguarding against them as best as we can.

ADS-B's potential is enormous. It is integral to our ability to achieve NextGen and to handle the tripling of today's air traffic predicted by 2025, but we do not want to oversell these capabilities. The only way we can present a realistic picture of our goals is to double-check our accomplishments along the way.

We have designed the contract to include several required milestone events that will help us track progress and test the system as each piece is completed. Further, we have created additional incentives and disincentives throughout the contract to maximize the contractor's commitment to success.

Finally, we have a building block plan for the contract. First, we build. Then, we test while we create the appropriate procedures for

use, and only after the groundwork has been laid, do we deploy the technology nationwide.

If the contractor is unable to achieve certain milestones, the FAA may consider it in default of the contract and may cancel the remainder of the contract.

The first milestone is set for May 2008, when the contractor is to test the uplinking of traffic and weather information to pilots. With this aggressive time line, we are not wasting any time in requiring our contractor to deliver. These milestones give us concrete measures of the contractor's progress and if needed, allow the FAA to adjust the program early on or redirect resources as needed.

Our goal is not only to test technical performance but also to test business performance. We also have other oversight measures built into the contract to include preliminary design reviews and critical design reviews that enable us to track the contractor's progress and success. We also have risk mitigation procedures in place, which require ITT to work with the FAA to resolve any issues that might arise in the course of the contract.

Some of the major incentives for our contractor are embedded in the additional $1.6 billion options that the FAA can choose to exercise or not. Depending on proven contractor performance or if the FAA does not receive the benefits anticipated in a particular area, these options would allow the FAA to unilaterally stop the contract in whole or in part.

Additionally, the contractor is allowed, subject to FAA approval, to develop the data for other aeronautical uses, which would result in a reduction of the costs of the contract to the FAA while allowing the contractor to recoup its investments.

We are confident that this system of carrots and sticks will afford the FAA considerable oversight of the contract, encourage the contractor to excel in performance and allow seamless integration of this important new technology.

FAA is a safety oversight agency first and foremost, and the certification of the data is critical to our mission to ensure safety is maintained and enhanced for the flying public.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions that you or the other Members of the Committee may have.

Mr. COSTELLO. Thank you, Mr. Capezzuto.

The Chair now recognizes the Inspector General, Mr. Scovel.

Mr. SCOVEL. Chairman Costello, Ranking Member Petri, Members of the Subcommittee, we appreciate the opportunity to testify on the FAA's efforts to develop and deploy ADS-B. At the request of the Chairman, we are examining the risks to this important effort and FAA's contracting approach.

We recognize that ADS-B has enormous potential to enhance capacity, improve safety and fundamentally change the way air traffic is managed. However, a full disclosure of costs, expected benefits and risks is needed. This is a complex, long term effort that requires significant investments from both Government and airspace users.

Given FAA's history with developing new technologies and its approach for ADS-B, we believe that an extraordinary level of oversight will be required.

Today, I will discuss three major points. First, realistic expectations need to be set for the benefits ADS-B will deliver in terms of capacity and reducing delays. ADS-B will not provide near term capacity benefits or relief from record level delays at the Nation's most congested airports.

FAA's plans call for the ADS-B ground infrastructure to be in place by 2013, and airspace users are not expected to be equipped with new avionics until 2020.

FAA does expect to see benefits in the 2009 time frame in the Gulf of Mexico from ADS-B where radar coverage is limited.

We note that FAA intends to mandate ADS-B Out, the broadcast of aircraft information to ground systems, but the majority of benefits rely on ADS-B In and the display of this information in the cockpit. However, costs and requirements for ADS-B In and cockpit displays, which could shift more responsibility to the pilot, are not well understood.

We think FAA needs to provide Congress and stakeholders with a much clearer path for moving forward with ADS-B and realizing much needed capacity improvements.

Second, ADS-B has demonstrated important benefits in Alaska where radar coverage is limited. However, ADS-B implementation in the continental United States, which involves supplementing and ultimately replacing radar, is a complex undertaking.

The widespread introduction of ADS-B faces a number of risks. They include user acceptance, frequency congestion concerns, development and approval of procedures that can capitalize on ADS-B and software modifications to existing controller displays and automation systems. All these risks could materially affect the cost schedule and expected benefits of ADS-B.

Finally, FAA has decided to rely on a service contract approach for ADS-B. This means that the Government will not own the ground infrastructure but will pay for broadcast services. A heretofore unseen level of FAA contract oversight will be needed.

Over the years, we have documented numerous problems with FAA's major acquisitions that resulted in million dollar cost increases and schedule slips measured in years. Problems are directly traceable to, among other things, poor contract oversight. FAA has never before relied on a service contract to introduce a revolutionary technology into the NAS.

As we testified last week, the experiences with flight service stations underscore the importance of strong oversight of contractor efforts. Important lessons learned focus on greater insight into contractor efforts and how problems are solved. The stakes are much higher with ADS-B and the need for oversight greatly amplified.

To FAA's credit, the Agency intends to use several controls to help manage the contract, including techniques for measuring cost and schedule changes and performance metrics. However, these controls are not fully in place. Once established, FAA must execute them properly and hold the contractor accountable.

An important oversight mechanism is the establishment of a performance control board. This board, comprised of FAA and contractor personnel, is expected to monitor ADS-B performance, review changes to the system and mutually resolve disagreements, all very important responsibilities.

This board is not yet in place, and its charter is not finalized. The overall comfort level with FAA's approach will increase only when this board is firmly established, and roles and responsibilities clearly defined.

Key watch items for FAA oversight going forward include managing requirements and having the right in-house expertise and skill mix for effective management and oversight. It cannot be business as usual with ADS-B. A different model of oversight is needed. The Air Traffic Organization must shift its role from providing a service to maintaining direct, sustained oversight.

We are concerned that FAA could find itself in a situation where it knows little about the system that is expected to be the foundation of NextGen. FAA must take steps to ensure it effectively addresses this risk.

This concludes my statement, Mr. Chairman. I would be pleased to answer any questions you or other Members of the Subcommittee might have.

Mr. COSTELLO. The Chair thanks you, Mr. Scovel, and now recognizes, for five minutes to summarize his testimony, Mr. Kefaliotis.

Mr. KEFALIOTIS. Thank you, Chairman.

ITT wishes to thank the Committee for the opportunity to testify about ADS-B, the vital program which is an essential building block of the NextGen air transportation system. We recognize the critical role of the Committee in exercising program oversight and in authorizing the necessary taxpayer dollars to make the program viable.

ITT, along with our teammates, is honored to have been selected to be the FAA's partner in the ADS-B program and, through this program, to serve the Nation's air traffic control needs.

ITT believes the FAA is to be commended for the efficient and professional manner in which this procurement was conducted. Salient elements of the FAA's procurement process were open and frequent communications with industry, adherence to the process and schedule promulgated early and procurement activities, and an effective statement of Government requirements.

ITT believes the contracting approach developed by the Government strikes a proper balance between allowing contractor efficiency and providing solid means for FAA oversight and control of ITT activity.

Notably, the contract provides a period and processes to ensure that the developed service fully meets defined requirements to include safety, security and radio frequency spectrum constraints, allows for continuous Government monitoring of deployed service, and provides significant financial incentives for contractor team performance. Finally, an FAA-defined performance control board allows continuous involvement of the FAA in system development, deployment and operation.

The contracting approach has also provided a mechanism to ensure the continuity of the service for which ADS-B assets are deployed. The FAA required vendors to submit succession plans as a part of their proposals. ITT's plan appoints AT&T a successor for the very unlikely contingency of a triggering event.

In closing, I would like to reiterate that ITT is proud to have been chosen to be the FAA's partner in this vital initiative and

state that ITT and its contractor team are fully committed to the success of this program.

Thank you again for the opportunity to appear before you today, and I would be pleased to respond to any questions you may have.

Mr. COSTELLO. Thank you.

The Chair now recognizes Dr. Sinha.

Mr. SINHA. Good afternoon, Chairman Costello, Congressman Petri and Members of the Subcommittee.

ADS-B is a well defined, tested and globally accepted system concept for air traffic control surveillance. Although first made operational in the United States, specifically in Alaska, ADS-B now is being accepted and introduced around the world for ATC applications.

It is used for tracking aircraft, both while in flight and on the airport surface. Aircraft pilots and ground vehicles' drivers also use ADS-B to monitor positions and velocities of other aircraft and ground vehicles.

ADS-B provides highly accurate, plus or minus three feet, position of aircraft; faster update, one second, for better tracking; speed and direction data of the aircraft and the ground vehicles. In addition, ADS-B ground stations can be sited and installed more easily than radars, permitting aircraft surveillance in heretofore inaccessible geographic locations such as the Gulf of Mexico and Alaska.

There are two fundamentally distinct types of ADS-B avionics configurations, commonly known as ADS-B Out and ADS-B In. With ADS-B Out, an aircraft or ground vehicle transmits ADS-B reports but does not receive reports from other ADS-B sources. With ADS-B In, they can not only transmit reports but also receive reports from other aircraft, ground vehicles or ADS-B ground stations.

These reports can include graphical and textual weather information as well as other flight information such as pilot reports and Notice to Airmen.

The improved surveillance, accuracy, integrity, latency and availability made possible by ADS-B will enable reduced aircraft separation standards to improve NAS capacity; comprehensive tracking of aircraft and vehicles operating in the air and on the airport surface to improve safety, security and operational effectiveness; improved access to under-utilized airspace and airports; improved four-dimensional trajectory information for better gate to gate airport operating efficiency and flight path conformance monitoring; flexible assignment of responsibilities on the ground and in the cockpit as needed to support decision-making and workload balancing; adaptive flexible spacing and sequencing of aircraft; improved collaborative air traffic management among flight and airport operators, service providers and other stakeholders.

Add to these improvements, the reduced weather impacts to traffic flow and airport access made possible by the use of an accurate weather picture and other advisory information; and we can see that ADS-B is an enabler of several key NextGen capabilities. However, the extent of ADS-B's benefits mentioned earlier will vary depending on the environment, whether it is radar or non-radar, and the aircraft equipage, ADS-B Out or ADS-B In, and how many aircraft are equipped.

Additional ADS-B benefits are possible based on new concepts in varying stages of exploration such as improved approach operations in instrument conditions due to the ability to electronically see proximate aircraft.

This can help us increase the capacity for paired approaches to closely spaced parallel runways as well as independent approaches to parallel runways down to 2,500 feet; improved departure operations in the most congested terminal areas by reductions in departure spacing afforded through delegation to flight crews; improved safety in the air through enhancements to onboard collision avoidance systems and on the airport surface through direct cockpit warnings of potential conflicting traffic; reduced controller workload through more equitable sharing of spacing and separation assurance responsibilities between ATC and pilots.

In closing, let me summarize my main messages. ADS-B is a well defined, tested and globally accepted surveillance technology that provides better performance than legacy technologies. ADS-B offers benefits from both mandated ADS-B Out and voluntary ADS-B In capabilities, and they accrue to both the FAA and NAS users.

The timely realization of ADS-B benefits is dependent on achieving appropriate ground automation system upgrades. This is beyond other ground automation systems like ERAM, avionics equipage and operational procedures.

ADS-B is a cornerstone capability for NextGen as several of the key NextGen improvements require it. It is imperative that ADS-B associated research and program implementation as well as the other NAS systems it leverages be managed closely so that the full set of projected benefits can be achieved.

Mr. Chairman, this concludes my testimony. I would be happy to answer any questions the Committee may have.

Mr. COSTELLO. Thank you.

The Chair now recognizes Mr. Brantley.

Mr. BRANTLEY. Chairman Costello, Congressman Petri and Members of the Subcommittee, thank you for inviting PASS to testify on the ADS-B contract.

PASS represents more than 11,000 FAA employees throughout the United States and overseas including the employees who install, repair and certify the systems making up our air traffic control system.

When fully implemented, ADS-B can be a useful tool for pilots and air traffic controllers to use in maintaining proper separation of aircraft while allowing more efficient use of our Nation's airways. PASS and the employees we represent welcome this advancement in air traffic control technology, but we will not give up our focus on safety in all modernization efforts.

It is our understanding that the FAA plans that ADS-B, unlike our current radar systems, will not be properly certified and all maintenance will be the responsibility of the contractor. Certification is a process in which a certificated FAA technician checks and tests systems or equipment periodically to ensure that the systems or equipment can safely remain in service and provide the advertised service while not negatively impacting any aspect of the NAS. Certification is also performed before returning a repaired system to service.

The FAA's own orders label certification as an inherently governmental function and, as such, it can only be accomplished by FAA employees. For decades, all NAS systems and services directly affecting the flying public were required to be certified.

However, shortly after the ADS-B contract was awarded, the FAA made changes to its time-tested certification program. In its update to the maintenance handbook effective October 1st, 2007, the FAA changed the order so that only FAA-owned systems can be certified. In other words, the FAA has not only changed the criteria to allow ADS-B to be deployed without requiring certification but actually went so far as to prohibit full and appropriate certification of all systems it does not own.

PASS has learned that the FAA intends to perform what it is calling service certification on ADS-B which would allow the FAA to certify the service based on users telling the Agency that the service works. In other words, the controllers will have to rely on the users—pilots and vendors—to tell the FAA that there is a problem. There will be no internal FAA quality checks as there are today.

PASS is certain that ADS-B must be fully and appropriately certified to ensure its safe operation. In the opinion of the experts, FAA technicians in the field, with the complete elimination of system certification for systems not owned by the FAA, there will be no way to independently determine if the system is safe.

It should also be noted that this new interpretation of the Agency's certification criteria would apply not only to ADS-B but also to any system or service that is not owned by the FAA. Any future contract awarded by the Agency that provides for vendor-owned equipment or services would be barred from the FAA certification program.

The NAS is not just one piece of equipment but rather a complex, integrated system that includes thousands of distinct smaller systems, all of which interface with one another, and aviation safety depends on oversight of the entire system. FAA employees are the only people anywhere with such a detailed knowledge of the intricacies associated with NAS systems and operations. Placing responsibility for a system as vital to air traffic as ADS-B entirely in the hands of the private sector threatens the safety of the flying public.

Furthermore, in order to have sufficient redundancy to avoid service interruptions, there also must be employees present who fully understand the different types of service. Since ADS-B will be an entirely vendor-run operation, the Agency will be held hostage to the vendor's response time which will, at the very least, result in longer delays and will leave the FAA with no in-house capability should the vendor fail to live up to the contract.

PASS strongly supports modernization of the NAS but never in a manner that compromises the very foundation of safety upon which our current system is based. PASS asks that Congress direct the FAA to fully and appropriately certify all NAS systems and services, including ADS-B, that meet the criteria for certification as defined by the Agency prior to October 1st, 2007, without regard for ownership of such systems and services.

Thank you, Mr. Chairman, and I would entertain any questions that anyone may have.

Mr. COSTELLO. I thank you, Mr. Brantley.

Mr. Scovel, in my opening statement, I raised concerns, as you did, with the issue of raising unrealistic expectations on the part of the Administration.

I am not here today to beat up on the Administration. I support ADS-B. I think we are moving in the right direction, but when the Administration came out with their budget proposal on February the 14th and throughout the process until we passed the House bill, the message to the American public and to the Congress was pass our budget proposal because we have to move forward with NextGen.

As we went through the busiest season that we have seen in recent history, this summer, and had unprecedented delays and cancellations, the people kept hearing, well, we need NextGen, and it was like we are going down to Target or Wal-Mart or some place and buy something off the shelf, plug it in and our problems are going away.

One, you raised the same issue in your statement that we need to be realistic as to what NextGen can deliver in terms of delays and capacity and so on. I wonder if you might elaborate on your statement.

Mr. SCOVEL. Thank you, Mr. Chairman.

You mentioned the term, realistic expectations, and we would certainly second the use of that term. As you and other Members of the Subcommittee have noted, ADS-B will have no impact on delays at the Nation's busiest airports in the near term.

As Mr. Capezzuto and others have stated today, the contract between FAA and ITT calls for installation of the ground infrastructure by the year 2013. FAA has mandated, or proposes to mandate, the initiation of ADS-B Out aboard user aircraft not until the year 2020. Clearly, that is a long time from where we stand today in late 2007.

I should also note, however, that ADS-B Out, which is the initial part of the system that will be implemented, does not propose to have the promise to address congestion and delays at the Nation's busiest airports. It is only the second part of the ADS-B system, the ADS-B In system, that will allow aircraft and other users conceivably to reduce separation standards and increase capacity.

So we would urge caution on the part of the Committee and other members of the aviation industry and the traveling public before they invest too much unrealistic expectations in ADS-B itself.

Mr. COSTELLO. I also noted in your statement and I think Mr. Brantley as well—and I will ask you, Mr. Brantley to comment on this—one is that you are concerned that the FAA may find itself in a situation where ITT knows a lot about the system and the FAA knows very little about the system.

I made note in my opening statement that we are all aware that under the contract, that ITT will build, own and operate the system and will have a contractual arrangement where they will actually purchase for transition.

I just wonder if you will elaborate, Mr. Brantley as well, your concerns about the FAA, at some point, knowing very little about

this new system and ITT folks knowing a lot about it which might imply to some that ITT would have a monopoly on this system.

Mr. SCOVEL. Yes, Mr. Chairman, we should note that our assessment at this time indicates that FAA has negotiated a very robust and aggressive contract with ITT. It has been successful in that regard. The skill set that it brought to the contracting process up to this point has given it this enviable position.

The contract as it goes forward, however, will unroll in a series of phases, and certainly the initial phase between now and 2013 presents the need for FAA to have a skill set. As ADS-B Out unrolls to 2020, perhaps a different skill set will be needed, and certainly with the advent of ADS-B In and full implementation throughout the NAS of ADS-B's capability, yet another skill set may be needed.

Given the length of time between 2007 and when full ADS-B capabilities may be realized, 2020 or in the years immediately following that, skills currently available in FAA may move out. They may retire. They will move on. Certainly, FAA will be challenged at each step along the way to acquire the skills that will be necessary to give it the robust contractual oversight capability that it will need.

Currently, we see going forward, and this would be for the immediate future, that a skill set would be needed along these lines: telecommunications expertise, signals processing, and systems engineering and integration. Finally, when we are talking about user involvement and potentially the use of pilots and human factors needed in order to fully implement ADS-B, FAA will need to have expertise in that area in order to ensure that the contract can be properly executed.

Mr. COSTELLO. Mr. Brantley, would you briefly follow with your concerns?

Mr. BRANTLEY. Yes, Mr. Chairman. In addition to what Mr. Scovel said, and I do agree with his assessment on the assumption that everything works well and that the vendor remains in place, my concern is, however unlikely or remote the chance, if the Agency found itself in a position where it had to take over the ground stations—either the vendor defaulted or the Agency decided that they weren't performing and they canceled the contract or whatever the case—the Agency would not have the in-house capability to do so.

So, at that point, they would no longer have a choice. They would be essentially stuck even if they felt that the vendor couldn't perform.

Mr. COSTELLO. Mr. Capezzuto, would you like to respond to the concerns expressed by Mr. Scovel and Mr. Brantley on that issue?

Mr. CAPEZZUTO. Yes, sir. Thank you.

As I understand it, I just want to point out that the contract let to ITT is really a sub-element of a full system. As was mentioned by Mr. Scovel, the avionics is the driving force behind this. It is really about having the aircraft with the proper avionics, and that is where the accuracy and integrity information is actually collected.

So this is the inverse of looking at radar. Where radar derives the information, now the information comes from GPS and avi-

onics. That information is transferred to the ITT sub-element which is then brought to our service delivery points where the FAA is playing the systems integrator. Our role is to pull this together, collect the data, submit that data to our regulator to get approval to use it for air traffic controllers to separate air traffic with.

To do any of this, we are governed by our safety management system, and that is first and foremost to us. Whenever we build a system, we are governed by the safety management system and we put the proper controls in place.

Mr. COSTELLO. What does that mean, the proper controls in place?

Mr. CAPEZZUTO. The way this contract was developed, we have three years to develop it co-jointly with ITT. I know we call it a service contract, but we are actually going through design reviews with them. We have designed the performance specifications and provided it to them. We are doing the oversight as they develop the system so that we build in security and safety up front.

After the deployment of this, we will have the capability to recognize what that proper data is at the service delivery point, and these are quantified requirements, things like availability or latency. These are things that can be measured, and you use those for certification of that information.

Mr. COSTELLO. So those who may be concerned, as Mr. Scovel just mentioned and Mr. Brantley, about turnover as time goes on, you have no concerns about that?

Mr. CAPEZZUTO. I think the other piece that is missing in this conversation is that the radar that we are going to keep in there as the backup. As part of this investment, we are only really removing 50 percent of our secondary surveillance radars, which essentially are overlapped right now and not used as a redundant function.

So what we are doing is slimming our particular inventory of secondary surveillance radars, but we have two things going for us. One, we are keeping all the primary radars, and we are keeping 50 percent of the secondary surveillance radars in our inventory as the capability of a backup. Then, additionally, we have in the specification of the contract that the provider has to have an independent validation of the information that is coming from ADS-B or the avionics. So, in all cases, we have the capability.

Then, finally, as we do today, we have procedural backups.

Mr. COSTELLO. We have other Members here who have questions. I have a final question, and then I will come back. I do have a few others.

Mr. Brantley, you talked about the certification process and that the FAA came back and changed it. I wonder if you might elaborate on the current system as far as certification is concerned versus what the FAA has proposed or what the change has done.

Mr. BRANTLEY. Certainly, thank you, Mr. Chairman.

Currently, any system, there are several criteria, but the two main ones, any system that is providing real-time positional information or that is providing data that is used by pilots or air traffic controllers, that is going to affect what a plane does, anything that meets those criteria has to be certified. Now that had no restrictions based on who owned the system or service.

However, the change that the Agency made seems specifically targeted, at least in part, to allow the approach the Agency has chosen to take with ADS-B. I think it would be hard to argue that ADS-B won't meet that criteria. It may be a matter of time. The argument may be over when it meets the criteria, but it will. So I think that is at least part of what is driving the change in certification.

I think also we need to keep in mind while the Agency talks about verifying or certifying the data, that is one step in certifying a system or service today. There are many other things that are checked. There are tests run on the systems themselves. There are system parameters checked. There are interfaces with other system. So it is not just the data that comes out the end that is checked to certify something today.

Apparently, the approach that is going to be taken here is the Agency will verify just the data and based on that, without having any knowledge of what is going on with the system itself, they will certify the service.

Mr. COSTELLO. The Chair now recognizes the Ranking Member, Mr. Petri.

Mr. PETRI. Thank you very much.

It is fascinating. I wonder if maybe you, Mr. Capezzuto or one of the other panel members could discuss this from the point of view not of the FAA or the contractors but from the point of view of the pilots or the airline companies, the users. How is this?

They have to make expenditures and buy some equipment or rent it. At what stage is it going to make sense for them to do it if there is a dual system out there and we are phasing this in? How is this really going to work? Could you discuss that? Is there a plan?

I am thinking in the back of my mind we are going to digital TV, and everyone is saying out there that they are going to send coupons eventually to people to equip it. Maybe it is different than that.

Maybe the pilots and the industry is already way ahead of the Government, and they have the stuff in their boxes already. Could you discuss how the two things are going to work together?

Mr. CAPEZZUTO. Let me start by saying that ADS-B has been in the Agency's research and development area for probably nine years. The cargo airline industry, a series of other airlines, pioneer airlines have basically participated in the development and testing and demonstration of this technology over those nine years.

We have essentially accelerated this or moved to the next phase with implementation based on those successes both up in Alaska and right here in the Ohio River Valley. So there were a lot of demonstrations that proved where the technology was.

We are essentially right now working on what is called an Air Traffic Management Advisory Council. We have an ADS-B Working Group that will have access to the aviation industry as the customer of the NAS where they understand the development of the strategy of this program, where we discuss some of the issues, such as the backup analysis which was done in concert with aviation industry, so they understood what we were delivering and what the decision meant.

In fact, they also participated in the development of the business case that we put forward to go through the investment analysis that concluded in awarding this contract. So I would say that the industry has been involved.

I think what we recently chartered this summer was an Aviation Rulemaking Committee as part of doing the Notice of Proposed Rulemaking. Again, many of the same members from the ATMAC ADS-B Working Group were involved, but now it has expanded even further. In that group, we were chartered with our first deliverable, which was a report to talk about how you can early incentivize the operators such that they wouldn't wait until 2018 or 2019 to comply to the 2020 rule.

In that report, which is now out on the web, it represented the aviation industry's desire to see incentives, either in the form of manufacturers being provided incentives or tax rebates where they could lower the cost of ADS-B. Likely that would increase equipage at an earlier rate and at a higher magnitude and then we would also look at incentives for the airlines in such a way that they would also be incentivized to acquire ADS-B at an earlier state.

Just one other thing to point out is we are working also with our international partners. In Canada, they deploying ADS-B in the Hudson Bay. In Australia, they are using ADS-B right now to separate air traffic in the en route or high altitude. Europe currently has a program under SESAR. CASCADE is the name of the program, in which they are looking to develop pioneer programs and move forward with this.

We are working in concert with the rest of the world so that we globally can implement this properly.

Mr. PETRI. With the international carriers, there will be continuity. So when they fly from one airspace to another, it will be compatible or the same system?

Mr. CAPEZZUTO. Yes, sir. We have been working closely with them to ensure that we have total global interoperability.

Mr. PETRI. Do you have an idea of what kind of investment we are talking for different categories of plane users?

Mr. CAPEZZUTO. Yes, sir. If you are talking about the total cost, as you are calling it, for the user it is approximately $6.9 billion, and that captures the 210,000 aircraft. Most of the 200,000 are general aviation, and you are looking at about 10,000 in the air transport category.

Mr. PETRI. A person who is buying a Piper, well, probably not a Piper. They wouldn't participate in this necessarily. They would use a smaller system.

If you are buying one of these corporate jets, how much would that cost?

Mr. CAPEZZUTO. The price varies as a function of if you are buying a brand new corporate jet and it already has a multi-function type display, already has GPS on board. So you can see prices for the general aviation community. It ranges from $10,000 to $15,000. When you are looking at the air transport, it is upwards of $40,000, $50,000, and it can go upwards of $160,000.

It depends on the vintage of the aircraft. As you know, if you are doing retrofits versus it coming off the assembly line as a forward fit, then you really get a huge reduction in the cost. The prices I

was giving you were the capture, acquire, acquisition costs and then implementation of it into your aircraft.

Mr. PETRI. The new planes are already having it or it is on the drawing board?

Mr. CAPEZZUTO. Well, by putting out the Notice of Proposed Rulemaking, what we have done is sent a strong signal of what the standards are for the development of ADS-B Out is.

What has been going on are some of the manufacturers have been going on risk and building it into the system. So, today, there are aircraft with ADS-B in it. Europe, as well, has enforced this through some of their rules. What is happening is people are deploying with a version of the standard.

What we just did by putting out the Notice of Proposed Rulemaking is we clarified what version of the standard we are interested in at the FAA.

Mr. PETRI. Thank you.

Mr. CAPEZZUTO. You are welcome, sir.

Mr. COSTELLO. The Chair recognizes the gentleman from Colorado, Mr. Salazar.

Mr. SALAZAR. Thank you, Mr. Chairman.

I have the same concerns as Mr. Petri has. Most of us that own small planes outfit them with a 430 Garmin. Is that going to be usable in this case? Would it be part of the system or are we going have to scrap that and toss it out and put something else into our airplanes, Mr. Capezzuto?

Mr. CAPEZZUTO. I understand your concern, sir.

I mean what we are looking at right now is that the aviation manufacturers are looking to combine the avionics so that if you have a current mode A/C type transponder, what you can do is remove that and replace it with a unit that does the same function as well as ADS-B. So right now, Garmin does produce a system that is available, and it is ADS-B capable. Also, that is what they are using up in Alaska right now, and it is very successful.

Mr. SALAZAR. If someone isn't equipped with this equipment, he won't be allowed to fly into certain airspace, is that correct?

Mr. CAPEZZUTO. Correct. The rule is an airspace rule. If we move forward with this, it would go into effect in 2010. You would have to comply by 2020. So, essentially, you are operating up until 2020 without it or you choose to equip early.

You mentioned that we would deploying ADS-B ground infrastructure by 2013. As part of that infrastructure, we would be providing an uplink capability, which essentially will allow weather to be viewed in the cockpit, and so we are looking at that as one of the ways to incentivize the general aviation community, such that they can acquire weather in the cockpit if they would buy the ADS-B equipment.

Mr. SALAZAR. Thank you.

I have a question that Dr. Kagen wanted to ask. I hope I can read his writing here: Privatization of essential safety-oriented programs does not allow for our Government to walk away from its responsibilities. How will the FAA control a private corporation without owning it?

Mr. Scovel, would you like to respond to that?

Mr. SCOVEL. Yes, sir, let me give it a try. As I understand the question, how will FAA control a private organization, a private company?

Through the contract mechanism, and our review indicates to date that FAA has negotiated a robust contract. Through controls in that contract, FAA will attempt to control the performance and cost and schedule metrics. It has indicated that it will require ITT to use the earned value management system, which is a process developed by DOD to keep contracts on schedule and on budget.

Perhaps, most important, FAA indicates that it, along with ITT, will comprise a performance control board which will monitor progress and evaluate effectiveness of execution of the contract as it goes along.

If I can borrow Mr. Hayes' term for myself, as the paid skeptic, we think at this point that all of those are to be commended, and we want to give due credit to FAA for inserting in the contract at this point those controls. If we have skepticism, it is due to the need to see proper execution and management of that contract as we go forward.

We stand right now really at the starting line. Much needs to be done very quickly, even in the next few months. So we will have a track record built very soon and, at that point, we and you should be able to reach a plenary opinion, at least, as to FAA's success on contract execution.

Mr. SALAZAR. Thank you, Mr. Chairman.

I yield back.

Mr. COSTELLO. Thank you.

The Chair now recognizes the gentleman from North Carolina, Mr. Hayes.

Mr. HAYES. Thank you, Mr. Chairman.

I hope you took my comment as a compliment, Mr. Scovel, because we need some skeptics around here when Government is at their work.

Several questions here, Vinny, you can do a seven-minute statement in five minutes. When you and I first met, I had to get you to talk southern and slow you down.

I did the math. Just so people understand, in my basic math, you could equip every one of those airplanes today for $1,260,000. Now that is oversimplification, but the point is the technology, given the competition and the desire of the part of the aviation community to use it because it is a tool that makes them safer and saves them fuel and all kinds of things, is the key for Mr. Salazar and my friend, Leonard, and others to getting this thing done.

We have to reverse the role of Government. You have kind of done it by the way you have done this very innovative contract.

Mr. Kefaliotis, we are really depending on you to demonstrate how well private industry can mesh with Government. As we have done with the RCI program for military housing, it can be done and should be done.

Having said all that, we are going to reverse it now. It is not the Government mandating you do something. The Government has come up with a way to do something that is so much better, people need to be lining up to get it like they did for iPhone at 4:00 in the morning.

We have gone from NDBs and ADFs—which are just way needle ball, and air speed—to something that is incredibly easy to use, incredibly accurate.

Mr. Brantley has very good foresight into what we are dong here, and we are certainly not ignoring him. I would ask FAA, as in the past with the very important relationship there, to make sure that everybody understands what is going on.

Let me get over here to a question before my time runs out. When we first started talking about this, my greatest criticism of the FAA is they came in selling the price, not the product. I finally figured out what the product was. I have been to Alaska twice, flown with it.

I have been to China. A couple of guys, a Navy pilot and two former FAA employees, are building the system, selling it, installing it and maintaining it in China out of their hangar which is about like a garage.

So the simplicity and the effectiveness is there. It is proven. It is not something that just appeared today. Those are the things that give me reason to be encouraged, enthusiastic and optimistic if we can look into the future.

Vinny, you talked about the mode C transponders. Can you update folks on where we are now?

When we first started, you had to have a box up in the plane, but six months ago that was the box. Now the box is integrated into a transponder. What do you see as the potential for the industry to bring in new technologies, smaller, lighter, less expensive? Give us a peek into that.

Mr. CAPEZZUTO. I think this is exciting for the manufacturing industry, and they have been waiting for us to send that signal that we are moving forward with this. The contract award and the NPRM are certainly two strong signals to them. In fact, I just briefed the GA Manufacturers Association last week. In there, we are basically opening up the doors and allowing them to see what this contract is about.

I will tell you there was a proposal. As part of the proposal process, ITT offered to spend corporate dollars, not out of our contract, but they will provide us insight and they will, at the Performance Control Board, provide us with status on how they are doing with this. What they have done is partnered through their Memorandum of Agreement with avionics manufacturers.

Essentially, they realize that the worth of this contract is tied to avionics and people equipping early, and so to do that they are investing their own dollars in the development of a joint avionics package that basically combines ADS-B with the current mode A/C transponders. Therefore, it now allows these new radios to replace your old radios, be interoperable with TCAS, the Traffic Collision Avoidance System, and be interoperable with our radar as we go through the transition point.

I think those are innovations that we will see other avionics manufacturers jump on.

Mr. HAYES. Absolutely. Let me cut you off just a minute before my time runs out and bring Mr. Kefaliotis in.

Speak to Mr. Brantley's concerns and Mr. Scovel's and also to the issue of what is in this for private industry in terms of the incen-

tives for being really successful and the new equipment and processes that can be developed out of this.

Mr. KEFALIOTIS. Congressman Hayes, on our side, we are installing a highly robust redundant architecture, a highly reliable system. The Government has as, I think, another innovation, specified technical performance measures against which the Government will judge the quality of the service we provide.

We, IIT, have instrumented our system such that those technical performance measures will be constantly monitored. We will provide data to the Government, to the FAA through an interface, so the FAA can also constantly monitor our performance parameters.

We have proposed, and the Government has accepted, an aggressive financial incentives penalties clause in the operational phase such that if we deliver services that do not meet the technical performance standards defined in the contract, we suffer pretty significant financial penalties.

So, in terms of what the contract has done and what we plan on deploying, we are deploying a highly robust, scalable, safe and secure architecture that will meet the Government's needs.

In regard to certification, the FAA has specified, and again we are independently instrumenting our system and will constantly monitor the technical performance of our system. The Government has required us to independently deliver to a certification server in FAA premises, data relevant to the performance of our system with which the Government can independently evaluate and monitor our performance and certified data. So we feel very good about what we are doing, and we think the Government has done a very good job of ensuring that they can monitor us.

We believe significantly in ADS-B technology. We believe it will deliver a significant benefit to the flying public and promises a potential for eventually dramatically enhancing the capabilities of the national airspace system. Thank you.

Mr. HAYES. Thank you, Mr. Chairman. Sorry, I ran over. Maybe we will get another crack at it.

Mr. COSTELLO. Thank you.

The Chair now recognizes the gentleman from Washington, Mr. Larsen.

Mr. LARSEN. Thank you, Mr. Chairman.

Mr. Kefaliotis, under the contract that ITT has with the FAA, is there anticipation of any use of the GPS system, of the current system, or you are anticipating changes made to the GPS system that will increase the capacity of the GPS system?

Right now, in the Armed Services Committee, we are struggling with do we go to 3F or stick with what we have. I am wondering what is your assumption about the capacity that that ADS-B will use of the GPS system and what is your assumption of the future of the GPS system and increased capacity within it.

Mr. KEFALIOTIS. Our design for the ground infrastructure takes advantage of airborne GPS receivers and the data linking of position data from aircraft to our ground system. So, in that sense, just as an adjunct, the navigation system onboard doesn't have to be GPS. It just has to be a navigation system that meets the performance requirements.

But that said, GPS is the system that will meet performance requirements, and a robust GPS network is essential to the successful operation of this system.

Mr. LARSEN. I would agree with that statement. My question is the assumption that the contract makes about the available capacity as we roll out ADS-B in the use of GPS.

Mr. KEFALIOTIS. Congressman, I apologize. I am not sure I understand the question. In terms of the number of satellites and the constellation and the robustness of the GPS constellation?

Mr. LARSEN. Yes.

Mr. KEFALIOTIS. Our contract assumes the baseline GPS constellation. The rulemaking requires navigational accuracy for a position parameter that is quite stringent, and a robust constellation will dramatically aid in achieving that parameter.

Mr. LARSEN. Okay. Well, it is an important question because we are walking through this in the Armed Services Committee as well.

Mr. Capezzuto, what incentives do either GA pilots or transport airlines have to install the avionics between 2013 and 2020 or between now and 2020 other than that they damn well better?

Mr. CAPEZZUTO. Okay, so, again working closely with the aviation community is a recognition that we believe there will be some benefits essential to the operations of the NAS, which translates into their operational capabilities. When we did the business case for this, it identifies pretty deep benefit pools in certain areas, and some of them are really ADS-B Out only, which I can say is in the economic analysis of the Notice of Proposed Rulemaking.

Essentially, the translation of air traffic control efficiency is a function of having more accurate information, higher update information, which translates into less deviations, which again is fuel savings. That is a pretty big thing, but it also translates into emissions as well. When you look at the concept of emissions, noise and fuel savings, we make a pretty good, robust case for just ADS-B Out.

Certainly, in the en route environment, high altitude airspace and some in the terminal environment, and in the non-radar airspace is really where we get to see some of those benefits earlier, such as the Gulf of Mexico, Alaska and Colorado. Those are primary areas where we could exploit this earlier on.

Fundamentally, putting this building block in place allows us to have a stable baseline to build ADS-B In. That is the key to NextGen.

Mr. LARSEN. Sure. Is FAA then planning on proposing any specific set of incentives to enhance deployability of ADS-B In to get them all right here?

Mr. CAPEZZUTO. Yes, and the example I will use would be in Alaska. In our business case, we have outlined where you will have better access to certain airports. This is not just about ADS-B. We are also providing weather at the destination airport.

In some cases in the Gulf of Mexico, we are putting in surveillance, communications and weather, so it is a full service provision to deliver to the Houston center. In that case, we are able to develop new routes. We are calling them performance routes.

Mr. LARSEN. Sure. So what kind of discussions have you had with larger aircraft regarding the—sorry, I am getting distracted by that vote call.

What specific conversations have you had with larger aircraft like the Boeings of the world about retrofitting as well as discussions about putting them in on the front end?

Mr. CAPEZZUTO. We have had some very robust discussions with Boeing and Airbus. We have been involved with the manufacturers of the actual equipment like Rockwell Collins.

Mr. LARSEN. Can you give us a flavor of the content of those discussions?

Mr. CAPEZZUTO. Sure. They are members of this ATMAC, Air Traffic Management Advisory Council, ADS-B Work Group. We, essentially, have been developing the strategy for execution for the last 16 months. In those discussions is the challenge of what is out there today and can you use what is out there today.

As I indicated earlier, people have been deploying ADS-B to a lesser standard. The question is, in the time frame over the next 10 years, are there things we can do with that to keep continue leveraging of the ADS-B, traction, if you want to call it that, but, essentially, also we were able to acquire those costs and embed them into the economic analysis both for the business case and the NPRM.

We have worked closely with the industry to make sure that we have certainty around the numbers that you see, and so therefore you are looking at what I would say is a very strong business case in the sense that we believe the data that is in there.

The return on investment time frame is a little scary when you look at it, but this is a building block. It is an infrastructure improvement, and those have long returns on investment. Essentially, we are not taking credit for all the future capabilities that are out there either, and that is really the place that we want to explore.

Mr. LARSEN. I would enjoy exploring that with Mr. Scovel when I have another five minutes. Thank you.

Mr. COSTELLO. I thank the gentleman.

The Chair will announce that we have two votes on the floor. We have about 13 minutes left.

At this time, I will recognize Mr. Duncan from Tennessee. After his questioning is over, then we will recess, go to the floor, vote and be back in approximately 30 minutes. So we would ask the witnesses to stay, if you would, and we have at least one other round of questions.

Mr. Duncan is recognized.

Mr. DUNCAN. Well, thank you, Mr. Chairman. I don't believe I am going to have enough time to really get into this, so maybe I can come back and do this, but I will start with this.

Mr. Capezzuto, I don't think there is anybody in the Congress, even the pilots, who have the details or maybe even the capability to really do the rigorous analysis of this deal that we have to hope that your team has done. So we have to rely on you.

But, in the hopes that maybe I can understand it a little bit better, it says in one of our papers on this: The total value of the contract, which has a number of options extending through 2025, is

$1.86 billion. Segment one is a $207 million cost plus incentive fee contract.

Can you tell me, $207 million, is that the maximum cost of Segment one or will the incentives add a lot of money to that? I am not really clear from that sentence.

Mr. CAPEZZUTO. That 207 represents a target fee of 8 percent that is included in that number. I just want to point out this is a cost plus incentive fee with a cost-share clause as well. So, if they overrun, not only does the fee go down, it can go as low as 4 percent, but they will also start paying for the cost overrun as well.

Mr. DUNCAN. In your team's analysis of this, how much markup or how much profit do you think is in there for this?

I have never seen a team quite this elaborate, involving this many big companies and so forth, anyway.

Mr. CAPEZZUTO. That fee translates to $15 million out of $207 million.

Mr. DUNCAN. Fifteen million.

Mr. CAPEZZUTO. Yes, sir.

Mr. DUNCAN. Is that pretty consistent through the remaining $1.86 billion, would you say?

Mr. CAPEZZUTO. No. We broke this up into like a hybrid set of contracts. What you have for the first one is a cost plus incentive fee with a cost-share because it is a development contract. So there is some risk there, and we want to make sure we design in the safety and security we mentioned earlier. We participate in that.

All the other deliverables are firm fixed price, and they are prenegotiated, and they are in the contract now.

Mr. DUNCAN. Then I am also curious. It says the total value of the contract is $1.86 billion, yet we are talking about a contract that extends to 2025.

Now in the STARS program and some of these programs in the past, we have had huge cost overruns. How did you analyze it because we don't really know where we are going to be in 2020, financially?

I mean we don't know what inflation is going to happen or going to have occurred in all that time. What has gone into that? How did you arrive at that $1.86 billion?

Maybe I just better come back for this.

Mr. COSTELLO. We have a little over nine minutes left, so if you want to take that.

Mr. DUNCAN. Okay, well, go ahead. You see what I am getting at, I think.

Mr. CAPEZZUTO. I do. Essentially, what we do is we negotiate with the vendor, and we look at their outlay versus what we had done in our independent Government cost estimate. We negotiate those prices.

We set up option break points. So the subscription charges they would be applying to us are on an annual basis. Essentially, what we do is we would be paying them on an annual basis once we prove the design works.

Just to point out, the FAA would own the paper design of this system. At the end of the day, the configuration of that system is ours. We manage it.

As we move forward, we essentially would be turning on service volume. We are buying this like you buy cable TV or a cell phone. You are turning on service volumes, and once you turn them on, you pay annual prices on it.

What we do is we have break points. At 2016, is a decision point on whether or not we continue paying those subscriptions for all the service volumes because they should all be turned on, and then another break point at 2021.

Mr. DUNCAN. How confident are you that by the year 2025, we have spent no more than $1.86 billion on this contract?

Mr. CAPEZZUTO. Well, the reason we have a lot of confidence in this is we built in penalties as well. So it is a function of them delivering the service as we measure.

Mr. DUNCAN. Let me ask one more quick question. We read all the time that in these defense contractors, they hire all the retired admirals and generals, and then, boy, they get just exorbitant, whopping profits in almost all these big defense contracts.

Mr. Scovel, have you looked into how many former FAA employees or would you look into that sometime and see how many are working for these companies that are involved in these contracts? I think it would be something interesting for you to look at sometime.

I yield back, Mr. Chairman.

Mr. COSTELLO. I thank the gentleman.

At this time, the Subcommittee will stand in recess for 30 minutes. We would ask the witnesses to be back at the table.

We do have three votes now. It was two votes a minute ago. Now it is three. So it is about 30 minutes.

The Subcommittee stands in recess.

[Recess.]

Mr. COSTELLO. The Subcommittee will come to order.

It looks like we have a few Members that are coming back. We will start on a second round of questions.

Vinny, let me ask you why the rulemaking is at 2020 as opposed to 2019 or 2021. How did you arrive at the year 2020?

Mr. CAPEZZUTO. Essentially, we took a look at the amount of aircraft that would have to be retrofitted. If you look at the GA community with 200,000 aircraft, even with 10 years, that is 20,000 aircraft a year that would have to be retrofitted. So that is a fairly aggressive schedule actually. That was pretty much one of the drivers.

The other component was we wanted to work with industry and demonstrate that we were going to make this investment and not pull away. This has been brought to our attention as something that they were concerned with. So we did the best we could to lay out an aggressive schedule to put that ground infrastructure in place, and the best we came up with was 2013.

Technically, you would equip. You would want to see that ground infrastructure in place as well, so the capabilities are there starting in 2010. We will be putting in the ground infrastructure—this is the uplink capability—but by 2013, it will be completed. So, really, you are looking at seven years of using the service nationwide.

Mr. COSTELLO. I am going to ask you a couple of questions about how Mr. Scovel complimented the FAA for the contract and said it

is a robust contract, and I want to talk a little bit about that in a second.

Just for the record and so the Subcommittee Members know, in putting the contract together as far as ITT's responsibilities and what needs to be accomplished and time lines and targets, who else was consulted in the process?

PASS is represented here, Mr. Brantley at the table. He has 11,000 members that he represented. The air traffic controllers are an integral part of operating this system once it is up and running. I wonder if you would tell how much input the agencies and stakeholders here were involved?

Mr. CAPEZZUTO. Sure. As I mentioned earlier, when we set up the program office for implementation which was approximately January 2006, one of the first things we did was develop a governance structure.

In that governance structure, we have stakeholders which essentially are internal to the FAA both on the regulatory side and the Air Traffic Organization. So you have people from airports involved. We have our safety oversight organization, the people that put together the economic analysis, our policy people for the NPRM and, on the ATO side, essentially, all the vice presidents for the Air Traffic Organization. Once a month, we meet. We, essentially, bring the program issues to the table and we discuss things and consolidate on an answer.

The other piece of that governance structure is also the ATMAC which started in February 2006. The Air Traffic Management Advisory Council, essentially the steering group, established us as a work group and then that is where we meet once a month over at RTCA.

Typically, what we are doing is we develop the strategy. Those strategies are basically the interdependencies of the program, and the things that were in the contract basically are peeled out from that.

Additionally, what we did is by June 2006, we had gone for our first investment analysis, which really was a strong signal that we were funded to move forward with ADS-B. Starting at that point in June, 2006, we had our first industry day, and we had three of those industry days where we worked with the manufacturers, the people that came to the industry days and solicited information. We presented and had dialogue and all this kind of merged together to create the product as you see in the contract.

Mr. COSTELLO. Mr. Brantley, we would like to hear from you as well. Were either you, personally, or your organization or your members consulted?

Mr. BRANTLEY. No, Mr. Chairman, we weren't. With respect to modernization efforts, we would very much like to be involved. I think our members have a lot to offer the Agency, but beginning about four years ago the Agency informed us that our participation was no longer welcome or needed and we have not been involved since. Prior to that, we were involved in the ADS-B program.

Mr. COSTELLO. But somewhere around three or four years ago, you were told that you were no longer welcome.

Mr. BRANTLEY. Yes, sir.

Mr. COSTELLO. I wonder if you would respond to that.

Mr. CAPEZZUTO. Sure, I would like to actually. Prior to the implementation phase, moving forward, so September 2005, was a key decision point for the FAA to select ADS-B as the technology and move forward. Prior to that was the test and demonstration work that occurred up in Alaska. In fact, what we developed there is certified by PASS.

Our employees were involved with the development of certification process and procedures for those particular elements that validated the requirements. That is what basically gave the confidence in moving forward in selecting ADS-B over radar and over multilateration at that point in time. Those were the three alternatives.

At the conclusion of that investment decision, we moved forward, and basically they moved into implementation and set up a program office. So we have been in, I would say, a planning state since January 2006, up until this point. We have gone through three additional joint resource councils, which are investment decisions, that acquired the funding for the full program to award the contract.

So, all the requirements that we are talking about were validated in the test and demonstration phase with the use of the employees of the FAA.

Mr. COSTELLO. It is troubling to me, personally, and I think to other Members of this Committee. We have held hearings on the flight service station contract with Lockheed Martin. We have held hearings on the issue of safety in the workplace and air traffic control towers and other FAA facilities.

It has been apparent in the past that when the Administration is making decisions that they are not consulting with all of the stakeholders, and I think that was noted by both the GAO and I think maybe even Mr. Scovel's predecessor and maybe even Mr. Scovel. I don't want to speak for you.

There is a disconnect, and I just had that discussion with a few Members of this Subcommittee earlier today. You are not the person that can correct that problem, but certainly we need to take that up with the Acting Administrator. It is troubling, and it is not in the best interest of what we want as the final product in improving, in this case, the air traffic control system.

Let me ask Mr. Scovel a final question. In your testimony, you indicate that ITT will have a monopoly over providing ADS-B services for the next 18 years. I wonder if you might talk a little bit about your concerns regarding competition and consumer issues as a result of one contractor that will be in charge and have, I think in your words, a monopoly over the ADS-B services for the next 18 years.

Mr. SCOVEL. Yes, Mr. Chairman, ITT will have virtually a monopoly over the service, the information that is generated through the ADS-B system.

FAA owns the data, but through the contract, FAA has consented to ITT being able to market, to package, to sell that data to users who might be interested. They might include air carriers. Our information is that UPS indicated they would certainly be interested, airports as well. Then they would find a multitude of uses, and we know that ITT is certainly looking on that prospect favorably.

As a policy decision, the FAA and the Administration are certainly free to enter into a contract with these terms. We do have concerns about the nature of the data that is being transmitted, that is being permitted to be used in this fashion, perhaps marketing concerns as well with competition factors. We would urge FAA to examine and carefully regulate, if appropriate, this use of data generated by the contract as it goes forward.

Mr. COSTELLO. I thank you.

The Chair now recognizes the Ranking Member, Mr. Petri.

Mr. PETRI. Thank you very much.

I am not sure if more than one member of the panel may want to address this subject, but we are all pretty familiar with the radar-based system and all of the NORAD and all the different things that we have in place to try to provide security in our airspace. How will this new system work? Is there a separate system.

Has this been scrutinized? Are there ways this will enhance our security or help us to deal with unauthorized entrance into our airspace more effectively and this kind of thing?

Mr. CAPEZZUTO. As part of the governance structure I mentioned earlier, DoD participates at the stakeholders' meeting that we discussed, and our involvement with them is looking at ways that we could exploit the technology.

Specific applications that have been coming up are right here in the ADIZ, the Air Defense Identification Zone, where if you are ADS-B equipped, it is obvious who you are. You have your identification, and therefore you can exploit that as knowing they are friendly as opposed to worrying if they are foe, the same thing in their special use airspace or the military operations area. So there are ways of exploiting the capability of identification coming off the aircraft now and being able to take advantage of it.

Mr. PETRI. Staff tells me they are worrying about people pretending to be someone else or spoofing, I guess. I guess we don't want to go into what you do, but do you have ways of dealing with spoofers?

Mr. CAPEZZUTO. Correct. In the specification, it is called out that you have to have a means for independent validation of the actual aircraft that we are surveilling. So that means they have to have another method that is independent of using ADS-B.

The concern with spoofing deals with the power level of the signal that comes down from the satellite, which is very low, and you can perturb it and you can make it to look like something else. So it is vulnerable from that angle.

What we have requested in the specification is that we have independent validation of those targets. To point out, they can do that with their own means, the contractor can, but we also have our radars in place. When you combine all that information, you are able to validate that that target truly is who they are.

Mr. COSTELLO. The Chair recognizes the gentleman from North Carolina, Mr. Hayes.

Mr. HAYES. I will pass.

Mr. COSTELLO. The gentleman from Michigan is recognized, and we will just give him his time and not yours, Mr. Hayes. How is that?

Mr. Ehlers is recognized?

Mr. EHLERS. Thank you, Mr. Costello. I apologize for the late arrival, but I was at another Committee meeting where I am the Ranking Member, and I had to be there. Fortunately, they gave up when votes came, so I dashed over here.

Mr. Hayes, I understand has already played his usual role as a staunch defender of general aviation, but there is one specific question I wanted to ask to see if you have any guidance on.

There are a great many older general aviation planes around, Cessnas 152, 172, 182, some older and some more recent. I think ADS-B is a great thing and, as a student pilot, I would love to have it because it is very hard today to operate the aircraft and be aware of all the airplanes around you.

But I am concerned about the cost. If you have a airplane that is worth only twenty to forty thousand dollars, you think twice about adding to much to it. Plus, many of these planes are owned by individuals who don't have high incomes. If they had higher incomes, they would buy better airplanes. Can you give me a ballpark figure of what the cost is going to be for someone trying to put an ADS-B unit in an older airplane like that?

I know that it will be easy to make the transition, but I still worry about the cost. Can you give me any figures on that?

Mr. CAPEZZUTO. I understand your concerns on that. In fact, Alaska probably provides us with the best image of what that was because there were over 400 aircraft that got retrofitted, and some of these were the type that it wasn't just about putting in a new piece of equipment. You had to make major modifications to the panel, wiring, antennas. So all that provided us with rich information to get a good feel for it.

You hear us using numbers that are like 10K to 18K, and when we say the 18K, you are really pushing that. That is the ones that were more invasive to the actual aircraft.

Also, I would suggest that as we start this off, the early adopters are going to end up probably paying a little bit more, but over time I think the market forces will lower those prices. We are speculating somewhere on the order of 30 percent reduction.

Mr. EHLERS. Are you saying that about 10K would put the basic unit in the average plane?

Mr. CAPEZZUTO. For the general aviation type aircraft.

Mr. EHLERS. Yes, right. Okay, so the 30 percent off that would get it down to roughly $7,000. Okay. Thank you very much. That is helpful.

I will be happy to yield the remainder of my time to Mr. Hayes.

Mr. HAYES. Thank you, Mr. Chairman and Mr. Ehlers.

Vinny, you are working for the Government. We don't want any more $600 hammers now.

Six thousand dollars you can get the box six months ago. It has gone down since then. We don't want to mislead people.

Vinny, what I want you to talk about is the level of equipage. You can equip so that you can transmit. You don't have to have an extensive multifunction display to receive. There is a lot of angst among the aviation community because of what the FAA has done to them in the past. We better not do it to them again here.

So talk about the levels of equipage, if you are going to be a transmitting ADS-B guy, transmit and receive and on up, if you would talk about that a little bit.

Mr. CAPEZZUTO. You have heard the terms earlier called ADS-B Out and ADS-B In. ADS-B Out is you can just have the pure function of transmitting your information. The new services that can be provided are basically expanding our service volume.

So today radars have floors, and they don't see below the floors. In places like Alaska, we learned that you can't see below the radar. You are basically doing procedural separation.

With ADS-B and the way we deploy the infrastructure, ADS-B Out can now feed the air traffic controllers where they can provide air traffic control separation services. So that is an example of just utilizing ADS-B Out.

Other examples of applications for ADS-B Out would be search and rescue. There is definitely improvement in that case. In Embry-Riddle, they could use it just strictly for collecting the data on the ground and then replaying it for looking at how their student pilots are doing and use it for training purposes.

Now you bring it to the next level, ADS-B In is, if I am transmitting out information, that is an enabler for other aircraft to receive it and display it. That is where you get that increased situational awareness. So not only can you see traffic, but now we have the opportunity to upload weather to the cockpit, and so you are talking about the ADS-B components essentially providing more information into the cockpit to increase the situational awareness, which translates into safety.

Mr. HAYES. Thank you, Mr. Chairman. Can I carry on?

Vinny, you are talking over our heads again. What I am looking for is a handheld unit for $1,295, out and in. It is certainly possible.

This is a BlackBerry, sitting out there on the ground at National Airport, looking at the weather over at Montebello, knowing exactly what is going on despite what the guy in the front is telling us.

This kind of technology, given competition, is absolutely in my opinion, if handled properly, again because people want it and because Mr. Kefaliotis and other manufacturers have a 220,000 customers base that they want to sell to. That is what I am anticipating that we want to do. Again, the various ways that we can incentivize folks to equip, AOPA was talking during our break period about ways that we can use the system more effectively.

My question for you and Mr. Kefaliotis is under the contract, it doesn't speak directly to the fact that if you want another unit in Grand Rapids, a ground station, and they don't have one, what would be the process and does the contract allow for that increased coverage using the same ADS and AWARS and all that routine?

Hey, we need it. FAA, can you help us? How would you deal with that under the contract?

Mr. CAPEZZUTO. The contract was set up in a very flexible manner. Two things that occurred this year:

In some of the reauthorization language, there was discussion about using airport improvement funds for airports to acquire the ground infrastructure. What that does is provide the expansion of our ground infrastructure beyond our baseline. It also would ac-

commodate possibilities of acquiring the radios that you would use in vehicles such as your fire trucks and safety vehicles.

Then the contract has in it what we call generic service volumes. So we would be able to use funds from other sources to essentially purchase this capability, and then we have multiple ways of taking airport improvement funds and funneling it through this contract vehicle so that you can open new service volumes.

Mr. HAYES. So 220,000 customers just went almost into infinity. I mean basically in terms of users. Of course, for a ground vehicle, you wouldn't have the same requirements as a multifunction display.

I was giving Mr. Petri a hard time about high definition TV. I don't have one of those. I don't know how to work it.

I do know you don't need a multifunction display in your pickup truck that is on the airport, but if you want it, you could put it there. So folks that are sport pilots and things like that, they should be able to transmit for a very inexpensive figure. Everybody agree with that?

Again, Mr. Brantley, we have not forgotten you. The Chairman was absolutely correct. We got to have everybody onboard if the general public, and that is who is involved here, is going to benefit to the maximum amount.

I don't know whether the clock is going up or down. I yield back, Mr. Chairman.

Mr. COSTELLO. I thank the gentleman.

Just a final question for Mr. Scovel and I guess too, Mr. Capezzuto, maybe you can comment as well.

Mr. Scovel, in your written testimony, you have a chart in here, Table 1 ADS-B Key Milestones. Of course, you have project completion date of October, 2007 for the NPRM issued and second is February of 2008, critical design review for the ground system. Then August of 2008, the key site initial operating capacity of broadcast service at Fort Myers.

From your standpoint, when is the next major project or the next major step in the completion of ADS-B that the FAA needs to be watching carefully and this Subcommittee needs to be watching carefully to see if, in fact, the contractor is performing as the contract calls for.

Mr. SCOVEL. Mr. Chairman, I would pick the very first item that you mentioned off the list that appears in the chart in our written testimony. The notice of proposed rulemaking was issued a short while ago. The comments to that rule are due from industry in early January. Those comments should give us a pretty good indication of how industry views the long term prospects for this program.

We know and FAA itself has identified for us, in its view, its primary risk being user acceptance and aircraft equipage. If those comments in response to the notice of proposed rulemaking come back and really hit that point hard and pound it home, then we will know that FAA has an uphill job in properly executing the contract.

We are confident that industry recognizes the potential, but it is rather the timetable, the mandate and the articulation of the user benefits, long term, which really will result from ADS-B In. We

should see some of those indications in their comments to the proposed rule.

Mr. COSTELLO. In the legislation that we passed out of the House, H.R. 2881, in that legislation, we asked the IG's Office to submit an annual report to the Congress concerning ADS-B. I am wondering when is the next scheduled report that you are to submit to the Congress on ADS-B?

Mr. SCOVEL. I will need to check with my staff, sir, and get back with you on that. I don't have it readily available. We are certainly prepared and look forward to meeting the Committee's requests.

Mr. COSTELLO. I thank you.

Mr. Hayes, if you have further questions, I would be happy to allow you more time.

Mr. HAYES. Thank you, Mr. Chairman.

I think it would be very instructive for those of us who remain for this video to be shown. It graphically demonstrates the space and the time savings involved in ADS-B, so if you wouldn't mind.

The other thing is when I was in Alaska the last time, is it Dan Hill in Alaska, Vinny, that is supervisor at Anchorage, or Jim Hill?

Jim Hill, he took me through and met with the controllers and supervisors and the FAA. It was fascinating because the test area initially is in Bethel, Alaska. If you will put up a map of Alaska in your mind, it is a huge area in the Yukon and Kuskokwim delta area, a tremendous amount of fishing, a lot of airplanes, fish spotting.

One of the controllers' brother works there in an airplane. So the combination of the controller seeing it from the inside and the brother with the airplane and the difference in time with the airplane that is equipped in being able to land under low visibility conditions was dramatic. These are real world examples.

Again, where we are in uncontrolled airspace like Mr. Salazar was talking about in Colorado, it gives you a shot in the arm, not a NASCAR shot, just a shot in the arm. I think this would be very helpful.

Could you run that for us, Vinny, and tell us what you are showing us?

[Referenced video played.]

Mr. CAPEZZUTO. Okay, what you are looking at is basically the airspace that is considered oceanic. As you look at that light shaded, blue area, that is about 100,000 square miles of what we call oceanic airspace.

And so, as you see aircraft leaving either out of Mexico, what you are seeing is that is radar coverage up to the light blue area. Once they go into that light blue area, what we do is we sanitize the airspace around the aircraft because we really don't have any surveillance capability.

That is about 120 miles behind an aircraft and then 50 miles on either side of it. So that is a fairly large volume of airspace that is considered sanitized. From a safety perspective, that is great, but we could make better use of that airspace.

As they approach on the United States coast, you will also notice that we pick them up in radar coverage. This gives you an example of the capacity constrained by our separation standards as a function of keeping safe separation between the aircraft.

Then to point out, there is also a whole lot of low altitude activity going on, and it goes pretty far out as well because they are doing deep oil exploration. There are a lot of platforms on the base underneath this, and we would like to exploit those platforms and deploy our ADS-B infrastructure. Again, that is something we could not accomplish with radars.

We have these nice, tight, small units that can be deployed on the oil platforms, providing services now that you can see that we can clearly put five mile separation. So you have increased capacity. You have reduced ground delays. You provide surveillance not only for the high altitude but you are also providing it for the low altitude.

Now we can provide or extend our surveillance capabilities offshore, 200 miles out and provide the helicopter operators with surveillance. As I mentioned, this was kind of a win-win situation. We worked closely with the Helicopter Association International to get access to those platforms. In kind contributions from them are providing the transportation, the electricity, the telecommunications and the space, and that is probably some of the most highly priced real estate in the world plus getting access on those platforms.

It worked out to be a pretty good deal where they gave us access. We were able to deploy our infrastructure or will be able to deploy our infrastructure. It will give us high altitude capability and low altitude capability.

Mr. HAYES. You can do that in other places where you don't have radar as well.

Mr. CAPEZZUTO. That is correct.

Mr. HAYES. Pacific, Atlantic, Colorado, Alaska.

Mr. CAPEZZUTO. Absolutely.

Mr. COSTELLO. Very good. Mr. Ehlers, any other comment or question?

Mr. EHLERS. As soon as they get down to 500 bucks, I will be first in line to buy one, but I first have to buy the airplane too.

[Laughter.]

Mr. COSTELLO. We thank all of you for being here to testify and to answer our questions. This is an issue that we will be following very closely as I know the Inspector General and the FAA will. We, of course, all have the same goal in mind, and that is to get the system up and running, implement it and get the maximum use of it as early as we possibly can.

The FAA, quite frankly, not only this Administration but previous administrations, they do not have the best track record in following through on contracts and monitoring them. We hope that will not be the case with ITT and with ADS-B.

It will be the responsibility of the FAA to monitor it, to make sure that ITT is performing. It will be our responsibility in this Subcommittee to provide aggressive oversight to make certain that the contract is being followed and implemented as it is spelled out and to make certain that the FAA is providing the right oversight as well.

With that, we thank the witnesses, and the Subcommittee stands adjourned.

[Whereupon, at 4:25 p.m., the Subcommittee was adjourned.]

STATEMENT OF
THE HONORABLE JERRY F. COSTELLO
SUBCOMMITTEE ON AVIATION
HEARING ON
NEXTGEN: THE FAA'S AUTOMATIC DEPENDENT SURVEILLANCE- BROADCAST (ADS-B)
CONTRACT
OCTOBER 17, 2007

- I want to welcome everyone to this Subcommittee hearing on *NextGen: The FAA's Automatic Dependant Surveillance – Broadcast (ADS-B) Contract.*

- A major part of FAA's Next Generation Air Transportation System (NextGen) plan to transform our air traffic control system is the transition from ground-based radar to satellite-based surveillance. Automatic Dependent Surveillance – Broadcast, or "ADS-B" as it is commonly known, is the key enabling technology for that transition.

- Within the last 60 days, the FAA has taken two major steps forward with ADS-B. At the end of August, the FAA

awarded a performance-based service contract valued at almost $1.9 billion to a consortium led by the ITT Corporation.

- The ITT team is required to build, own and operate a system that will provide nationwide ADS-B surveillance and broadcast services by as early as 2013.

- And earlier this month, the FAA published a notice of proposed rulemaking that would require aircraft operating in certain classes of airspace to equip with "ADS-B Out" avionics by 2020.

- Over the last several months, the FAA has described ADS-B as the "cornerstone" and "backbone" NextGen, and "the future of air traffic control." I agree that ADS-B is a

technology that holds enormous promise. It is potentially much more accurate than radar, which may help the FAA and airspace users utilize our airspace more efficiently. It can enhance safety by providing surveillance to areas that cannot be covered by radar, and by granting pilots greater situational awareness. It may also enable the FAA to avoid hundreds of millions of dollars in cost by downsizing its ground based infrastructure.

- However, that said, reasonable expectations must be set about what relief ADS-B can realistically provide for the type of meltdown and record setting delays that our system faced this summer.

- Unfortunately, I think that the American public has been led to believe that the silver bullet solution for gridlock is a new

satellite-based surveillance system. The truth is, ADS-B will probably not provide significant tangible nationwide benefits for several more years, and then only in conjunction with other NextGen technologies that are years away from implementation.

- It is time for the rhetoric to stop and for this Administration to start explaining all the "ifs" and "whens" about ADS-B and the NextGen system.

- First, some have pointed out that ADS-B is a relatively mature technology that is not highly complex. Regardless, we should not underestimate the technical complexity of building and integrating this new system into the NAS. As with any modernization program, there is clearly the potential for setbacks and slippage on implementation.

- In addition, even if the ITT team meets the FAA's ambitious schedule for deploying ground infrastructure and services, how quickly ADS-B can deliver major benefits will be determined largely by how quickly users equip. The FAA's proposed rule does not mandate ADS-B equipage until 2020.

- Furthermore, some of ADS-B's most advanced applications and capabilities, like reduced separation standards and aircraft self-separation, have received the most public attention. However, the FAA first needs to demonstrate that ADS-B performs as well as our current radar-based system before these capabilities can seriously be considered. Moreover, some of these advanced capabilities require "ADS-B In"

avionics, which the FAA did not mandate in its proposed rule.

- Given that the FAA has advertised ADS-B as "the future of air traffic control," the public should know that the FAA placed a tremendous amount of responsibility for that future in the hands of the private sector.

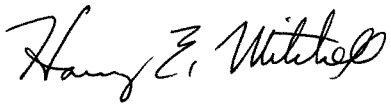
- Instead of adopting a more traditional acquisition strategy for ADS-B, the FAA has opted for a service contract approach, whereby the ITT team will build the ADS-B ground stations and own and operate the equipment. The FAA will pay subscription charges for ADS-B broadcasts transmitted to aircraft and air traffic control facilities.

- The FAA estimates that its contracting approach will save the Government roughly $820 million over the next 30 years and cut 5 years off the deployment schedule. Regardless, I believe that there are inherent risks in this strategy. The FAA cannot let reliance on its contractor lead to a loss of objectivity with regard to the contract's performance or the protection of consumers. Both Congress and the FAA must provide vigorous oversight of this contract going forward.

- With that, I want to again welcome our witnesses today and I look forward to their testimony.

- **Before I recognize Mr. Petri for his opening statement, I ask unanimous consent to allow 2 weeks for all Members to revise and extend their remarks and to permit the submission of additional statements and**

materials by Members and witnesses. Without objection, so ordered.

1 

Statement of Rep. Harry Mitchell
House Transportation and Infrastructure Committee
Subcommittee on Aviation
10/17/07

--Thank you Mr. Chairman.

--As you know, the U.S. Department of Transportation predicts up to a tripling of air passengers and cargo operations by 2025.

--And as anyone who's flown recently can tell you, we've got our hands full dealing with the flight load we're facing right now.

2

--Airline delays have gone from bad to worse.

--According to the Bureau of Transportation Statistics, the first half of 2007 was the worst for airline delays since they started keeping comprehensive statistics. Nearly 28 percent of flights were delayed.

--And it's not just the *number* of delayed flights that's breaking records, it's the *duration* of flight delays as well. Average flight arrival delays are now up to 57 minutes.

3

--But perhaps most disturbing is the rapid growth we're witnessing in on-board tarmac delays. According to the Department of Transportation's Inspector General, in the first 7 months of 2007, "More than 54,000 flights affecting nearly 3.7 million passengers experienced taxi-in and taxi-out times of 1 to 5 hours or more. This is an increase of nearly 42 percent as compared to the same period in 2006."

4

--These are complex issues and will require complex solutions.

--However, we know that at least part of the solution lies in the transition from a radar-based to a satellite-based navigation system.

--According to the FAA, this new technology will be the "cornerstone" of the Next Generation Air Transportation System (NextGen). Once deployed, the FAA believes it will enable them to safely reduce separation

5

standards between planes, and allow more planes to occupy the same air space.

--On August 30, 2007, the FAA awarded a service contract worth potentially $1.86 billion to begin deployment of this new system.

--I look forward to hearing from today's witnesses about this contract, as well as their thoughts on technology, and how soon we can start using it to reduce delays.

6

--I yield back.

OPENING STATEMENT OF
THE HONORABLE JAMES L. OBERSTAR
SUBCOMMITTEE ON AVIATION
NEXTGEN: THE FAA'S AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST CONTRACT
OCTOBER 17, 2007

I want to thank Chairman Costello and Ranking Member Petri for calling today's hearing on *NextGen: The FAA's Automatic Dependent Surveillance – Broadcast Contract.* Mr. Chairman, for the last several months we have all heard a lot about the Next Generation Air Transportation System (NextGen) and how we need to upgrade our antiquated radar-based ATC system with new satellite-based technologies, or face gridlock and delays. Well, this summer we had gridlock and delays.

In August, the FAA awarded a contract worth $1.86 billion to a team led by ITT Corporation to build, own, operate and maintain a new satellite-based surveillance system called Automatic Dependent Surveillance – Broadcast, or "ADS-B." So now that the FAA has signed this contract, which would effectively turn our principal surveillance infrastructure over to the private sector, does that mean we won't have delays next summer, or the summer after that, or the summer after that? No, not really. It will still be several more summers before the ADS-B infrastructure is in place, and nationwide services are being provided, and several more summers after that before aircraft have equipped with required avionics and the system is functioning as planned.

Mr. Chairman, ADS-B is a technology that clearly has tremendous potential, and I support the FAA's decision to transition to satellite-based surveillance. For the FAA, ADS-B may offer cost savings because it requires less ground-based infrastructure to maintain, refurbish, and replace. For national airspace system (NAS) users, ADS-B could offer more safety through enhanced pilot situational awareness, additional services broadcast to the flight deck, and surveillance coverage to areas that are not now radar accessible. ADS-B is potentially much more accurate than radar, which may help the both the FAA and NAS users utilize our airspace more efficiently.

Yet, I believe that there is a perception in the public, due partly to the Administration's aggressive messaging of its financing proposal, that a new satellite-based infrastructure is the cure-all for the unprecedented delays we experienced this summer. It is time to stop the salesmanship and to start a serious exploration of what ADS-B and other NextGen programs are likely to provide and when.

First, while FAA officials have stated that ADS-B technology "is not highly complex," the Inspector General will testify today that, in fact, integrating ADS-B into the NAS will be a technically complex undertaking. And even if there are no slips in the deployment of ADS-B infrastructure, how quickly we will see tangible system-wide benefits will be determined by how quickly NAS users equip with avionics. Moreover, many of ADS-B's most advanced applications that offer users the greatest

benefits require "ADS-B In" avionics, which are not mandated by the FAA 's proposed rule.

Mr. Chairman, given the critical role envisioned for ADS-B, the FAA has delegated an enormous amount of responsibility to the private sector. Instead of adopting a more traditional acquisition strategy for ADS-B, the FAA has opted for a service contract approach, whereby the ITT team will build the ADS-B ground stations and own and operate the equipment. The FAA will pay subscription charges for ADS-B broadcasts transmitted to aircraft and ATC facilities.

The FAA believes that its approach will allow ADS-B infrastructure to be deployed five years sooner and $820 million dollars cheaper than a more traditional acquisition strategy. Be that as it may, I am concerned that potential over-reliance on the contractor could lead to FAA's loss of objectivity, impinging on the agency's ability to adequately evaluate how the system is performing and how the public is being served. Under the contract, the ITT team would not only own, operate and maintain the infrastructure, but would also hold a competitive advantage, potentially even a monopoly, over new "value added services" provided over its infrastructure.

Historically, we have seen this situation before. In the 1960s and into the 1970s and the mid-1980s, the relationship between FAA and IBM in the development

of ATC technology was such that you could not tell where FAA left off and IBM began or vice versa. For a while, when IBM was the giant uncontested, that was somewhat accepted practice. But as other technology and other firms with that capability came forward with services and equipment and software to offer, and challenged that leadership role, and we began to see that FAA was losing its objectivity, FAA was losing its innovative ability separate from that of IBM, and too strong a dependence on one contractor became a detriment to the diversification of the FAA ATC technology.

When we had eventually what I called at the time a "meltdown," when FAA/IBM proposed technology standard was going to cost billions more, may not really be achievable, that is finally when the Inspector General gave us the reaffirmation of the concerns and fears that we had. We must not repeat this again. We must ensure that there is some distance and separation between FAA and the ITT team that will keep the FAA, as Inspector General Scovel said last May, in a position of day-to-day, hands-on management.

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

Opening Statement
Congressman John T. Salazar
T&I Aviation Subcommittee Hearing
NextGen: the FAA's Automatic Dependent Surveillance-Broadcast (ADS-B) Contract
October 17, 2007

Thank you, Mr. Chairman, for calling this hearing.

I'm proud to say that the State of Colorado supports and is fully invested in NextGen.

The State and the FAA are engaged in deploying a surveillance system that utilizes the emerging technologies of ADS-B and Wide Area Multilateration.

The system will provide surveillance for areas of the Colorado Mountains that currently have no radar coverage.

And will increase safety and capacity at some of Colorado's busiest Ski Country Airports.

The Colorado Project represents a transitional strategy between current radars and ADS-B.

It will provide surveillance services for all General Aviation, Air Carrier and Military transponder equipped aircraft, and is capable of

"seeing" aircraft that are ADS-B (Mode S 1090 ES) equipped.

Recognizing the strain that is projected to be put on the air traffic system and the funding challenges facing the FAA, Colorado has taken this proactive approach to solving problems facing its Ski Country Airports.

I believe this project should be a model for other states facing unique air transportation problems that do not meet the requirements to be fully funded by the FAA.

I would like to take this opportunity to thank and commend the FAA, and in particular Mr. Capezzuto, for their forward thinking posture in helping Colorado solve a very difficult problem.

ADS-B represents a significant step forward in modernization of our National Air Space system and promises to enhance safety and efficiency system wide.

I look forward to the testimony today and again, I thank the panel members for being here.

Thank you.

FOUNDED 1977

PROFESSIONAL AIRWAYS SYSTEMS SPECIALISTS

1150 17th Street, NW, Suite 702, Washington, D C. 20036
Telephone· (202) 293-PASS Fax: (202) 293-7727

STATEMENT OF TOM BRANTLEY
PRESIDENT
PROFESSIONAL AIRWAYS SYSTEMS SPECIALISTS (PASS)
AFL-CIO

BEFORE THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE – SUBCOMMITTEE ON AVIATION

ON
NEXTGEN: THE FEDERAL AVIATION ADMINISTRATION'S AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) CONTRACT

OCTOBER 17, 2007

Chairman Costello, Congressman Petri and members of the subcommittee, thank you for inviting PASS to testify on the Automatic Dependent Surveillance – Broadcast (ADS-B) contract. The Professional Airways Systems Specialists (PASS) represents more than 11,000 Federal Aviation Administration (FAA) employees in five separate bargaining units throughout the United States and in several foreign locations. The largest PASS bargaining unit is the Air Traffic Organization Technical Operations unit, consisting of technical employees (systems specialists, electronics technicians and computer specialists) who install, maintain, repair and certify the radar, navigation and communication systems making up the air traffic control system.

It appears that ADS-B, when fully implemented, could be a very useful tool for pilots and air traffic controllers to use to maintain proper separation of aircraft while allowing more efficient use of our nation's airways. ADS-B will allow aircraft to transmit their exact position, direction of flight and speed to ground stations and other aircraft. According to the FAA, ADS-B is "the future of air traffic control."[1] Changes like those resulting from ADS-B could be extremely beneficial to the aviation industry if they are fully—and safely—realized.

PASS and the employees we represent welcome this advancement in air traffic control technology, but it is critically important that safety be the focus of any modernization efforts. In our view, the approach being used by the FAA to deploy ADS-B is one that discounts decades of responsibly ensuring the safety of the flying public. It is our understanding of the FAA's plans that with the implementation of this system, ADS-B, unlike our current radar systems, will not be certified and all maintenance will be the responsibility of the contractor.

It is PASS's hope that with modernization of the National Airspace System (NAS), new systems will enhance safety and efficiency. However, we are concerned that the newly awarded ADS-B contract may have negative consequences on aviation safety. PASS is especially disturbed by the elimination of FAA certification of the system, the decrease in system redundancy and the FAA's troubled history of contract management.

The ADS-B Technology

ADS-B is a digital alternative to radar designed to provide position and flight information simultaneously to pilots and air traffic control facilities. Instead of using radar data to determine flight position, ADS-B uses signals from the Global Navigation Satellite System. Aircraft transponders receive these signals and transponder transmissions are then used to determine the locations of aircraft. The position is converted into a digital code and combined with other data from the aircraft's flight monitoring system, such as type of aircraft and its speed. The code containing all relevant data is broadcast from the aircraft's transponder once per second; ADS-B-equipped aircraft and ground stations within 200 miles receive these broadcasts. ADS-B ground stations will also add radar-based targets for aircraft not equipped with ADS-B and then send this data, along with graphical information from the National Weather Service and flight information, back to equipped aircraft. As such, for the first time, both pilots and controllers will see the same real-time air traffic displays.

[1] Federal Aviation Administration, "Fact Sheet: Automatic Dependent Surveillance – Broadcast (ADS-B), June 21, 2007.

In 2005, after being used by general aviation pilots in Alaska, the FAA determined that ADS-B was ready to be made operational throughout the NAS. The FAA has indicated that ADS-B is "critical to the agency's Next Generation Air Transportation System plan for meeting the nation's predicted tripling of demand in coming years."[2] According to the agency, since ADS-B will result in more accurate tracking, aircraft will be able to fly safely with less distance between them, thus allowing for an increase in airspace capacity. The FAA predicts that the ADS-B technology will also allow air traffic controllers to better manage the air traffic at congested airports.

The FAA anticipates being able to "commission" ADS-B services for use in the NAS by 2010, and by 2013 to have coverage everywhere there is currently radar coverage. The agency expects full implementation to take approximately 20 years, at which time primary radar will be eliminated and about half of the legacy secondary radars will be maintained to provide a backup in case of an ADS-B outage.

Elimination of Certification

Certification is the process in which a certificated FAA technician checks and tests systems or pieces of equipment on a periodic basis in order to ensure that the systems or pieces of equipment can be safely returned to service and not negatively impact any aspect of the NAS. According to the FAA's own order, "Certification is a quality control method used by the ATO [Air Traffic Organization] to ensure NAS facilities are providing their advertised service. The ATO employee's independent discretionary judgment about the provision of advertised services, the need to separate profit motivations from operational decisions, and the desire to minimize liability, make the regulatory function of certification and oversight of the NAS an inherently governmental function."[3] Since certification is an inherently governmental function,[4] it can *only* be accomplished by FAA employees.

For decades, the FAA has had in place criteria for determining which NAS systems and services require certification. Among the criteria used are the following:

a. FAA NAS systems, subsystems, and services directly affecting the flying public shall be certified when they do any of the following:
- **(1)** Provide moment-by-moment positional information to pilots or air traffic operations personnel during aircraft operations.
- **(2)** Provide necessary communication or communication control among pilots and air traffic operations personnel during the above aircraft operations.
- **(3)** Provide decision support information that directly affects aircraft heading, altitude, routing, control, or conflict awareness.
- **(4)** Provide essential meteorological information for takeoff and landing aircraft at airports.

---

[2] Id.
[3] FAA Order 6000.15E – *General Maintenance Handbook for National Airspace System (NAS) Facilities.*
[4] Manager, General Law Branch, AGC-110, memorandum to Manager, Maintenance Engineering Division, ASM-100, "Contractor Certification of Navigational Systems in National Airspace System (NAS)," June 18, 1991.

(5) Provide short term, long term, continuous, and conditioned power to NAS systems requiring certification at a Service Delivery Point (SDP).... These [elements necessary to require certification] are characterized as follows:
- **(a)** Short term power source; e.g., batteries, or flywheel capable of carrying the load during the transfer.
- **(b)** Long term power source; e.g., an engine generator, or fuel cell.
- **(c)** Continuous indicates capability for transparent transfer between power sources; e.g., an automatic transfer switch.
- **(d)** Conditioned power; e.g., voltage regulation and filtering of the waveform.[5]

As you can see, based on its design, ADS-B unmistakably meets criteria a.(1) and a.(3); therefore, ADS-B should no doubt be certified in order to ensure that the system is providing its advertised service and, more importantly, that it is doing so in a *safe* manner. In fact, the long-standing criteria for certification stated that "FAA NAS systems, subsystems, and services directly affecting the flying public shall be certified."[6] However, the agency has been very creative in finding a way to circumvent its own certification program, even making changes to this time-tested order. In a recent update to the order, effective October 1, 2007, the agency has "clarified" the text to read, "*FAA owned* NAS systems, subsystems, and services directly affecting the flying public shall be certified" (emphasis added)[7]. In other words, the FAA has not only re-interpreted the criteria to allow ADS-B to be deployed without requiring certification but actually *prohibits* full and appropriate certification of all systems it does not own.

In addition, PASS has learned that the FAA intends to perform "service certification" on ADS-B in order to give the pretense that the agency can oversee the safety and performance of the system. Further changes the agency has made to its own orders reveal the agency's true intentions of taking FAA employees out of the process. Until recently, FAA orders described the criteria for service certification as follows:

b. Service certification is based upon several fundamental characteristics of NAS service such as:
- **(1)** Constituent systems and subsystems are certified.
- **(2)** Indications on monitor and control consoles are normal.
- **(3)** Customer activity reports contain no complaints.[8]

In the update to the order, the following guidelines are now provided on service certification:

b. ATO personnel with certification authority must certify NAS infrastructure services listed in Appendix 3.
c. Service certification is based upon several fundamental characteristics of NAS Infrastructure Service provision, such as:

---

[5] FAA Order 6000.15D – *General Maintenance Handbook for National Airspace System (NAS) Facilities.*
[6] Id.
[7] FAA Order 6000.15E – *General Maintenance Handbook for National Airspace System (NAS) Facilities,* draft dated February 13, 2007, effective October 1, 2007.
[8] FAA Order 6000.15D – *General Maintenance Handbook for National Airspace System (NAS) Facilities*

(1) Constituent systems and subsystems are certified.
(2) Indications on monitor and control consoles are normal.
(3) Customer activity reports contain no complaints.
(4) Observation or knowledge of customers using the NAS Infrastructure Service.[9]

Since ADS-B is not a system owned by the FAA, and will therefore not be listed in Appendix 3, FAA employees will not be performing system certification; thus, the first two criteria above will no longer apply. The agency will then fall back to the newly added fourth criteria, "Observation or knowledge of customers using the NAS Infrastructure Service." In essence, without a true certification of ADS-B, the controllers will have to rely on the users, i.e., pilots or the vendor, to tell the FAA that the service is wrong. Even the smallest inaccuracy will only be addressed if the "users" report a problem. There will be no internal FAA quality checks as there are today.

PASS is certain that ADS-B must be appropriately and fully certified to ensure its safe operation. Radar has always been certified by the FAA, and the FAA's own documents state that ADS-B is an alternative to radar, providing similar service with advanced technology. Yet, the agency has made changes that will allow private contractors to be fully responsible for its safe operation and eradicate the role of FAA employees in the maintenance and use of the system. In other words, certification for systems not owned by the FAA will be totally eliminated and, in the opinion of the experts, technicians in the field, there will be no way to independently determine if the system is safe.

In addition to being a requirement for years that the FAA certify systems and services that are crucial to safe air travel, FAA involvement often provides that necessary margin of safety when it is most needed. As anyone who studies risk management will agree, it is during transitions that the greatest vulnerability occurs. The transition from our current ground-based means of separation to a satellite-based means of separating air traffic will be a huge transition. It may take many years for the changeover to occur, but the transition is nonetheless an enormous undertaking. The added safety provided by having FAA employees certify that the NAS, whether ADS-B or legacy systems, is safe for use will be very important to a successful change.

It should also be noted that this new interpretation of the agency's certification criteria would apply not only to ADS-B but also to any system or service that is not owned by the FAA—any future contract awarded by the FAA that provides for vendor-owned equipment or services would be barred from the FAA certification program. In addition, the pilot programs contained in the Senate's version of the reauthorization bill that would turn over ownership, maintenance and operation of airports to entities other than the FAA would also place the systems and services used or provided by those airports in a category of being prohibited from the FAA's certification program.

Clearly, the agency's ill-advised goal is to turn over as much of the NAS as possible to the private sector. This means that anything requiring work of FAA employees, such as certification, is now looked upon by the FAA as an obstacle that must be overcome. In effect, the agency is saying that its own certification program, which is the key factor in our country's air traffic

[9] FAA Order 6000.15E – *General Maintenance Handbook for National Airspace System (NAS) Facilities,* draft dated February 13, 2007, effective October 1, 2007.

control system being the world's safest, is now a roadblock to an ideological choice that supersedes the agency's mission "to provide the safest, most efficient aerospace system in the world." PASS finds the agency's actions to avoid the certification of ADS-B systems and services to be misguided and irresponsible. Aside from it being a legal requirement for FAA employees to be the ones who certify NAS systems, FAA employees are the only people anywhere with such a detailed knowledge of the intricacies associated with NAS systems and operations and are the only individuals trained to deal specifically with equipment failures and the complex intricacies associated with such a vast network of systems and equipment. Private contractors simply lack the skills, training and knowledge of federal employees. They are not acutely familiar with the delicate balance that makes up the NAS. The NAS is not just one piece of equipment, but rather a complex, integrated system that includes thousands of distinct smaller systems, all of which interface with one another, and aviation safety depends on oversight of the entire system. The NAS cannot be divided into individual components, just as the work of those responsible for maintaining it cannot be contracted out as independent functions. Placing responsibility for a system as vital to air travel as ADS-B entirely in the hands of the private sector threatens the safety of the flying public. PASS strongly supports modernization of the NAS, but *never* in a manner that compromises the very foundation of safety upon which our current system is based.

Lack of Redundancy

Redundancy in the aviation system allows for disturbances to the system without corresponding disturbances to air travel. In other words, the safety and efficiency of the NAS relies not only on the proper operation of major systems but on the presence and availability of a sufficient backup system as well. Although the FAA is claiming that it will maintain about half of the current network of secondary radars as a backup system in case of a GPS outage, the plan nonetheless results in a severe cut in redundancy.

According to the Government Accountability Office (GAO), the "the ADS-B rollout will allow the agency to remove 50 percent of its current secondary radars, saving money in the program's baseline." Full implementation of ADS-B would mean that the primary radar would be eliminated and 50 percent of secondary radars would also be removed. The FAA considers providing backup for half of ADS-B users sufficient, but PASS questions the consequences of such a drastic cut in redundancy, literally moving almost entirely to a satellite-based system. Furthermore, if the ADS-B technology truly allows for the reduction of space between aircraft, what happens if ADS-B fails and aircraft are forced to switch to secondary radar, which requires more space between aircraft in order to ensure safety? PASS believes that the FAA must seriously examine such possibilities before considering 50 percent of secondary radar a safe backup. In fact, the FAA *Aeronautical Information Manual* specifically states that "ADS-B alone does not ensure safe separation."[10] If this is indeed the case, a sufficient level of redundancy must be maintained to ensure that the airways are safely populated. Relying on half of the secondary radar is simply not adequate.

---

[10] Federal Aviation Administration, *Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures*, February 16, 2006, Section 4-4-18.b.

Furthermore, in order to have sufficient redundancy to avoid service disruptions, there also must be employees present who fully comprehend the different types of service. Under the current contract, ADS-B would exist as an entirely vendor-run operation. In other words, FAA involvement would be nearly eliminated. If FAA employees are not familiar with the workings of the system, the agency will be held hostage to the vendor's response time, which will, at the very least, increase restoration times and result in delays. Plus, if FAA employees are not working with ADS-B and secondary radar has been cut by half, it stands to reason that there will be fewer technicians employed by the FAA. Fewer FAA employees will also increase delays and risk the safety of the system, especially if the FAA is forced to switch to backup radar.

Contract Management

The FAA's problems with management of its contracts are well documented. PASS is extremely concerned that the elimination of FAA involvement related to such an important system places far too much reliance on the corporate vendor and the terms of the contract. Most disquieting is the fact that the contract places control of the system entirely in the hands of the vendor. As briefly mentioned above, if there is a problem with ADS-B, the agency is completely reliant on the vendor to address the problem. In fact, the FAA must even rely on the vendor to report any problems. However, what a contractor who could lose profit considers a problem and what an FAA employee whose only concern is safety and who has detailed knowledge of the NAS considers a problem may be drastically different. In other words, the contractor may not address a problem in time to avoid a disruption to the system, which would then force the FAA to rely on its limited backup radar. Furthermore, once a problem has been detected, the FAA will be forced to wait for the vendor to correct the issue. There is no way to determine what type of restoration time may be involved if the contractor is not located within convenient traveling distance of all ADS-B ground stations.

In addition, there are also no safeguards in place in the event that the vendor enters bankruptcy or is acquired by another firm. While PASS appreciates the language regarding ADS-B contract requirements in the House version of the reauthorization bill, the most effective way to reduce problems is to involve FAA employees. If FAA employees are certifying the system, they will be knowledgeable in the operations of the technology and able to provide assistance in the case that vendors are changed. This is also extremely important when considering that ITT is only the primary contractor with a team of several other vendors, including AT&T, Thales and PriceWaterhouseCoopers. If the agency is completely reliant on the contractor, any problem at any of these companies could result in a disruption to ADS-B service. With a knowledgeable and adequate FAA technical workforce, there would indeed be more of a safeguard in place to protect against service disruptions.

The FAA makes an apples-to-oranges comparison when it relates the current ADS-B contracting efforts to the telecommunications services the FAA is currently contracting through Harris Corporation.[11] Even though comparing telecommunications services to vital air traffic equipment is unrealistic, examining the performance of the telecommunications contract does shed additional light on the FAA's problems with contract management. The FAA is currently

[11] Federal Aviation Administration, "Follow Up Contract Award ADS-B Q&As," August 30, 2007.

working with a private corporation to provide communications services for air traffic control and consolidate multiple networks under the FAA Telecommunications Infrastructure (FTI). The chronic scheduling and cost problems and inept contractor performance involved with the transition have resulted in scrutiny of the process from members of Congress, the Government Accountability Board and the Department of Transportation Inspector General.

For example, in its April 2006 report, the IG indicated that a major problem with the FTI program is a lack of contractor understanding.[12] Only trained FAA technicians are fully aware of the way in which every interconnected unit affects the entire NAS system and thus the aviation system as a whole. Neither the FTI Program Office nor Harris fully comprehend the requirements of site installation and the potential problems, and Harris contractors tasked with maintaining FTI are not properly supervised. This lack of knowledge has resulted in numerous outages and delays throughout the country. If turning over a communications system to a private entity has resulted in such a level of problems and criticism, should the FAA risk a similar move with the safety-critical work performed by FAA technicians?

In addition, poor management of FTI implementation is also leading to an increase in cost and a corresponding decrease in benefits. As with ADS-B, the FAA has touted the cost savings associated with FTI; however, according to the IG, acquisition costs have increased while cost savings have decreased by over $400 million—more than half of the FAA's original estimated savings. Since the FAA has not independently validated the FTI cost and benefits estimates, despite recommendations from the IG to do so, the actual costs and benefits remain unknown. Rising cost should be a major concern regarding the current ADS-B contract and the FAA's management of the contract. When factoring in the incredible complexity that will be involved in making a prototype ADS-B system work throughout the NAS, PASS is very concerned that the FAA's ability to manage the development of such a system is lacking.

Conclusion

Since the current FAA administration seems to have abandoned its responsibility for ensuring the safety of our nation's air traffic control system, PASS strongly urges Congress to take the lead in keeping the agency focused on its true duty, maintaining the safest air traffic control system possible. PASS asks that Congress direct the FAA to fully and appropriately certify all NAS systems and services, including ADS-B, that meet the criteria for certification as defined by the agency prior to October 1, 2007, without regard for ownership of such systems and services. Additionally, Congress should require the agency to notify the appropriate congressional committees before making such a fundamental change in its safety philosophy. Only by maintaining the integrity of the highly successful certification system can such a leap in technology as that envisioned with ADS-B be accomplished safely.

---

[12] Department of Transportation Inspector General, *FAA Telecommunications Infrastructure Program: FAA Needs to Take Steps to Improve Management Controls and Reduce Schedule Risks*, AV-2006-047 (Washington, D.C.: April 27, 2006), p. 18.

STATEMENT OF VINCENT CAPEZZUTO, DIRECTOR OF SURVEILLANCE AND BROADCAST SERVICES PROGRAM OFFICE, EN ROUTE AND OCEANIC SERVICES, AIR TRAFFIC ORGANIZATION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION, ON NEXTGEN: THE AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST CONTRACT, ON OCTOBER 17, 2007.

Chairman Costello, Congressman Petri, Members of the Subcommittee:

Thank you for holding today's hearing on the Federal Aviation Administration's (FAA) contract for the Automatic Dependent Surveillance-Broadcast (ADS-B) system. My name is Vincent Capezzuto, and as the Director of Surveillance and Broadcast Services in the Air Traffic Organization at the FAA, I have responsibility for oversight of this performance based contract. ADS-B is a new service for the FAA and this vehicle will allow the FAA to deploy the equipment and service far more quickly and easily than traditional methods, which in turn will increase efficiency and capacity in the National Airspace System (NAS), and most important, enhance aviation safety.

As you know, this system is vital to building the Next Generation Air Transportation System (NextGen). In order to ensure the success of ADS-B while maintaining the safest aviation system in the world, the FAA has crafted an innovative and closely monitored contract with the ITT Corporation for the development of ADS-B. We appreciate the role that Congress has already played in developing this contract. In fact, our confidence in the contract is directly due to Congress' oversight and input, as well as contributions from other government entities, which have been invaluable to this process. We

welcome the Members' continued oversight to help us manage the contract moving forward.

ADS-B: Description and Benefits

While some of the Members have been able to see ADS-B in action, I wanted to give some brief background as to ADS-B's capabilities and how it fits into the FAA's longer-term NextGen goals. ADS-B uses signals from the international Global Navigation Satellite System to provide air traffic controllers and pilots with much more accurate information that will help keep aircraft safely separated in the sky and on runways. Aircraft avionics receive satellite signals and transmit the aircraft's precise locations to air traffic controllers and pilots. The avionics convert that position into a digital code and combine it with other unique data from the aircraft's flight monitoring system — such as the type of aircraft, its speed, its flight number, and whether it is turning, climbing, or descending. The code containing all of this data is automatically broadcast from the aircraft's avionics once a second or more, as compared to the current five to twelve second refresh from today's radar. While a time savings of four to eleven seconds may seem brief to some, this savings actually allows for far greater accuracy in determining aircraft position.

ADS-B equipped aircraft as well as ADS-B ground stations up to 200 miles away from the originating ADS-B aircraft will receive these broadcasts. Air traffic controllers will see the ADS-B surveillance information on displays they are already using, so little additional training will be needed for the controller workforce. The ADS-B ground

stations also transmit data to aircraft. These stations send radar-based targets for non-ADS-B-equipped aircraft up to ADS-B equipped aircraft — this function is called Traffic Information Service-Broadcast (TIS-B). ADS-B ground stations also send out textual and graphical information and forecasts from the National Weather Service and flight information, such as Notice to Airmen or temporary flight restrictions — this is called Flight Information Service-Broadcast (FIS-B). Pilots can see the ADS-B, TIS-B and FIS-B information on their certified cockpit traffic display screens.

When properly equipped with ADS-B, both pilots and controllers will, for the first time, see similar real-time displays of air traffic. Pilots will have much better situational awareness because they will know with greater accuracy where their own aircraft are, and their displays will show them all the aircraft in the air and on the ground around them. Pilots will be able to have better situational awareness of other aircraft with fewer instructions or advisories from ground-based controllers. At night and in poor visual conditions, pilots will also be able to see where they are in relation to the ground using on-board avionics and terrain maps. In addition to improved safety in the sky, ADS-B can help reduce the risk of runway incursions. Both pilots and controllers will see the precise location on runway maps of each aircraft and equipped ground vehicles, along with data that shows where they are in relation to each other. These displays are clear and accurate, even at night or during heavy rainfall.

ADS-B also has the potential to increase capacity significantly, because more accurate tracking using satellite based positioning means aircraft will be able to fly safely with less

distance between them. Because the better accuracy available with ADS-B also means greater predictability of aircraft movement, air traffic controllers will be able to manage the air traffic arriving and departing from congested airports with greater precision, resulting in even more gains in efficiency. Eventually, with ADS-B, we envision that pilots can play a more active role in keeping safe distances between aircraft, if they have the certified displays on the aircraft pinpointing all the air traffic around them, along with local weather displays.

Although radar technology has advanced, it is essentially a product of World War II technology. Radar occasionally has problems discriminating airplanes from migratory birds and rain "clutter." Secondary surveillance radar systems can determine the identity of the aircraft because they interrogate transponders on-board the aircraft; however, both primary and secondary radars are very large structures that are expensive to deploy, need continuous maintenance, and require the agency to lease large plots of land on which to situate them. ADS-B, on the other hand, does not have problems with clutter because it receives data directly from aircraft transmitters rather than passively scanning for input like radars do. Also, ADS-B provides superior accuracy and timeliness of information in comparison to secondary radars. ADS-B ground stations are inexpensive compared to radar, and are the size of mini-refrigerators that can go essentially anywhere, so they minimize the required real estate. In addition, ADS-B also provides greater coverage, since ADS-B ground stations are much easier to place than radar. Remote areas where there is currently no radar, such as the Gulf of Mexico and parts of Alaska, will have precise surveillance coverage with ADS-B.

The ADS-B Contractor: ITT Corporation

As you know, in August 2007, the FAA selected ITT Corporation as the prime contractor for the development and deployment of ADS-B. The contract requires ITT to have the system ready for use by 2010 and expand coverage nationwide by 2013. The first stage of the contract is worth $207 million, with options worth an additional $1.6 billion. With a system as important as ADS-B, and the price tag that comes with it, we want to make sure that we are working responsibly with the taxpayers' dollars.

The FAA believes that we have a strong contract in place and that ITT, as a proven systems architect and integrator, has the experience and expertise to fulfill that contract. The ITT team has deployed ADS-B equipment for use in aircraft separation in Australia and has worked with the FAA previously on the Telecommunications Engineering Operations and Management contract. Additionally, the contract accounts for risk mitigation, which requires ITT to work with the FAA to identify any risks within the program along with applicable mitigation plans to execute together in partnership.

To help achieve the goals of the contract, ITT has a team of subcontractors that includes:

- AT&T – to create, manage and secure our telecommunications networks and infrastructure;
- Thales North America (formerly Wilcox Electronics, which provided most of FAA's instrument landing systems) – to provide expertise as a leading provider of ADS-B ground stations;

- WSI – to continue as a trusted weather provider to the FAA;
- SAIC – to provide scientific, engineering, systems integration, and technical services and solutions;
- PriceWaterhouseCoopers – to validate and support the business aspects of the contract;
- Aerospace Engineering – to provide prototyping and metrics of the benefits of ADS-B-enabled systems, operational procedures, and air traffic control (ATC) concepts;
- Sunhillo – to help integrate ADS-B information seamlessly into the NAS with existing and future automation systems;
- Comsearch – to perform radio frequency interference and coverage analysis for ADS-B;
- Mission Critical Solutions of Tampa – to assemble ADS-B equipment racks and perform critical field installations; and
- Pragmatics, Washington Consulting Group, Aviation Communications and Surveillance Systems (ACSS), and NCR Corporation.

These corporations provide additional and complementary expertise and capabilities to ITT's core abilities in aviation, avionics, and service maintenance. In addition, ITT has partnered with L-3 Avionics Systems and Sandia Aerospace to develop low cost avionics for ADS-B and secondary radar transponders. We believe that these strategic partnerships will result in a better product that is seamlessly and reliably integrated into

the NAS while providing increased capacity, enhanced services, and maximum benefits for aviation safety.

The ADS-B Contract: Milestones and Safeguards

As mentioned above, ADS-B is a serious investment. In order to protect that investment, we have designed the contract to include several required milestone events that will help us track progress and test the system as each piece is completed. Further, we have created additional incentives and disincentives throughout the contract to maximize the contractor's commitment to success. Finally, we have a building block plan for the contract; first we build, then we test, while we create the appropriate procedures for use, and only after the groundwork has been laid do we deploy the technology nationwide.

We are keenly aware of the risks inherent to new technology and new procedures, and we are safeguarding against them as best we can. ADS-B's potential is enormous; it is integral to our ability to achieve NextGen and to handle the doubling of today's air traffic predicted by 2025. But, we do not want to oversell these capabilities, and the only way we can present a realistic picture of our goals is to double-check our accomplishments along the way.

Just this month, we achieved a major goal for our ADS-B program, by publishing a Notice of Proposed Rulemaking that allow only aircraft equipped with ADS-B avionics to access certain controlled-airspace. Equipage of aircraft is obviously essential to the FAA's future ability to perform applications such as self separation of aircraft as well as

encourages ITT to develop cost-effective hardware to maximize its investment. We anticipate a Final Rule will be issued in late 2009.

Currently, we are targeting the following goals:

- Testing ground infrastructure and continuing voluntary avionics equipage by April 2008;
- Rolling out initial operating capability by October 2009;
- Deploying NAS-wide ground infrastructure between 2010-2013;
- Completing avionics equipage between 2010-2020.

We have set "default" milestones for key accomplishments in the contract; if the contractor is unable to achieve the milestones, the FAA may consider it in default of the contract, and may cancel the remainder of the contract. With the first milestone set for May 2008, when the contractor is to test the up-linking of traffic and weather information to pilots (Key Site Initial Operating Capability). With this aggressive timeline, it is clear we are not wasting any time in requiring our contractor to deliver. Additional milestones are set for March, April, June, August, and October of 2009. These milestones give us concrete measures of the contractor's progress and, if needed, allow the FAA to adjust the program early on or redirect resources as needed. Our goal is not only to test technical performance, but also to test business performance.

Other oversight measures include preliminary design reviews and critical design reviews, which enable us to track the contractor's progress and success. As previously mentioned,

we also have risk mitigation built into the contract, which requires ITT's full participation. By no means is the FAA a passive entity in this contract.

As noted above, some of the major incentives for our contractor are embedded in the additional $1.6 billion options that the FAA can choose to exercise or not. Depending on proven contractor performance or if FAA does not receive the benefits anticipated in a particular area, these options would allow the FAA to unilaterally stop the contract in whole or in part. Additionally, the contractor is allowed, *subject to FAA approval*, to develop the data for other aeronautical uses, which would result in a reduction of the cost of the contract to the FAA while allowing the contractor to recoup its investment.

We are confident that this system of "carrots and sticks" will afford the FAA considerable oversight of the contract, encourage the contractor to excel in performance, and allow seamless integration of this important new technology. The contract is structured to place responsibility and ownership of hardware with the contractor or other third parties, thus ensuring long-term buy-in by the contractor and the industry, while the FAA retains control over system performance and data transmitted. The FAA also retains ownership and control of the "paper design" of the system as reflected in the final design review and any subsequent activities that might impact the design or the safety and security of the system. Finally, all data will be certified by the FAA, to guarantee its integrity prior to use for air traffic control purposes. FAA is a safety oversight agency first and foremost, and the certification of the data is critical to our mission to ensure safety is maintained and enhanced for the flying public.

The ADS-B User Community

A necessary component of all our planning and efforts has been the input of the ADS-B user community – the pilots, the controllers, the airlines, the engineers, the manufacturers – all the interested stakeholders have a place at the ADS-B table.

The FAA has formed the Air Traffic Management Advisory Management Committee (ATMAC) ADS-B Work Group, which includes representation from government and industry, including the Air Transport Association, the Air Line Pilots Association, and Helicopter Association International, to name a few. The objective of the Work Group is to collaboratively plan and expedite NAS-wide implementation of ADS-B and to offer solutions to implementation issues.

Further, we have formed an Aviation Rulemaking Committee (ARC) to assist the agency in coordinating responses to the previously mentioned NPRM. In addition, the ARC was formed to help us encourage avionics equipage even before the rule's compliance date to speed the safety and efficiency gains possible with ADS-B. ARC participants include many of the same participants from the ADS-B Work Group, as well as the General Aviation Manufacturers Association, the Department of Defense, the National Air Traffic Controllers Association, as well as many others. Now that the NPRM has been published, the ARC will make specific recommendations to the FAA concerning the proposed requirements, based upon comments received in response to the NPRM.

Stakeholder participation is vital to the success of the ADS-B contract and overall program. We are committed to continuing to receive input from the aviation community in order to create a better service product and optimize the ways that service is applied. In that vein, we welcome Congress' continued interest in and oversight of this program; we have already made good use of your input in framing our issues and addressing our shared concerns.

Mr. Chairman, this concludes our prepared statement. We would be happy to answer any questions that you or the other Members of the Committee may have.

October 17, 2007
Subcommittee on Aviation
HEARING on
NextGen: The FAA's Automatic Dependent Surveillance – Broadcast (ADS-B) Contract

Questions for the Record
To:
Vincent Capezzuto, Director, Surveillance and Broadcast Services Program Office, Air Traffic Organization – En route and Oceanic Services
Federal Aviation Administration

1. **Mr. Capezzuto, in your written testimony, you state that "all [ADS-B] data will be certified by the FAA, to guarantee its integrity prior to use for the air traffic control purposes." Would you explain precisely what you mean when you say that the "data" will be certified?**

   One important distinction to understand with ADS-B is that it is aircraft-centric. In other words, the aircraft transmits its GPS location data to other ADS-B-equipped aircraft and ground stations. Surveillance data is not captured on the ground by radars, but in the air by the aircraft itself, so making sure that data is accurate and reliable is the key to ensuring the integrity of ADS-B surveillance. The aircraft avionics is certified for its intended use before it can be used on board the aircraft.

   Once all aircraft in required airspace are properly equipped, traffic broadcasts will not come from ground stations at all – aircraft will send and receive data to and from other aircraft directly. Before that time, ground stations will receive data from ADS-B-equipped aircraft, mix it with radar data for non-ADS-B-equipped aircraft, and broadcast the complete traffic data out. As you can see, certifying the accuracy and reliability of the data is critical.

   This is not to say that the FAA won't also certify ITT's ADS-B infrastructure. We have a preliminary design review scheduled for November 2007 and a critical design review in February 2008. In the contract, we detailed the specifications and requirements that ITT must follow, in addition to required information security and safety risk management practices, all of which we will validate. We will test to make sure the data broadcast by the vendor's equipment meets key performance requirements, such as latency, position validation, update intervals, and target loading. In other words, the FAA will validate ITT's design, operation and maintenance program, and certify the broadcast data meets all contract requirements before that data is displayed on the controllers screen.

   In addition, as with all new technology introduced into the national airspace system, the FAA will test the data at key sites before they are used operationally, and then test them operationally before ADS-B is declared to be "commissioned"

(we call this an "in-service decision") for the national airspace system. This means we will make sure the data being broadcast is accurate and reliable in all the respects outlined in the paragraph above. FAA employees will also certify that FAA air traffic control platforms, like STARS and ERAM, are properly adapted to display ADS-B data.

At every stage in the transition, the FAA will follow safety management practices to mitigate risks and ensure operation acceptability.

2. **Mr. Capezzuto, in your written testimony you state that ADS-B ground station are inexpensive compared to radar. How much more inexpensive?**

The ADS-B ground infrastructure costs less to install and maintain than the existing radar technology and, once we have made the transition to ADS-B, we can avoid future radar acquisition costs.

Per site, a radar costs approximately $3.5M to install and commission, while a ground station costs roughly $450K. Annual operating costs are approximately $160K for a radar site and $125K for a ground station.

3. **Mr. Capezzuto, can you quantify the benefits that ADS-B will provide to the FAA and to airspace users? Also, please explain how you calculated those benefits.**

The total benefits of the program for 2007-2035 in base-year 2007 dollars is $18,498.1 million, which is $5,043.2 million in risk-adjusted present-value dollars.

We have quantified all of the benefits of ADS-B to the FAA and to airspace users in "Surveillance and Broadcast Services Benefits Basis of Estimate, August 2007." This benefits document formed the business justification the agency used to determine its final investment decision for ADS-B. It includes all of the ADS-B applications; the outcomes in terms of cost-avoidance, safety improvements, and efficiency benefits; and the associated savings.

These benefits are shown on an overview chart (attached), while the rest of the document describes the methodologies and analyses that formed the basis for these conclusions. As you can see, there are many benefits associated with the program. I believe the benefits document is a good overview of our benefits calculations and I would be very happy to answer any further questions you may have about any of these benefits.

Attachment:

SBS program benefits by location, application, and desired outcome

Location	Application	Outcome	Benefit (BY7 $M)	Benefit (PV $M)
CONUS, Hawaii, and Caribbean Surveillance	Radar Airspace ATC Surveillance	Surveillance cost avoidance	$1,263.2	$371.1
		More efficient en route conflict resolution	$3,258.1	$801.8
		More efficient en route metering to the arrival fix	$1,746.6	$417.0
		Increased safety on the surface by controllers	$11.6	$3.2
		More efficient ATC management of surface movement	$92.1	$26.9
		Reduction in FAA subscription charges due to value added services	$232.0	$80.6
CONUS, Hawaii, and Caribbean Broadcast Services	Enhanced Visual Acquisition and Conflict Detection	Fewer aircraft-to-aircraft conflicts	$719.8	$203.6
	Weather and NAS Status Situational Awareness	Fewer encounters with hazardous weather	$792.3	$232.5
		More efficient routes in adverse weather	$18.4	$4.9
		Reduction in user costs to obtain weather info	$88.9	$26.1
		Fewer controlled flights into terrain	$1,015.6	$284.3
CONUS, Hawaii, and Caribbean Aircraft Applications	Enhanced Visual Approach - Initial Application	More efficient spacing on approach in VMC	$1,247.8	$300.4
	Enhanced Visual Approach - CAVS	Continuation of Visual Approaches in marginal conditions	$803.7	$196.4
	Enhanced Visual Approach - Merging and Spacing	Increased ability to allow continuous descent approaches	$2,876.7	$796.0
	ADS-B ATC Automation Integration			
	Airport Surface Situational Awareness	Increased safety on the surface by pilots	$299.5	$70.5
	Final Approach and Runway Occupancy Awareness			
Gulf of Mexico Surveillance	Non-radar Airspace ATC Surveillance (includes weather and comm as needed)	High Altitude - Increased Capacity	$2,064.7	$459.3
		High Altitude - Optimal Routing	$256.5	$86.5
		Low Altitude - Increased Capacity	$238.3	$84.2
		Fewer encounters with hazardous weather-low altitude Gulf	$13.1	$5.0
Alaska Surveillance and Broadcast Services	Weather and NAS Status Situational Awareness and Enhanced Visual Acquisition and Conflict Detection	Fewer aviation accidents in Alaska	$760.2	$306.1
	Non-Radar Airspace ATC Surveillance	Access to lower altitude routes in Alaska	$53.1	$19.5
		Increased IFR capacity (JNU)	$3.0	$1.1
		Fewer aircraft-to-aircraft conflicts (JNU)	$0.0	$0.0
		Improved search and rescue services in Alaska	$15.8	$7.0
Alaska Airport IFR Upgrade Services	Weather Automation upgrade and IFR Approach Development	Increased access to remote villages in Alaska	$215.3	$90.0
		Increased Medevac access to remote villages in Alaska	$411.8	$175.4
Total			$18,498.1	$5,043.2

Statement of John Kefaliotis
ADS-B Program Manager

ITT Corporation

For the

U.S. House Transportation and Infrastructure Subcommittee on Aviation

Hearing

On

NextGen: The FAA's Automatic Dependence Surveillance Broadcast (ADS-B) Contract

October 17, 2007

ITT wishes to thank the Committee for the opportunity to testify about this vital program which is an essential building block of the Next Generation Air Transportation System – ADS-B. We recognize the critical role of this committee in exercising program oversight and in authorizing the necessary taxpayer dollars to make the program viable.

ADS-B, a Joint Planning and Development Office (JPDO) priority program, will deliver substantial benefit to the National Airspace System (NAS). ADS-B infrastructure will provide more accurate and more frequently updated ATC surveillance data supporting improved operation of today's Air Traffic Control (ATC) automation tools and providing the potential for reduced aircraft separation standards. ADS-B allows the installation of surveillance capability to areas currently without real-time aircraft tracking, providing increased safety and dramatically increased capacity and efficiency in these areas. The system provides a vehicle for the broadcast of safety services such as Flight Information Service – Broadcast (FIS-B) and Traffic Information Service – Broadcast (TIS-B) to the cockpit. Its capacity for dramatically increasing pilot situational awareness promises significant help to critical safety issues such as runway incursions. Finally, ADS-B is a critical enabler of the improved air traffic control procedures that will provide the increased capacity and efficiency essential to allowing the National Airspace System to service forecast demand. ITT is proud to be the FAA's partner in this vital initiative and welcomes the opportunity to participate in this important forum.

This statement addresses four topics. First, it provides a brief overview of ITT as a company and our experience in ATC technology. Secondly, it covers the FAA's procurement approach and the basis for the contract award to ITT. Then we address the structure of the contract and the features of the contract that we believe make it an ideal vehicle for assuring that ITT delivers, operates and maintains an ADS-B system that meets the nation's needs. Finally, it describes our Succession Plan, which is designed to ensure the vital national infrastructure deployed under our contract remains available for the purpose for which it is to be installed.

ITT Corporation is a global engineering and manufacturing company with leading positions in the markets we serve. ITT is a substantial firm generating $7.8B of sales in company fiscal year 2006. ITT is a global leader in water and fluid transport, treatment and control technology. The company also plays a role in defense and security with communications and electronics products; space surveillance and intelligence systems; and advanced engineering and services. It also serves the growing marine, transportation and electrical markets with a wide range of products. Of direct relevance to the ADS-B Program, the company is a major supplier of sophisticated systems, and provides advanced technical and operational services to a broad range of government agencies. Based in White Plains, New York, ITT employs approximately 35,000 people around the world.

The ADS-B Program will be executed within the Defense group of ITT Corporation. ITT Defense businesses are those that directly serve the military and government agencies with products and services. These include air traffic control systems, jamming devices

that guard military planes against radar-guided weapons, digital combat radios, night vision devices and satellite instruments. Approximately 44 percent of the sales in this segment are generated through contracts for integration, technical and support services that the company provides for the military and other government agencies. Headquartered in McLean, VA, ITT's Defense business employs approximately 16,000 people.

Within ITT's corporate experience base is a 60-year history of work in the air traffic control technology arena. ITT supplied the world's first military ATC surveillance system - the AN/MPN-1. Since that development, ITT has provided more than 1,500 ATC systems to the U.S. military and customers in over 35 nations. As a part of our ATC background, ITT has worked extensively with the FAA conducting research and study activities for advanced ATC concepts, providing engineering services, and developing products in use by the FAA. Contract activities for the FAA include:

- Significant seminal involvement in the application of satellite navigation technology to the National Airspace System (NAS), to include feasibility studies and the development of the test bed against which the Crows Landing flight tests that led to the Wide Area Augmentation System Program were conducted. ITT has manufactured every GPS navigational payload ever flown.

- Provision of thousands of person years of engineering services through support contracts that include our FAA Telecommunications Support Contract and its follow-on Telecommunications Service Management Engineering, Operation and Maintenance Contract, under which ITT has supported the implementation and operations of all FAA operational terrestrial communications.

- Extensive background in air/ground communications, beginning with our provision to the FAA of the VHF and UHF JUMP radios in the mid 1960s and continuing through our current prime Multi-Mode Digital Radio Contract, under which ITT is supplying the FAA's VHF replacement radio. Other air/ground activities include performing as a NEXCOM Design Competition Phase prime contractor and ongoing work in support of the ICAO-sponsored joint FAA/Eurocontrol Future Communications Study.

ITT , along with its teammates AT&T, Thales North America, WSI, SAIC, Sunhillo, PWC, Comsearch, Pragmatics, NCR, MCS of Tampa, Aerospace Engineering, ACSS and the Washington Consulting Group, is honored to have been selected to be the FAA's partner in the ADS-B Program, and through this program we will continue to serve the nation's air traffic control needs.

ITT was awarded the FAA's ADS-B Contract on August 30, 2007 after more than two years of preparation, which included more than one year of active participation in the procurement process. During our preparatory work, ITT conducted detailed analyses of the FAA's preliminary program requirements, developed a top-level architecture for meeting these requirements, and developed our strategic approach to the development or

acquisition of key system components. Additionally, ITT synthesized an Engineering Development Model (EDM) that validated our proposed approach. The EDM consisted of a radar system and ADS-B radios in California, an ADS-B radio in Herndon, VA, a weather data interface to our chosen weather provider WSI, a wide-area network provided by our partner AT&T, processing software and equipment in Herndon performing processing functions essential to meeting the FAA's requirements, and avionics equipment to validate system interoperability with airborne equipment. In addition to validating ITT's ADS-B design approach, the EDM provided an environment within which ITT performed pre-contract development as a measure to mitigate schedule risk should we be awarded the contract. All described pre-contract award activities were conducted at ITT's expense.

ITT believes the FAA is to be commended for the efficient and professional manner in which this procurement was conducted. Salient elements of this effort were the open and frequent communications that were facilitated with industry, the FAA's adherence to the process and schedule promulgated early in procurement activities, and the effective statement of government requirements.

The award to ITT was based on our offering to the government a cost-effective superior technical solution with no evaluated technical risk. Cost effectiveness in our solution has involved three principal factors. The first of these is our extensive use of existing facilities where feasible. This includes the hosting of our four control stations in existing AT&T data centers, the hosting of system monitoring equipment in existing AT&T network operations centers, and extensive use of existing tower infrastructure. The second cost effectiveness factor is an optimized system-siting approach. Finally, our innovative proposal for value-added services and the sharing of revenues for these services with the FAA will act to reduce FAA costs for system operation. Salient elements of our superior technical solution include:

- A flexible, scalable, safe and secure system architecture,
- Technical features to include multi-channel radios with power control features, sectorized antennas, data distribution algorithms, and system-siting to ensure the ability to operate within the current and future spectrum environment,
- Systems, processes and personnel to ensure very high system availability, and
- A large number of radio stations assuring system radio frequency coverage are provided where required.

We believe the awarded contract represents an optimum balance between allowing ITT the freedom to efficiently deliver a cost-effective system that meets the government's needs while providing the mechanisms for the government to exercise its responsibility for oversight and control of program implementation, operations, and maintenance.

The contract is divided into Contract Line Item Numbers (CLINs). CLIN 1 was awarded with the base contract. Under CLIN 1, ITT is required to design, develop, test and conduct limited field deployment of the system. The majority of the remaining CLINs are fixed-price contract options for nationwide deployment of the system and for

operations and maintenance of deployed infrastructure through 2025. These CLINs are to be exercised at the FAA's discretion.

CLIN 1 is a Cost Plus Incentive Fee (CPIF) contract element with cost-sharing provisions. The value of this contract is $207M. CPIF contracting is highly appropriate for a developmental effort allowing flexibility to ensure that the developed system will meet overall system requirements. It will maximize adherence to the FAA's special needs for safety, security and operation within the FAA's radio frequency spectrum environment. Under CLIN 1, ITT will be required to conduct a Preliminary Design Review (PDR) which will review our subsystem architecture in detail with the government. It includes a Critical Design Review (CDR) which will review the details of our product baseline reflected in software and hardware design specifications and in the supporting detail required to build, operate, and maintain the ADS-B system. This process will allow full FAA visibility into the details of the system to be implemented. During CLIN 1, performance extensive system testing will be conducted. This testing will include factory acceptance testing to verify all detailed functional and performance requirements. It also includes key site acceptance testing (SAT), to verify all system functional and performance requirements, but in this case, in a field operational environment. This testing will ensure that ITT has delivered the system that the FAA has specified, i.e., the one that will meet the needs of the National Airspace System. The work of CLIN 1 will be completed in September of 2010. At this point in the program, the FAA will have achieved the in-service decision for all Surveillance and Broadcast Services and ITT will have under CLIN 1 installed 20 of the service volumes involving 340 radio stations.

The FAA has combined very strong financial incentive provisions with detailed government oversight through earned value management (EVM) reporting. This cost-plus-incentive-fee contract type, as combined with cost-sharing provisions, is an innovative contracting approach that provides very substantial incentive to ITT to perform the contract under or within budget. If ITT performs the contract under the target cost, this contract works like a normal CPIF contract with a 50-percent share ratio. Specifically, for every dollar that ITT performs under target (proposed) cost, we receive a 50-cent increase in target fee (profit) to a maximum allowable profit. If we perform at target cost, ITT will receive a modest incentive. The uniqueness of the contract is that for performance above target cost before the fee reduction associated with a normal CPIF contract occurs, ITT will be required to share in the cost overrun. Under this approach, ITT's profit is reduced very quickly, and ultimately ITT will incur monetary loss. In support of EVM reporting ITT has undergone an FAA-conducted Integrated Baseline Review (IBR) on Monday and Tuesday of this week. Additionally, in Segments 1 and 2 the FAA will employ a program control board (PCB) for active program control.

The PCB is a joint FAA/ITT body that functions to maintain system configuration management. It will monitor ITT performance against metrics and incentives and review and agree upon on, any safety and security changes that need to be incorporated into the system. It will review and agree upon proposed value-added services and mutually resolve any disagreements regarding responsibilities of the parties and their respective

programmatic issues. ITT believes the PCB construct to be a vehicle for ITT to work with the FAA and outside groups as true partners in the provision of the valuable ADS-B service. A charter for the PCB is being prepared currently and we hope to move toward its establishment in the near future.

CLINs 3 through 17 of the contract provide for the nationwide rollout of radio stations and the operation and maintenance of the deployed infrastructure. These are fixed-price contract elements. As for CLIN 1, the contract provides for significant FAA oversight and control of contractor behavior during ITT performance of these contract options. FAA oversight of contract performance during the system deployment process is facilitated by the PCB. ITT performance will be controlled through required ITT testing and independent FAA testing of each service volume installed. Under our contract, nationwide deployment will be complete in 2013. Government oversight during the system operational phase is provided through two primary mechanisms. These are ITT continuous monitoring and reporting of technical performance measures (TPMs) and FAA monitoring and certification of system data. Government control during this phase is exercised through the PCB, a system of financial incentives and disincentives tied to the TPMs and the operational phase, and ultimately the division of the contract into a series of options that the government can choose not to exercise.

Technical performance measures represent an innovative element on the part of the FAA in program and contract definition. For each required service, (TIS-B, FIS-B, ADS-B, and ADS-R) high-level parameters have been defined that set the standard as to whether the system is operating to needs in a given service volume. This innovation creates two tiers of requirements – the detailed tier reflected in the system specifications and interface control documentation and a higher-level tier reflected in the TPMs that has a view above the details of bits and bytes to the quality of the overall service. TPM requirements are established for each service in each service volume for update rate, latency, and availability. ITT has proposed, and will implement in our architecture, features to measure and report to the FAA on an ongoing basis these parameters for each service volume.

In addition to ITT proposed monitoring and reporting of TPMs, the FAA has required that ITT provide regular reporting of system performance via periodic, near real-time (less than 1 second old) delivery of system status messages to the FAA service delivery points. These status messages allow the FAA to independently evaluate system performance and allow the certification of data for air traffic control use. This separate mechanism is entirely under FAA control and provides an independent check of ITT reported performance.

During the procurement phase, the FAA encouraged vendors to propose incentives and penalties for the operational portion of the program. ITT proposed and the government included into the contract incentives and penalties tied to the technical performance measures. If defined technical performance parameters are met or exceeded, ITT will receive an incentive for each service volume in which they are met or exceeded. If required TPM parameters are not met, ITT will forfeit a portion of the service volume

charge for the service volume(s) in which requirements are not met. As an example, if the ADS-B update interval parameter meets contract requirements for a month at a given service volume, that will result in a 2% incentive. Failure to meet required performance will result in either a 5, 10 or 20% penalty in proportion to the degree of shortfall during the period.

To summarize remarks about the contract – it allows, during the initial development and limited deployment phase - a period to ensure that the developed service fully meets defined requirements to include safety, security, and radio frequency spectrum constraints and provides significant financial incentives for contractor team performance to cost and schedule. During the full-scale deployment and operational phases it provides for continuous government monitoring and, again, significant financial incentives for performance. Finally, the Performance Control Board allows continuous involvement of the FAA in system development, deployment and operation.

There is also a mechanism established to ensure continuity of the service for which ADS-B assets are deployed. The FAA required vendors to submit succession plans as a part of their proposals. ITT's succession plan appoints AT&T as a successor to ITT. Under the plan, with the occurrence of a triggering event, action will be taken to transfer the asset base and novate the prime and subcontracts to AT&T. Our plan is supported by a Memorandum of Understanding entered into by ITT and AT&T committing the parties to required actions to effectuate the succession plan in the very unlikely event that action should be required.

In closing, I would like to reiterate that ITT and its industry team are proud to have been chosen to be the FAA's partner in this vital initiative. ITT and its contractor team are fully committed to the success of this program. We recognize the critical role of this committee in exercising program oversight and in authorizing the necessary taxpayer dollars to make the program viable.

Thank you again for the opportunity to appear before you today. I would be pleased to respond to any questions you may have.

Before the Committee on Transportation and Infrastructure
Subcommittee on Aviation
United States House of Representatives

For Release on Delivery
Expected at
2:00 p.m. EDT
Wednesday
October 17, 2007
CC-2007-100

Challenges Facing the Implementation of FAA's Automatic Dependent Surveillance – Broadcast Program

Statement of
The Honorable Calvin L. Scovel III
Inspector General
U.S. Department of Transportation

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to testify on the Federal Aviation Administration's (FAA) efforts to develop and deploy a new satellite-based technology called Automatic Dependent Surveillance-Broadcast (ADS-B). At the request of the Chairman, we are examining the risks to this important effort and the strengths and weaknesses of FAA's contracting approach.

As you know, FAA recently awarded a contract valued at $1.8 billion to ITT for the development, implementation, and operation of the ADS-B ground infrastructure. ADS-B is an important part of the FAA's plans for the Next Generation Air Traffic Management System (NextGen), but it must be considered along with other planned technologies and improvements. New routes, data link communications for controllers and pilots, new automation systems, and new procedures are also required to handle the expected growth in air traffic.

We recognize that ADS-B has potential to enhance capacity, improve safety, and fundamentally change the way air traffic is managed. However, a full disclosure of costs, expected benefits, and risks is needed. This is a complex, long-term effort that requires significant investments from both the Government and airspace users. Given FAA's history with developing new technologies and its approach for ADS-B, we believe that an extraordinary level of oversight will be required.

Today, I will discuss three major points.

- First, realistic expectations need to be set for what benefits ADS-B will deliver in terms of capacity and delay reduction. ADS-B will not provide near-term capacity benefits or relief from record-level delays at the Nation's most congested airports. FAA's plans call for the ADS-B ground infrastructure to be in place by 2013, and airspace users are not expected to be equipped with new avionics until 2020. FAA and industry groups do expect to see tangible benefits in the Gulf of Mexico in 2009 from using ADS-B where radar coverage is not available.

  It is important to note that FAA intends to mandate "ADS-B Out" usage[1] (the broadcast of position information from aircraft to ground systems), but the majority of benefits from the new satellite-based technology rely on "ADS-B In" and the display of this information in the cockpit. FAA is developing several air-to-air capabilities with United Parcel Service (UPS) that show considerable promise for enhancing pilot situational awareness. However, costs and other requirements for ADS-B In and cockpit displays, which could shift more responsibility to the pilot, are not clear at this time. FAA needs to provide

[1] FAA's Notice of Proposed Rule Making mandates the use of ADS-B for specific classes of airspace. Generally speaking, airspace users under air traffic control at high-altitude and high-density airspace must equip. According to FAA, military and other Government aircraft will have to equip with ADS-B.

Congress and the aviation community with a much clearer path for moving forward with ADS-B and realizing the potential capacity enhancing benefits from this satellite-based technology.

- Second, ADS-B has demonstrated important benefits in Alaska where radar coverage is limited, but its implementation in the continental United States, which involves supplementing and ultimately replacing radar, is a complex undertaking. Before FAA even considers the more advanced capabilities, (such as reducing distances between aircraft in congested airspace), ADS-B must demonstrate the same level of service that radar now provides.

  Our work shows that the widespread introduction of ADS-B faces a myriad of risks. These risks include user acceptance, frequency congestion concerns about the broadcast link for large transport aircraft, development and approval of air traffic procedures that can capitalize on ADS-B, and necessary adjustments to existing controller displays and related automation systems. All of these risks could materially affect the cost, schedule, and expected benefits of ADS-B.

- Finally, FAA has decided to rely on a service contract approach for ADS-B. This means that the Government will not own the ADS-B ground infrastructure but will pay for broadcast services. FAA will, however, own the data and certify the ADS-B service. This approach is expected to reduce cost and speed the introduction of new technology.

  We found that FAA intends to use several controls to help manage the contract, including techniques for measuring cost and schedule changes, performance metrics, and cost sharing arrangements for cost overruns. However, these controls are not fully in place; once they are established, FAA must execute them properly and hold the contractor accountable.

  An important oversight mechanism is the establishment of a performance control board for ADS-B. This board, comprised of FAA and contractor personnel, is expected to monitor ADS-B performance, review changes to the system, and mutually resolve disagreements. This board is not yet place, and its charter is not finalized. The comfort level with FAA's contracting approach will increase only when this board is firmly established and roles and responsibilities are clearly defined.

  Our work shows that key areas for FAA oversight include managing requirements and having the right in-house expertise and skill mix for effective management and oversight. This will be particularly important since FAA will not own the ADS-B hardware, software, or infrastructure. We are concerned that FAA could find itself in a situation where it knows very little about the system that is expected

to be the foundation of NextGen. FAA must take steps to ensure it effectively addresses this risk.

I will now discuss these issues in further detail.

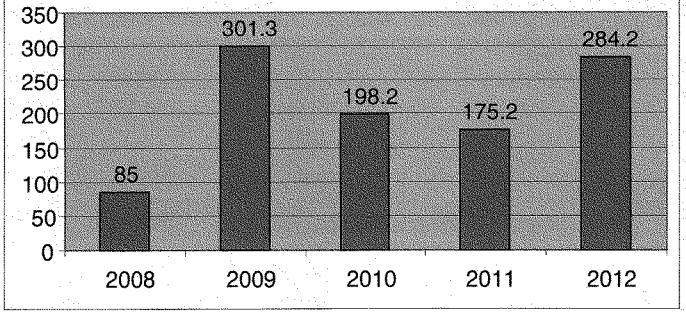
ADS-B Is a Key Enabling Technology for NextGen, but Realistic Expectations Need To Be Set for When Benefits That Enhance Capacity and Reduce Delays Can Be Realized

Nationwide ADS-B implementation is a challenge that will span well over a decade and require airspace users to equip with new avionics. FAA does not expect the ground infrastructure to be completed until 2013 or airspace users to be fully equipped with the ability to broadcast their position (ADS-B Out) until 2020. There are differences in what large commercial aircraft and general aviation aircraft operators are expected to purchase and install. A clear transition path for moving forward with ADS-B with well-defined costs and benefits does not yet exist.

FAA's Costs, Schedules, and Plans for Implementing ADS-B Nationwide

Currently, FAA estimates that ADS-B will cost the Agency about $1.6 billion in capital costs for initial segments of ADS-B implementation through 2014 (segments 1 and 2), which include the completion of a nationwide ground system for receiving and broadcasting ADS-B signals. The total life-cycle cost of the ADS-B effort is estimated to be about $4.3 billion; this includes $2.2 billion in capital costs that have not yet been formally "baselined." The following figure illustrates FAA's annual spending plans for ADS-B for the next 5 years.

Figure. ADS-B Spending Plan FY 2008 to FY 2012



Source: FAA Capital Investment Plan, dated September 18, 2007

FAA is pursuing ADS-B through a phased (or segmented) approach. Between now and 2011 (segment 1), FAA plans to complete ADS-B implementation in Alaska,

provide services in the Gulf of Mexico, initiate broadcast service on the East Coast (for general aviation users), and continue efforts to develop air-to-air applications with UPS at Louisville International Airport. FAA chose these sites because of prior ADS-B development efforts, existing ADS-B infrastructure, and the need to provide surveillance coverage where radar coverage does not exist.

Between 2009 and 2014 (segment 2), FAA plans to issue a final rule for mandating ADS-B usage by 2020, complete the ground infrastructure, and integrate ADS-B with existing FAA automation systems—all critical steps. Further refinement of additional air-to-air applications (for ADS-B-In) and the decommissioning of radars are planned for the 2015 to 2025 timeframe (segments 3 and 4). Plans for ADS-B- In are still being determined. Table 1 shows the key milestones for ADS-B implementation.

Table 1. ADS-B Key Milestones

Milestone	Projected Completion Date
Notice of Proposed Rule Making (NPRM) Issued	October 2007
Critical Design Review for the ground system	February 2008
Key Site "Initial Operating Capability" of Broadcast Services at Fort Myers	August 2008
Final Rule Published "ADS-B-Out"	November 2009
"Initial Operating Capability" in the Gulf of Mexico for Surveillance and Broadcast Services	December 2009
"Initial Operating Capability" at Philadelphia for Surveillance and Broadcast Services	February 2010
Complete ADS-B NAS-Wide Infrastructure Deployment	FY 2013

Source: ATMAC ADS-B Work Group Status Briefing, September 5, 2007

FAA will implement ADS-B in the United States via two separate broadcast links. FAA selected these two links in 2002 to provide a targeted level of service for specific user groups.

- FAA expects that air carrier and commuter fleets will equip with the "1090" MHz extended squitter (or 1090-ES). Currently, the 1090 MHz frequency band is already allocated for use by secondary surveillance radar and the Traffic Collision and Avoidance System (TCAS).[2] Consequently, this frequency is somewhat congested.

[2] The Traffic Alert and Collision Avoidance System (TCAS) is an airborne system developed by the FAA that operates independently from the ground-based Air Traffic Control system. TCAS was designed to increase cockpit awareness of proximate aircraft and serve as a "last line of defense" for the prevention of mid-air collisions.

- FAA expects that air taxi and general aviation fleets will most likely equip with the Universal Access Transceiver (UAT) developed by the Mitre Corporation, which operates in the 978 MHz frequency band. The UAT technology was used successfully for trials and demonstrations in Alaska during SafeFlight 21. Because of available bandwidth, it can accommodate graphic weather information and other data. Large commercial aircraft, which rely on weather radar and information from airline dispatchers, are not expected to equip with UAT technology.

Costs for Airspace Users To Equip With ADS-B Need Further Refinement

We have seen a wide variety of costs for airspace users to equip with ADS-B avionics, ranging from $1.3 billion to $7.5 billion. These generally exclude the costs for taking transport aircraft out of service to install new technology. FAA's estimates reflect considerable uncertainty and require further refinement.

Several factors affect the cost of equipping with ADS-B, such as the age and type of aircraft as well as what broadcast link different airspace users decide to purchase and the services they expect to obtain. Another factor is the position source of ADS-B, which may or may not require a new Global Positioning System (GPS) receiver or an upgrade for an aircraft's flight management system.

Another reason for cost uncertainty is that some large commercial aircraft are already equipped with ADS-B avionics (e.g., 1090 ES alternative) but many may not be compliant with the proposed rule for ADS-B, which is expected to be based on updated standards. FAA stated that all new aircraft being produced by Airbus and Boeing will be delivered with the capability to broadcast ADS-B information without modification.

While FAA will mandate usage of ADS-B Out for most classes of controlled airspace, it expects that airspace users will *voluntarily equip* with additional capabilities associated with ADS-B In. This complicates the cost equation even further. The following illustrates the range of costs for airspace users that FAA has developed thus far.

- **Air Transport Aircraft ("1090" MHz extended squitter):** Average unit costs for ADS-B Out range from $32,000 to $174,000 per aircraft. FAA estimates the incremental costs for ADS-B In (depending on display requirements) to range from $162,000 to $670,000 per aircraft.

- **General Aviation (UAT technology):** Average unit costs for ADS-B Out range from $7,600 to $10,900 per aircraft. FAA estimates the average cost for ADS-B In and Out to range from $10,444 to $29,700, depending on the aircraft type.

Because standards for ADS-B In are not mature, it is difficult to reliably estimate costs at this time. There is also the risk of continually changing standards during ADS-B development, and users may be wary of equipping too soon. FAA needs to continue to work with aviation stakeholders to refine ADS-B costs so that all airspace users can invest in necessary technologies with some level of comfort.

FAA Needs To Clarify ADS-B Benefits for Congress and Airspace Users

Airspace users have important questions about ADS-B benefits and the timeframe for when benefits can be realized. This issue will determine how quickly airspace users will install new avionics and will drive how long the transition to ADS-B will ultimately take. FAA needs to provide Congress and aviation stakeholders with a much clearer understanding of expected benefits and the steps needed to obtain them.

Experience thus far indicates that ADS-B is beneficial where radar coverage is limited or non-existent, such as in Alaska. In this environment, ADS-B has enhanced safety and proven valuable in search and rescue missions. The challenge is quantifying the benefits from ADS-B in the continental United States where radar coverage exists and exploiting new procedures that can enhance capacity and reduce delays.

In the near term, ADS-B will not provide capacity benefits or relief from record level delays at the Nation's most congested airports. The first stage of ADS-B implementation will be limited to specific geographic locations, including Alaska, the Gulf of Mexico, and select airports on the East Coast. FAA and the industry expect to see tangible benefits from ADS-B in the Gulf of Mexico from reduced separation between aircraft (from 50 miles to 5 miles) in airspace where radar coverage is limited. There are important distinctions between ADS-B Out and ADS-B In technologies and their expected benefits.

ADS-B Out: This refers to the broadcast of ADS-B information from the aircraft to FAA ground systems. The principal benefits focus on providing a more accurate source of an aircraft's position (than radar) for controllers to manage traffic. FAA also expects to see significant savings from decommissioning large numbers of secondary surveillance radars around the year 2020.[3] However, FAA cannot decommission radars until all aircraft are equipped to broadcast their position.

ADS-B Out is expected to provide "radar-like" separation services—not a reduction in existing separation standards. Coupled with new automation, FAA expects ADS-B to allow for more efficient merging and spacing of traffic and far better detection of conflicts between aircraft. The productivity enhancements for controllers have not yet

[3] Both FAA and the Department of Defense operate radars in the National Airspace System. FAA does not plan to decommission primary radars (which require no equipment on an aircraft). FAA's plans focus on decommissioning some secondary surveillance radars. This system transmits pulses that elicit a response from transponders on the aircraft. The information is then portrayed with a data tag on the controller's display.

been quantified. FAA also expects to realize more efficient management of the airport surface by linking ADS-B with existing runway safety technologies. However, these benefits depend on ADS-B performance being equal to or better than radar. They will also depend on procedure development and significant changes to existing automation systems.

ADS-B In: This refers to the receipt and display of traffic information in the cockpit. This is where the most benefits from ADS-B are expected, particularly with respect to enhancing capacity at congested airports. However, it also requires a cockpit display. FAA will not mandate usage of ADS-In or cockpit display but hopes that airspace users will voluntarily equip based on benefits.

At the most basic level, ADS-B In allows pilots to "see and avoid" other aircraft operating in their proximity. UPS has been instrumental in pioneering ADS-B and the first generation of cockpit display applications for enhanced "see and avoid" capabilities, and it will continue to provide testing for advanced air-to-air and air-to ground applications over the next several years.

When ADS-B information is displayed in the cockpit, it greatly increases pilot situational awareness in all phases of flight. A cockpit display of information would also allow pilots to make better use of runways in bad weather. This could also improve safety of busy runways and taxiways by providing a "second set of eyes" in the cockpit. FAA needs to establish how these improvements for enhanced situational awareness can be implemented, what level of certification for displays will be required, and which locations would receive the most benefits.

Promising but long-term applications for aircraft self-separation and fundamentally changing current air traffic concepts, roles, responsibilities, and procedures depend on users having ADS-B In and a robust, certified cockpit display. The technical requirements for ADS-B In that would allow for self-separation (and a reduction in separation) have not been finalized. Further, air and ground systems will have to be certified to exacting standards. The full potential of ADS-B In will also require consideration of human factors, such as new procedures for pilots and changes to procedures both in the cockpit and on the ground.

Nationwide ADS-B Implementation Faces Several Risks That Must Be Mitigated

ADS-B implementation in the continental United States is a complex undertaking that will require coordinated investments between FAA and the industry over the next decade. Our review identified five major risks that will have a direct bearing on the cost, schedule, and expected benefits of ADS-B: (1) gaining stakeholder acceptance and aircraft equipage, (2) addressing broadcast frequency congestion concerns, (3) integrating ADS-B with existing systems, (4) implementing procedures for separating

aircraft based on ADS-B, and (5) assessing potential security vulnerabilities in managing air traffic with ADS-B.

Gaining Stakeholder Acceptance and Aircraft Equipage

Although most stakeholders agree that ADS-B is part of the future, FAA is concerned that the costs associated with equipage may generate opposition from stakeholders. FAA believes that this is the biggest risk to ADS-B implementation.

Because all airspace users must equip with ADS-B to get benefits and probably would not voluntarily equip, FAA intends to rely on a rulemaking initiative to mandate ADS-B equipage. FAA published the Notice of Proposed Rule Making (NPRM) earlier this month and plans to issue a final rule in the 2009 to 2010 timeframe. As noted previously, FAA intends to mandate usage of ADS-B Out, not ADS-B In.

There is justifiable skepticism in the aviation community about advancing revolutionary technologies and equipping with new avionics because of past experiences. FAA cancelled a Microwave Landing System in the 1990s because of industry concerns and opposition. More recently, FAA cancelled the Controller-Pilot Data Link Communications Program in 2003 because of uncertain benefits, technical problems, and cost growth issues. Stakeholders are concerned that ADS-B could become another situation where some industry members equip and FAA never follows through with the requisite ground infrastructure or mandate.

In response to the industry's desire for more input, FAA established an Aviation Rulemaking Committee (ARC) in July 2007. The ARC is comprised of 20 government and industry representatives and is chartered to review the NPRM and make recommendations to FAA for structuring an ADS-B mandate. After the release of the NPRM, this group is expected to make specific recommendations about proposed ADS-B requirements.

Because ADS-B benefits are not clearly defined for airspace users, many in the industry and FAA believe that incentives will be required to help spur aircraft equipage. Industry groups have suggested that these incentives could include an investment tax credit, an adjustment to current excise taxes for ADS-B-equipped aircraft, or research and development tax credits specifically for avionics manufacturers. Whether or not incentives should be used is a policy decision for Congress, but we think full consideration of their timing and impact is needed.

Addressing Frequency Congestion Concerns for the Broadcast of ADS-B for Transport Aircraft

There is concern that the frequency planned for large commercial carriers (1090 MHz spectrum) will become overcrowded with the addition of ADS-B signal traffic. Currently, the same frequency is used by FAA and airspace users for other important

systems, which include ground-based secondary radar, runway incursion systems, and aircraft collision avoidance systems. This is one reason that FAA decided to rely on two separate frequencies for ADS-B.

As FAA points out, without proper control of the 1090 MHz spectrum, the performance and benefits of ADS-B will be diminished. Conversely, the broadcast of ADS-B in this frequency range could have unintended consequences and affect the effectiveness of existing systems. FAA plans to research the impact of and potential solutions for frequency congestion for ADS-B and other users of the 1090 MHz spectrum in congested airspace.

Integrating ADS-B With FAA's Existing Automation Systems

Nationwide ADS-B implementation will require FAA to significantly modify existing automation systems (e.g., controller displays, software, and related computer equipment) in both the terminal and en route environments. It will also require adjustment to the format of flight plans so that ADS-B aircraft are properly identified.

Currently, most automation systems do not process and display ADS-B information. If existing controller displays and related equipment are not modified, air traffic surveillance applications for ADS-B cannot be used.

All of FAA's automation platforms that controllers rely on for separating aircraft will require software modification to accommodate ADS-B. This includes the $2.1 billion En Route Automation Modernization effort that is modernizing the displays, hardware and software that controllers use to manage high-altitude traffic. It also includes modifying the Standard Terminal Automation Replacement System and Common Automated Radar Terminal System, which controllers use to manage traffic in the vicinity of airports.

An important step to realize the benefits of ADS-B is the development and implementation of "fusion." Fusion in this context is defined as taking all surveillance data available for an aircraft and using the best data or combination of data to determine aircraft position and intent. Industry groups have asked FAA to accelerate its work on fusion. FAA needs to determine requirements for fusion and the best approach for implementing it.

Developing, Certifying, and Implementing Procedures for Separating Aircraft Based on ADS-B Information

For ADS-B to successfully transition into the National Airspace System, FAA must be able to confirm that it can provide a level of service with ADS-B that is at least as good as, if not better than, the level it now provides using radar to safely separate aircraft.

It is important to note that FAA is focusing on providing radar-like services from ADS-B in the near term, not reducing existing separation standards. To meet existing criteria for separating aircraft, ADS-B must provide services that allow 5 nautical miles in the en route environment; 3 nautical miles in the terminal environment; 2.5 nautical miles on approach; and 1.5 nautical miles on staggered, dependent approaches. The most stringent criteria focus on 4,300-foot spacing on parallel, independent approaches.

Because of concerns about whether or not ADS-B could provide equivalent service, FAA sponsored research and modeling that examined the use of radar and ADS-B targets for separating air traffic. This research was performed by the Massachusetts Institute of Technology/Lincoln Labs, the Johns Hopkins University/Applied Physics Laboratory, and the Mitre Corporation. The studies show that ADS-B should be able to provide surveillance that is at least as good as radar if not better. However, automation systems will need to compensate for differences in ADS-B and radar update and error rates. This issue underscores the need for fusion.

However, ADS-B performance must be demonstrated and tested in a real-world environment. Also, FAA must validate and certify ADS-B procedures. Full achievement of ADS-B potential will also depend on enhancements to existing automation platforms. However, it will be difficult to ask users to equip with new avionics until FAA has systems and procedures in place that provide at least the same level of service they receive through radar.

Assessing the Potential Security Vulnerabilities of Using ADS-B for Managing Air Traffic

Because ADS-B makes the position of aircraft in flight generally available, a security assessment is needed to determine risks and appropriate countermeasures. There are several specific concerns noted in FAA planning documents, including unauthorized use of ADS-B information for introducing false targets into the system. We believe a full discussion of ADS-B security and potential vulnerabilities is inappropriate in an open forum.

FAA needs to continue to work with the intelligence community and the Departments of Defense and Homeland Security to ensure that concerns about ADS-B security are adequately addressed. Failure to address these concerns early in the program could result in cost increases and schedule delays to the ADS-B effort. Given that ADS-B is expected to be the foundation of NextGen, it is better to have a full understanding of security risks sooner rather than later.

FAA's Contracting Approach for ADS-B Requires Robust and Extraordinary Oversight

Over the years, we have emphasized the importance of strong FAA oversight of contracts to protect the Government's interests. While FAA intends to use several important controls to manage the ADS-B contract; including cost, schedule, and performance metrics; they need to be fully implemented and should hold the contractor accountable. A key mechanism for oversight—a performance review board—is not yet in place. We identified several areas that are essential for governance and oversight of the ADS-B contract.

FAA Relies on a Service-Contract Approach for the Development and Implementation of ADS-B

FAA is relying on a service contract, which means it will not own the ADS-B ground infrastructure. FAA will own the data transmitted between aircraft and the ground but not the hardware, software, or ground stations. In a more traditional acquisition, FAA would specify the functional design and hardware deliverables and would ultimately own the equipment.

FAA believes there are important reasons for relying on a service-based acquisition for ADS-B. First, FAA expects it to be less expensive because the Agency will not have to own and maintain ground systems. FAA's data suggests that a service approach for ADS-B would cost $800 million less than a traditional acquisition approach. We have not validated these estimates. Table 2 compares the cost for relying on traditional acquisition versus a service contract for ADS-B.

Table 2. Cost Differential From FAA Ownership and Service Approach
($ in Millions)

Cost Element	Traditional Government-Owned Approach	Service Provider Approach	Expected Cost Savings
Facilities and Equipment Costs	$ 1,799.30	$ 1,445.20	$ 354.10
In-Service Management Costs (Operations & Maintenance)	$ 1,946.30	$ 1,478.70	$ 467.60
Total	**$ 3,745.60**	**$ 2,923.90**	**$ 821.70**

Source: FAA's Surveillance and Broadcast Service Program Office, May 2007

Also, FAA states that the service-based approach offers an opportunity for the Agency to make use of commercially available equipment, land, or services that the contractor already has in place. Further, FAA states that this approach increases the likelihood of meeting cost and schedule milestones.

Nevertheless, a service contract is not a "silver bullet" for implementing ADS-B in the United States. We think the transition to ADS-B will be driven by stable requirements (for air and ground components), new procedures, and user benefits (from purchasing new ADS-B avionics) rather than the contracting vehicle.

The ADS-B Contract Structure Includes Both Cost-Plus and Firm-Fixed Price Elements

The ADS-B contract is a complex vehicle worth $1.8 billion that will span 18 years, if all options are exercised. The first 3 years of the contract focus on developing the ADS-B ground infrastructure including 340 ground stations and 4 master control stations. In reality, the ADS-B contract is a combination of contracting mechanisms, including a cost-plus incentive fee arrangement for the development of the ground system, subscription fees for ADS-B broadcast services, and time and materials arrangements for engineering work. Table 3 breaks out the contract elements with associated costs.

Table 3. Elements of the ADS-B Contract

Supplies /Services	Contract Type	Costs
Development and Installation	Cost Plus Incentive Fee	$ 207,576,480.00
Equipment Charges	Firm Fixed Price	$ 30,952,941.00
Engineering Services	Time and Material	$ 4, 500, 000.00
Subtotal		**$ 243,029, 421.00**
Options (Segments 1 and 2)	Subscription Charges	$ 1,502,634,179.00
Program Management for Segment 1 & 2	Firm Fixed Price	$ 84, 823, 266.00
Engineering Services	Time and Material	$ 34,504,404.00
Subtotal (FY 2010 – FY 2025)		**$ 1,621,961,849.00**
Grand Total		**$ 1,864,991,270.00**

Source: FAA /Surveillance and Broadcast Services, ADSB Contract, August 2007

FAA's Contract Has Important Controls, but They Must Be Fully Implemented and Used To Hold the Contractor Accountable

We found that FAA's contract for ADS-B has controls that are important for managing and overseeing a complex acquisition. For example, the contract calls for the use of Earned Value Management[4] to monitor progress in meeting cost and schedule targets. According to the contractor, it does not currently have a certified

[4] Earned Value Management System (EVMS) is a management tool that provides for integrating technical, cost and schedule information about contract performance. This information enables the FAA to proactively manage contracts.

Earned Value Management System in place to provide reliable data, but efforts are underway to certify the system. Also, FAA is planning to use performance metrics, such as "service availability" to assess how well the service performs with respect to performance standards.

In the event of cost increases with the development and installation of ground systems, the contract calls for a cost sharing; this means that FAA will pay 85 percent of cost overruns and the contractor will pay for 15 percent. However, most of the risk with the development of a ground system (under a cost-plus arrangement) lies with the Government.

Because the contract was signed in August and work has just begun, it is too early to evaluate the effectiveness of these controls. FAA needs to fully implement them and hold the contractor accountable.

During congressional hearings this past spring, valid concerns were expressed about continuity of service; specifically, if there should be a change of contractor and thus a change in ownership of ADS-B infrastructure. In response, FAA placed two clauses in the contract that seek to address these issues.

Specifically, in the event of bankruptcy, acquisition by another entity, or events that jeopardize service, the contractor is directed to establish a *succession plan*, where at least one member of the team (other than the prime contractor) is deemed to have the necessary resources to perform the contract. Also, the contract gives the Government the right to require continued contract performance for up to 2 years to facilitate transition to an alternative service provider.

A succession plan is particularly important given the contract's potential span of 18 years and the unknowns about how quickly airspace users will equip. In a memorandum of agreement, ITT designated AT&T as the successor for the ADS-B ground system. We have not yet reviewed the details of this plan or how it would work in practice. Therefore, we are not in a position to discuss the plan's strengths or weaknesses. FAA should alert Congress immediately of significant changes in the financial status of the contractor and the actions it is taking to prevent disruptions of service.

Performance Oversight Board for ADS-B Services Is Not Yet in Place

An important part of FAA's governance of the ground infrastructure is the establishment of *a performance control board*, which will be comprised of Agency and contractor personnel. This board is expected to monitor the ADS-B system, compare contractor performance against metrics, review changes to the system, mutually resolve disagreements, and resolve programmatic issues.

However, the board has not been established, and its charter has not been finalized. According to FAA officials, there is some discussion about expanding membership to include aviation stakeholders. The comfort level with FAA's contracting approach will increase only when the board is fully established, membership is finalized, and roles and responsibilities are clearly defined. There should be no substitute for strong Government oversight.

An Extraordinary Level of Oversight of ADS-B Development and Implementation Will Be Required

Over the years, we have documented numerous problems with major FAA acquisitions that led to cost increases, schedule delays, diminished cost savings, or unmet expectations. Problems are directly traceable to poor contract oversight, among other things. The need for strong oversight for ADS-B is amplified by the fact that FAA has never before relied on service contract for introducing a revolutionary technology into the National Airspace System.

Recent experiences with the FAA Telecommunications Infrastructure (FTI) program and efforts to transition flight service stations operations to Lockheed Martin, underscore the importance of strong Federal oversight. An important lesson learned is the need for strong oversight and greater insight into contractor efforts and problem resolution. With the FTI and flight service stations efforts, the objective was to replace a clearly defined service that was already in place. ADS-B, on the other hand, is the development and installation of services that will become the foundation of NextGen.

Because successful ADS-B implementation requires air and ground elements—owned and operated by different entities—to perform at a high level, a different model of FAA oversight for modernization efforts will be required. The Air Traffic Organization must change its role from providing a service to providing direct, sustained oversight. We believe that several specific areas will require oversight.

The nationwide implementation of ADS-B ground infrastructure is a significant undertaking. According to ITT, the schedule is aggressive but achievable. Currently, FAA and ITT estimate that approximately 800 ground stations (with ADS-B software radios) will be required to provide service to over 320 segments of airspace, or "service volumes." For example, each major airport constitutes a specific service volume; FAA estimates that about 60 service volumes will be required to provide surveillance for the Nation's 20 facilities that manage high-altitude traffic.

Requirements for ADS-B are still evolving, and there could be considerable changes that have significant cost and schedule implications. Costs associated with changing requirements will be the responsibility of the Government, not the contractor. Because FAA will rely on two links, it must re-broadcast the ADS-B

information to all aircraft to get the benefits from ADS-B In. It is important to ensure that different aircraft (equipped with different broadcast links) can "see" each other. This capability is referred to as Automatic Dependent Surveillance-Rebroadcast, or ADS-R. The timely delivery of ADS-R signals will be necessary to enable advanced applications. FAA officials told us that some development will be required and that some changes to requirements should be expected.

As FAA points out, much work remains to refine requirements for ADS-B In. Because ADS-B relies on air and ground elements, changes can be expected to on-board avionics, FAA automation systems, and ground systems. At this stage, it would be unrealistic to assume that there will be no changes to ADS-B requirements.

As ADS-B usage evolves and pilots begin to rely on the system, complex safety and certification issues will have to be addressed that could have profound cost implications. A case in point is FAA's experience with the Wide Area Augmentation System, a satellite-based navigation system. We note that FAA's problems with this multibillion-dollar program were directly traceable to difficulties in certifying the satellite-based system.

FAA will need considerable in-house expertise to effectively monitor contractor efforts and conduct effective oversight of system performance over the long term. FAA must ensure that all 320 planned service volumes are working as intended on a regular basis. It will be difficult for the Agency to build and sustain sufficient in-house knowledge of how the system actually works and how problems are solved since it will neither own the hardware, ground stations, and related software nor be responsible for the operation and maintenance of the ground system. Further, much of the ADS-B infrastructure will be embedded in commercial equipment and networks. The key personnel skills that are needed for effective ADS-B oversight include telecommunications, signal processing, and knowledge of the GPS constellation. We are concerned that FAA could find itself in the unenviable position of knowing very little about a system that is expected to be the foundation of NextGen. FAA needs to determine what skill mix will be required for effective oversight.

FAA will allow ITT to sell "value-added services" to various aviation stakeholders. In essence, ITT will have a monopoly over providing ADS-B services for the next 18 years. The contractor must seek approval from FAA before releasing surveillance data, and the Agency is expected to provide criteria for filtering the data as necessary. Although these services are not yet well-defined, they could include enhanced weather products for specific regions (like the Gulf of Mexico) and subscription sales of traffic information. FAA officials commented that airports may be interested in purchasing information on aircraft position and location for better understanding of facility utilization and better surface management. FAA believes that these services will help reduce overall costs and accelerate avionics equipage.

Nevertheless, because ADS-B can provide highly accurate information on aircraft, FAA will have to exercise strong oversight of which data are being sold and what they are being used for.

Mr. Chairman, this concludes my statement. I would be happy to answer any questions you or other Members of the Subcommittee might have.

STATEMENT OF DR. AGAM N. SINHA
BEFORE THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION HEARING ON NEXTGEN: THE FAA'S AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) CONTRACT

October 17, 2007

DR. AGAM N. SINHA
SENIOR VICE PRESIDENT AND GENERAL MANAGER
THE MITRE CORPORATION
CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT
7515 COLSHIRE DRIVE
MCLEAN, VA 22102-7539

(703) 983-6410

STATEMENT OF DR. AGAM N. SINHA
BEFORE THE HOUSE COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION HEARING ON NEXTGEN: THE FAA'S AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) CONTRACT
October 17, 2007

Good afternoon Chairman Costello and Members of the Subcommittee. Thank you for inviting me to participate in today's hearing on NextGen: The FAA's Automatic Dependent Surveillance - Broadcast (ADS-B) Contract. My name is Agam Sinha and I am a Senior Vice President at The MITRE Corporation. I am also the General Manager of MITRE's Center for Advanced Aviation System Development (CAASD), which is the FAA's Federally Funded Research and Development Center (FFRDC).

After a brief overview of the motivation for and workings of ADS-B, I will discuss why ADS-B is a cornerstone of the Next-Generation Air Transportation System (NextGen). This will be followed by a high-level description of the benefits ADS-B could deliver in the NextGen timeframe, including some of the early benefits that will accrue to the Federal Aviation Administration (FAA) and the National Airspace System (NAS) users under the FAA's current ADS-B program. An estimate of ADS-B costs is presented followed by a summary of the main messages.

Motivation for ADS-B

ADS-B is a well-defined, long-tested and globally accepted system concept for air traffic control (ATC) surveillance. Today's ADS-B concepts originated over 15 years ago. Since that time, operational applications have been proposed and defined, standards have been established, and avionics and ground stations have been developed and tested. Although first made operational in the U.S., ADS-B now is being accepted and introduced around the world for ATC applications. It is used for tracking aircraft both while in flight and on the airport surface. Aircraft pilots and ground-vehicle drivers also use ADS-B to monitor positions and velocities of other aircraft and ground vehicles.

ADS-B provides improved aircraft location information over most other civil ATC surveillance systems, including airborne sensors used by the Traffic Alert and Collision Avoidance System (TCAS) as well as ground-based sensors such as en route and terminal radars and Airport Surface Detection Equipment (ASDE). The aircraft surveillance performance improvement of ADS-B is enabled through on-board position determination using the Global Positioning System (GPS) and its augmentation systems, such as the FAA's Wide Area Augmentation System (WAAS). Using GPS/WAAS, the position is accurate to within +/- 3 feet horizontally. Unlike radar, the position accuracy of ADS-B does not change based on the distance between the target and the sensor. While a radar's error in measuring the target's distance from the radar remains constant at approximately +/- 50 feet (based on modern radars used in the NAS, such as the Air Traffic Control Beacon Interrogator-6 [ATCBI-6] and the Airport Surveillance Radar-11 [ASR-11]), a

radar's error in measuring the target's azimuth (angle around the radar) varies from +/- 100 feet at 10 miles from the radar to +/- 500 feet at 40 miles from the radar. For air traffic management purposes, both ADS-B and radar[1] report an aircraft's altitude as measured by the aircraft's barometric altimeter, which is accurate to +/- 100 feet.

In addition to reporting a 3-dimensional position, ADS-B also reports an aircraft's or ground-vehicle's velocity – both speed and direction of movement. As is true for position information, the velocity information is determined by on-board navigation systems. This directly-reported velocity information is consistently more accurate than that which can be derived by the ground system based on successive aircraft position reports from radar.

A key distinction between ADS-B and radar is the update rate of aircraft position. ADS-B transmits position reports once per second, whereas terminal radars generate reports once every 4 to 5 seconds and en route radars generate reports once every 10 to 12 seconds. The faster position reporting can improve the display of target movement as well as the performance of software applications that use target reports as input.

ADS-B reports currently include information beyond a target's position and velocity, for example:

- International Civil Aviation Organization (ICAO) aircraft identifier, which is unique to each aircraft
- Information characterizing the accuracy and integrity of the reported position and velocity
- Other aircraft parameters, such as magnetic heading.

An aircraft's intended flight path could be included as information in future ADS-B messages to improve ATC services, including conflict prediction and resolution, metering, and route conformance monitoring. Draft standards have been defined for reporting aircraft intent information.

ADS-B ground stations can be sited and installed more easily than radars, permitting aircraft surveillance in heretofore inaccessible geographic locations, such as the Gulf of Mexico and Alaska. This ease of siting is based, in part, on the reduced size, weight, and power requirements of ADS-B ground station electronics, which require no moving parts and simpler antenna structures.

There are two fundamentally distinct types of ADS-B avionics configurations, commonly known as "ADS-B out" and "ADS-B in." "ADS-B out" describes a configuration in which an aircraft or ground vehicle transmits ADS-B reports but does not receive reports

[1] In this case and in other references to radar in this testimony, the radars of interest are Secondary Surveillance Radars (SSRs). SSRs interrogate transponders onboard aircraft for identification, altitude, and other information; they are a "cooperative" system. SSRs are more accurate and generally considered more informative than primary radars, which depend on radar signal reflections alone and thus are a "non-cooperative" system. Today, SSRs are the principal means of ATC surveillance.

from other aircraft, ground vehicles, or ADS-B ground stations. "ADS-B in" describes a capability in which an aircraft or ground vehicle not only transmits reports, per the "ADS-B out" description, but also receives reports from other aircraft, ground vehicles or ADS-B ground stations.

When "ADS-B in" is used, the information contained in the received reports typically is shown on an electronic display. For aircraft, the display is termed a Cockpit Display of Traffic Information (CDTI). Most cockpit displays are expected to be provided as part of multi-function displays. In addition to displaying traffic information, these displays can show graphical and textual weather information, as well as other flight information (e.g., pilot reports [PIREPs] from other aircraft and notices to airmen [NOTAMs]).

Cockpit Display of Traffic Information

Explanation of ADS-B

ADS-B is a form of surveillance in which an aircraft or ground vehicle continuously determines its own position and velocity and periodically transmits this information along with an identifier and other pertinent information for receipt by ATC, as well as by other aircraft and ground vehicles.

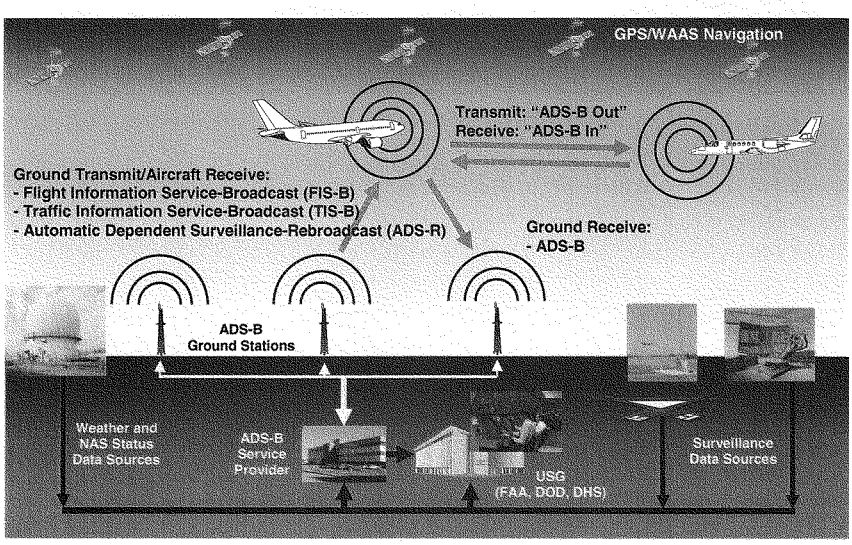
ADS-B transmissions are automatic. No pilot action is required, nor is any stimulus required from an external system (as is required for aircraft transponders, which only transmit in response to radar or TCAS interrogations).

ADS-B is a dependent system, in that it relies on the aircraft or ground vehicle to determine its own position and velocity. This information is determined by the aircraft's or ground-vehicle's navigation system. GPS augmented with WAAS is the preferred navigation reference source for aircraft because it provides the best accuracy, integrity, and availability of the sources available to pilots today.

ADS-B is a surveillance system which provides an aircraft's or ground-vehicle's 3-dimensional position (latitude, longitude, and altitude), velocity, identification, and other pertinent information.

ADS-B messages are broadcast for receipt by all ADS-B receivers in line of sight and within radio transmission range. The ADS-B receivers could be ADS-B ground stations as well as "ADS-B in" units on aircraft and ground-vehicles. The messages are transmitted over a digital data link which meets ICAO and FAA standards for ADS-B transmissions.

ADS-B Functional Diagram



ADS-B ground stations send the received messages to FAA-defined service delivery points. The service delivery points are located at or near air traffic control facilities, where automation systems process the ADS-B messages and generate air traffic displays for controllers, flow managers, and other positions. The messages also can be sent to other approved recipients, such as the Department of Defense (DOD) and the Department of Homeland Security (DHS). Authorized commercial entities can also receive ADS-B surveillance information; however, the information will be time delayed and appropriately filtered.

In addition to receiving ADS-B messages, the ground stations transmit Flight Information Services - Broadcast (FIS-B) and Traffic Information Services - Broadcast (TIS-B) messages. Flight information for the FIS-B messages, which can be processed and displayed by "ADS-B in" avionics, includes weather and non-control advisory information derived from various NAS information sources (e.g., the FAA's NOTAM system and Next-Generation Weather Radars [NEXRAD]). TIS-B is an essential service during the transition to ADS-B, as it allows aircraft equipped with "ADS-B in" to see other proximate aircraft that do not yet have any ADS-B capability, but are visible to other FAA surveillance systems. Since ADS-B can operate on either of two FAA-approved radio frequencies, 978 MHz or 1090 MHz, a ground broadcast service known as ADS – Rebroadcast (ADS-R) will cross-link information between users on different frequencies.

One critical design element of the ADS-B system is a backup concept for ensuring continuity of surveillance during system outages. Since ADS-B depends on the aircraft's navigation system, a potential point of failure is the navigation reference source – typically GPS augmented with WAAS. The FAA, working with government and industry stakeholders, examined several alternative backup concepts to mitigate the negative impact on ADS-B caused by a GPS outage. It was determined that the best option was to keep about half of the existing radars – enough to provide coverage at the 40 busiest terminal areas and all en route airspace over 18,000 feet above mean sea level.

Importance of ADS-B for NextGen

By 2025, the annual number of U.S. aircraft operations is expected to increase to 1.4 – 2 times today's level of 116 million. Some estimates are even higher depending on the business growth models of very light jets and shifts to smaller aircraft. The current air transportation system will not be able to accommodate this growth. NextGen is the U.S. Government's plan to modernize the NAS, addressing the impact of air traffic growth by increasing NAS capacity and efficiency while simultaneously improving safety, reducing environmental impacts, and increasing user airspace access. The FAA is implementing ADS-B as a cornerstone NextGen capability to enable a host of new user benefits. These benefits are achieved through a combination of new procedures and technologies deployed to better manage passenger, air cargo, general aviation, and air traffic operations.

NextGen Surveillance Information Services, including the improved surveillance accuracy, integrity, latency, and availability made possible by ADS-B, will enable:

- Reduced aircraft separation standards to improve NAS capacity
- Comprehensive tracking of aircraft and vehicles operating in the air and on the airport surface to improve safety, security, and operational effectiveness
- Improved access to underutilized airspace and airports
- Improved 4-dimensional trajectory information for better gate-to-gate aircraft operating efficiency and flight path conformance monitoring

- Flexible assignment of responsibilities on the ground and to the cockpit, as needed, to support distributed decision-making and workload balancing
- Adaptive, flexible spacing and sequencing of aircraft on the ground and in the air
- Improved collaborative air traffic management among flight and airport operators, service providers, and other stakeholders.

Add to these improvements the reduced weather impacts to traffic flow and airport access made possible by the use of an accurate weather picture and other advisory information shared between air traffic control and the cockpit (via FIS-B in appropriately equipped aircraft), and we can see that ADS-B is an enabler of several key NextGen capabilities.

Benefits of ADS-B

Expected ADS-B benefits are presented here in order of the needed avionics capability (the aforementioned "ADS-B out" and "ADS-B in"), then the geographical location, and finally the operational improvement. The total benefit values for those expected outcomes estimated from the years 2007 to 2035 total over $5B in present-value dollars.

About $400M of the expected $5B benefits pool are FAA savings due to avoidance of the costs of radar maintenance, upgrade, replacement, and new installations. A significant portion of these benefits comes after the effective date of a planned equipage mandate for "ADS-B out" avionics, circa 2020. It is at this time that some radars can start to be decommissioned by the FAA since ADS-B service will exist nation-wide for the affected airspace. (The ADS-B mandate will be defined by airspace class, and not all NAS airspace will require ADS-B equipage.)

Most of the expected $5B benefits pool, about $4.5B, is expected to accrue to NAS users – air transport and general aviation aircraft that can fly more efficiently, in greater numbers and to more places, and in a safer manner due to ADS-B.

Flying with the mandated "ADS-B out" avionics, pilots in the contiguous U.S. (CONUS), Hawaii, and Caribbean airspace currently covered by radar service[2] will be able to realize:

- More efficient en route conflict prediction and resolution capability, shaving miles off of flights due to fewer and shorter conflict maneuvers afforded by ADS-B position accuracies
- Improved runway throughput due to more efficient en route metering to arrival fixes afforded by ADS-B position and velocity accuracies
- More efficient ATC management of aircraft on the surface, and increased surface safety from upgrades to the Airport Surface Detection Equipment.

[2] With a few (regional) exceptions, ADS-B ground infrastructure "coverage" is targeted for areas currently afforded radar coverage since there is a desire by the FAA to not diminish radar-based ATC services in any portion of the NAS.

Flying with the mandated "ADS-B out" avionics, pilots in portions of U.S. airspace currently not covered by radar service will be able to realize (in addition to some of the aforementioned benefits):

- Increased Instrument Flight Rules (IFR) capacity due to the change from procedural to radar/ADS-B separation standards
- Lower-altitude route access based on ATC enabled by ADS-B surveillance
- Improved search and rescue services through better fleet monitoring afforded by ADS-B position reports.

Flying with voluntary "ADS-B in" avionics, pilots in the CONUS, Hawaii, and Caribbean airspace currently covered by radar service will be able to realize:

- Enhanced visual acquisition and conflict detection provided by displayed ADS-B surveillance reports of proximate aircraft
- Improved weather and NAS status situational awareness provided through FIS-B reports
- Enhanced visual approaches through the transfer of some aircraft spacing responsibility to pilots in select operations (e.g., CDTI-assisted visual separation [CAVS] and Merging and Spacing [M&S] operations)
- Improved airport surface situational awareness through the display of surface traffic (aircraft and ground vehicles) and airport maps on aircraft displays
- Better final approach and runway occupancy awareness through the display of arriving, departing and surface traffic, and an airport map.

Flying with the voluntary "ADS-B in" avionics, pilots in U.S. airspace currently not covered by radar service will be able to realize (in addition to some of the aforementioned benefits):

- Fewer aircraft accidents through improved traffic and weather situational awareness afforded by ADS-B, TIS-B, and FIS-B. (This benefit already has been demonstrated under the FAA's Capstone program in what had been a high accident rate area in southwest Alaska. Aircraft equipped with Capstone avionics experienced a decline in the cumulative accident rate relative to non-equipped aircraft of almost 50% from 1999 to 2006.)
- Increased access to remote locations through additional IFR approaches.

Additional ADS-B benefit potential exists, but its scope and magnitude are not fully known. Some of this potential exists in concepts in varying stages of exploration, while other concepts are yet to be defined. Some examples of the concepts being explored are:

- Improved approach operations in IMC, allowing throughput closer to that of Visual Meteorological Conditions (VMC) operations, due to "seeing" proximate aircraft on a CDTI, including:
    - paired approaches to closely spaced (700' to 1200') parallel runways in IMC

  - independent approaches to parallel runways down to 2500' spacing in IMC
- Improved departure operations in the most congested terminal areas by reductions in departure spacing afforded through delegation to flight crews
- Improved safety
  - in the air through enhancements to onboard collision avoidance systems
  - on the airport surface through direct cockpit warnings of potentially conflicting traffic
- Reduced controller workload through more equitable sharing of spacing and separation assurance responsibility between ATC and pilots.

There is a direct correlation between the concepts listed here and the previously estimated NextGen benefits. For these example concepts as well as others, it is important to maintain or start the necessary research and development in order to achieve timely implementation.

Cost of ADS-B

The FAA's cost for nation-wide ADS-B service through 2025 is estimated to be $1.9 billion. The NAS users' (exclusive of military aircraft) cost for 100 percent avionics equipage of "ADS-B in" capability is estimated to be $4.5 billion, although it is projected that not all users need or will elect to equip. A more likely scenario is that a mix of mandated "ADS-B out" and voluntary "ADS-B in" equipage costing users about $2.6 billion will materialize by the time the planned mandate takes effect in 2020 (at which time removal of legacy radars can begin). It is imperative that program implementation risks and resources for ADS-B and the other NAS systems it leverages be managed closely so that the full set of projected benefits can be achieved.

Summary

In closing, let me summarize my main messages:

- ADS-B is a well-defined, long-tested, and globally accepted surveillance technology that provides better performance than legacy technologies. Today's ADS-B concepts originated over 15 years ago. Since that time, operational applications have been proposed and defined, standards have been established, and avionics and ground stations have been developed and tested.

- ADS-B offers benefits in NAS capacity, efficiency, and safety. These benefits come from both mandated "ADS-B out" and voluntary "ADS-B in" capabilities and they accrue to both the FAA and NAS users. The initial set of applications enabled by the FAA's current ADS-B program is expected to generate benefits totaling $5B between 2007 and 2035.

- The timely realization of ADS-B benefits is dependent on achieving appropriate ground automation system upgrades, avionics equipage rates, and operational procedure development. It is important that these activities, in conjunction with a

strong commitment to ADS-B by the FAA and NAS user community, proceed in lockstep with the ADS-B ground infrastructure implementation. NAS users who choose to equip with "ADS-B in" capability instead of the minimum capability that will be required circa 2020 ("ADS-B out") can start to reap benefits early.

- ADS-B is a cornerstone capability for NextGen, as several of the key NextGen operational improvements require it. With its current ADS-B program, the FAA is taking a first step in transforming the NAS to accommodate NextGen. As this transformation unfolds, more ADS-B applications will be identified. The realization of these new applications will require continued emphasis on the necessary research and development to mature them as well as the identification of efficient means to implement the most promising ones in the NAS.

Mr. Chairman, this concludes my testimony. I would be happy to answer any questions the Committee may have.

U.S. House of Representatives
Committee on Transportation and Infrastructure
Washington, DC 20515

James L. Oberstar
Chairman

David Heymsfeld, Chief of Staff
Ward W. McCarragher, Chief Counsel

John L. Mica
Ranking Republican Member

James W. Coon II, Republican Chief of Staff

October 22, 2007

Dr. Agam N. Sinha
Senior Vice President and General Manager
Center for Advanced Aviation System Development
The MITRE Corporation
7515 Colshire Drive
McLean, Virginia 22102-7539

Dear Dr. Sinha:

On October 17, 2007, the Subcommittee on Aviation held a hearing on **NextGen: The FAA's Automatic Dependent Surveillance – Broadcast (ADS-B) Contract.**

Attached are questions to answer for the record. I would appreciate receiving your written response to these questions within 14 days so that they may be made a part of the hearing record.

Sincerely,

Jerry F. Costello
Chairman
Subcommittee on Aviation

October 17, 2007
Subcommittee on Aviation
HEARING on
"NextGen: The FAA's Automatic Dependent Surveillance – Broadcast (ADS-B) Contract

Questions for the Record
To:

Dr. Agam N. Sinha
Senior Vice President and General Manager
Center for Advanced Aviation System Development
The MITRE Corporation

1. Dr. Sinha, can aircraft safely be separated in airspace using ADS-B in an environment where some aircraft are equipped and some are not? In other words, do all aircraft in the same airspace need to be equipped with "ADS-B Out" for controllers to provide ADS-B separation services in that airspace?

2. Dr. Sinha, MITRE has been involved in developing ADS-B air-to-air capabilities with United Parcel Service (UPS) in Louisville, Kentucky. Would you explain what has been going on with UPS in Louisville?

3. Dr. Sinha, many have cited significant benefits from ADS-B air-to-air capabilities like those being demonstrated by UPS. What prevents similar ADS-B air-to-air applications from being used in congested airspace at airports like New York's John F. Kennedy?

CAASD

Dr. Agam N. Sinha
Senior Vice President
and General Manager

2 November 2007
F010-L-229

The Honorable Jerry F. Costello
Chairman, Subcommittee on Aviation
U.S. House of Representatives
Committee on Transportation and Infrastructure
2408 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Costello:

Enclosed is my response to the Questions for the Record for the Subcommittee on Aviation hearing on October 17, 2007, regarding NextGen: The FAA's Automatic Dependent Surveillance – Broadcast (ADS-B) Contract.

Please call me at 703-983-6410 if you have any questions regarding this response.

Sincerely,

Agam Sinha

Dr. Agam N. Sinha
Sr. Vice President and General Manager
Center for Advanced Aviation System Development (CAASD)

ANS efv

Enclosure

MITRE

Questions for the Record

Dr. Agam N. Sinha
Sr. Vice President and General Manager
Center for Advanced Aviation System Development
The MITRE Corporation

October 17, 2007
Subcommittee on Aviation
Hearing on "NextGen: The FAA's Automatic Dependent Surveillance – Broadcast (ADS-B) Contract"

Question 1: Dr. Sinha, Can aircraft safely be separated in airspace using ADS-B in an environment where some aircraft are equipped and some are not? In other words, do all aircraft in the same airspace need to be equipped with "ADS-B Out" for controllers to provide ADS-B separation services in that airspace?

Answer: All aircraft in the same airspace do not have to be ADS-B-equipped to receive air traffic control (ATC) separation services. A mix of ADS-B-derived and Secondary Surveillance Radar (SSR)-derived aircraft position information is planned for simultaneous display on U.S. air traffic controllers' screens for air traffic separation purposes. This operation, already approved for portions of Alaskan airspace, will be necessary in much of U.S. airspace as the national transition to ADS-B occurs.

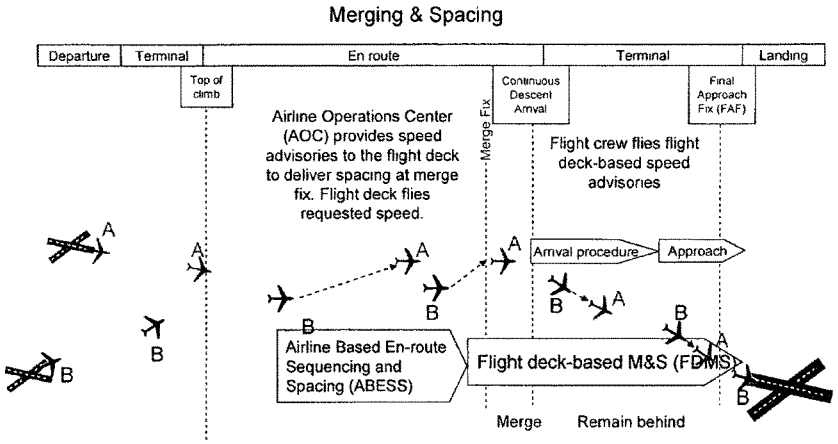
To ensure operational safety, thorough surveillance data quality requirements and safety assurance analyses for mixed-equipage operations are being defined by the FAA's ADS-B Separation Standards Working Group. As an initial application, ADS-B to SSR and ADS-B to ADS-B separation services were approved by FAA for Anchorage Center aircraft operations in summer 2007 based on analyses conducted by the Working Group. These analyses will be used as the starting point for broader approval in areas of higher aircraft density.

Question 2: Dr. Sinha, MITRE has been involved in developing ADS-B air-to-air capabilities with United Parcel Service (UPS) in Louisville, Kentucky. Would you explain what has been going on with UPS in Louisville?

Answer: UPS Boeing 757 and 767 aircraft have been equipped with "ADS-B in" and a Cockpit Display of Traffic Information (CDTI) depicting ADS-B and Traffic Alert and Collision Avoidance System traffic since June 2004. The equipment is currently approved for basic traffic awareness including "see and avoid in visual conditions" and "traffic awareness in all weather conditions." This additional traffic awareness provided by the CDTI has already allowed UPS to reduce its distance flown in the terminal area by approximately four miles in the standard landing configuration (FAA, 2005).

UPS has also tested Continuous Descent Arrival (CDA) procedures at Louisville International Airport, which allow an aircraft to remain at idle or near idle power during the en route arrival until approximately the Final Approach Fix. CDAs result in time and fuel savings as well as noise and emissions reductions (Clarke, et al, 2006) due to the elimination of step-down altitudes and the associated power changes. In order for CDA

efficiency gains to be realized, ATC interventions prior to descent as well as throughout the arrival need to be minimized. To accomplish this, a concept termed Merging and Spacing (M&S) has been developed that allow carriers to space and sequence their own aircraft in a manner consistent with ATC goals and requirements.



The M&S application is expected to allow UPS to realize the efficiencies inherent in CDAs by minimizing controller interventions in the UPS arrival stream. The initial M&S implementation will occur in a homogeneous, late night environment at Louisville and is comprised of two phases: a strategic ground setup phase and a tactical flight deck phase. The first phase is termed Airline Based En-Route Sequencing and Spacing and consists of UPS' Global Operations Center (GOC) using a new tool to determine the desired sequence and temporal spacing at a common merge fix for its arrival flow. Once the sequence and spacing intervals are determined, the GOC sends speed commands to company aircraft via the Aircraft Communications Addressing and Reporting System to achieve the desired goal. As the flight crew approaches the merge fix, the GOC will uplink an advisory that includes, at a minimum, the lead aircraft flight identification, the spacing interval in seconds, and the common merge waypoint for the aircraft pair. After the flight crew inputs this information into the on-board systems, the operation can transition to the second phase, designated Flight Deck-based Merging and Spacing (FDMS).

FDMS allows for active flight crew participation in achieving the desired spacing interval of the GOC and ATC. The main objective is to achieve consistent, low variance spacing intervals between aircraft pairs during arrival operations through flight deck-originated speed adjustments. FDMS provides for the use of on-board equipment and specialized algorithms to calculate and display information that allows flight crews to manage speed to achieve a desired spacing interval at and beyond a merge fix. The delivery of aircraft from FDMS should look similar to operations where ATC has metered traffic, except the aircraft are expected to have less variable and more consistent intervals.

FDMS is part of UPS' Gate-to-Gate Project (Hilb, 2006), and will be initially implemented at Louisville in their Boeing 757 and 767 aircraft in the near future. The 757 and 767 aircraft comprise about 40% of the total UPS fleet and are a majority of the aircraft that arrive in a late night arrival bank to Louisville. UPS plans to equip the remainder of their fleet by the fall of 2009.

In addition to the M&S activities, UPS and avionics vendors have jointly developed the CDTI Assisted Visual Separation (CAVS) (for use during visual approaches) and Surface Area Movement Management (SAMM) applications. CAVS is an extension of the current visual approach and separation procedures. In CAVS, the flight crew is authorized to use the CDTI, for the visual separation task, in lieu of Out-The-Window (OTW) contact with an aircraft on a visual approach. The CDTI may also be used to initially detect, monitor, and potentially reacquire the lead aircraft more effectively. If the CDTI fails or the target degrades or disappears from the display (and the target is not in visual contact OTW), the flight crew must contact ATC, as is currently done when the aircraft is lost from the visual scene. The only operational change from current procedures is the flight crew's use of the CDTI solely to maintain visual separation with the lead aircraft. CAVS is expected to provide an increase in capacity by allowing for near-visual approach capacities when these approaches otherwise would have been suspended. The SAMM application provides the flight crew with a surface map and an overlay of nearby traffic. Flight crews thus will have detailed information on encroaching traffic and surface obstacles, helping prevent runway incursions and other surface incidents. CAVS and SAMM implementation are expected in conjunction with M&S.

FAA (2005). *Technology development future surveillance sdf metrics update - January 2005*. Washington, DC: DOT FAA.

Clarke, J. P., Bennett, D., Elmer, K., Firth, J., Hilb, R., Ho, N., Johnson, S., Lau, S., Ren, L., Senechal, D., Sizov, N., Slattery, R., Tong, K., Walton, J., Willgruber, A., and Williams, D. (2006). *Development, design, and flight test evaluation of a continuous descent approach procedure for nighttime operation at louisville international airport*, Report of the PARTNER CDA Development Team, Report No. PARTNER-COE-2006-02. Available at http://www.mit.edu/people/liling/files/cda_rpt.pdf

Hilb, B. (2006). *Gate-to-gate project: implementing sequencing, merging, and spacing.* Presented at the Third ASAS-TN Workshop Glasgow, Scotland, 11th - 13th September 2006. Available at http://asas-tn.eurocontrol.fr/tn2wksp3/index.htm

Question 3: Dr. Sinha, many have cited significant benefits from ADS-B air-to-air capabilities like those being demonstrated by UPS. What prevents similar ADS-B air-to-air applications from being used in congested airspace at airports like New York's John F. Kennedy?

Answer: The initial trials in Louisville are feasible because UPS flies nearly all the late-night arrivals. Because of this fact, there is a fleet of homogeneously-equipped aircraft that can be exploited for the ADS-B applications mentioned earlier. While this type of operation may be applicable to other carriers in similar environments (e.g., FEDEX at Memphis), in large airports such as JFK, this homogeneity of equipage does not exist. Also, since different aircraft typically have different performance characteristics (e.g.,

optimum cruising speeds and altitudes) and operating limitations (e.g., wake vortex safe-separation requirements), efficiencies are necessarily lost in spacing a stream of non-homogenous aircraft. The aircraft flying in and out of JFK and other busy airports comprise many different types. Finally, while the M&S operations at Louisville require coordination between ATC and the UPS GOC; operations at busier, more closely-spaced airports would require coordination among a number of Airline Operations Centers dealing with a greater number of complicated, interconnected approach paths.

○