

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

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# **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<sup>1</sup> (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

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<sup>1</sup> 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 in 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.

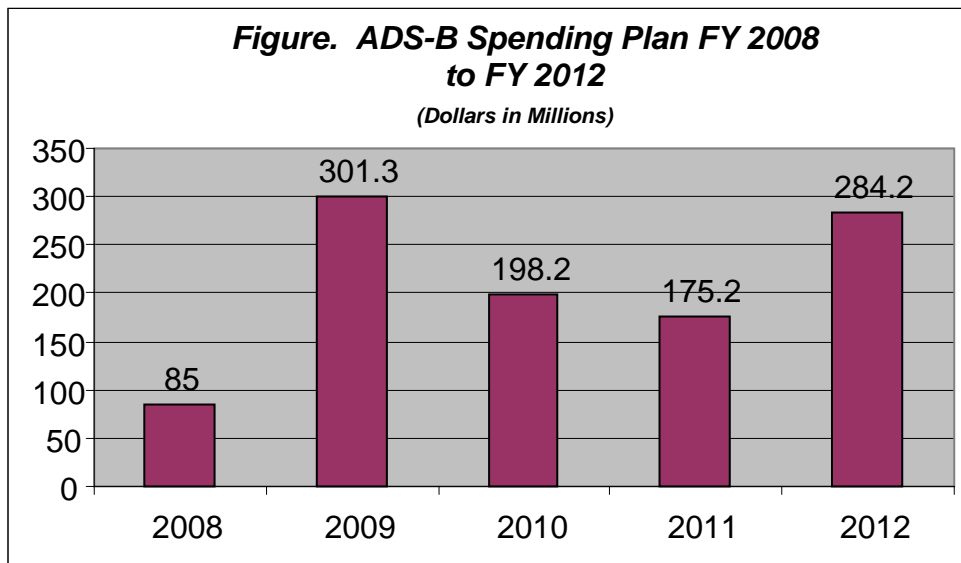
I will now discuss these issues in further detail.

### **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.



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).<sup>2</sup> Consequently, this frequency is somewhat congested.

<sup>2</sup> 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.<sup>3</sup> 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

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<sup>3</sup> 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
<b>Total</b>	<b>\$ 3,745.60</b>	<b>\$ 2,923.90</b>	<b>\$ 821.70</b>

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**

<b>Supplies /Services</b>	<b>Contract Type</b>	<b>Costs</b>
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	\$ <u>4,500,000.00</u>
<b>Subtotal</b>		<b>\$ 243,029,421.00</b>
<b>Options (Segments 1 and 2)</b>	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	\$ <u>34,504,404.00</u>
<b>Subtotal (FY 2010 – FY 2025)</b>		<b>\$ 1,621,961,849.00</b>
<b>Grand Total</b>		<b>\$ 1,864,991,270.00</b>

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<sup>4</sup> to monitor progress in meeting cost and schedule targets. According to the contractor, it does not currently have a certified

<sup>4</sup> 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.

The following pages contain textual versions of the graphs and charts found in this document. These pages were not in the original document but have been added here to accommodate assistive technology.

**Challenges Facing the Implementation of FAA’s Automatic Dependent Surveillance-Broadcast Program (ADS-B)**

**Testimony Before the Committee on Transportation and Infrastructure, Subcommittee on Aviation**

**508 Compliant Presentation**

**Figure. ADS-B Spending Plan, Fiscal Year 2008 to Fiscal Year 2012**

The figure data illustrates FAA’s annual spending plans for ADS-B for the next 5 years.

<b>Fiscal Year</b>	<b>Dollar Amount</b>
Fiscal Year 2008	\$85 million
Fiscal Year 2009	\$301.3 million
Fiscal Year 2010	\$198.2 million
Fiscal Year 2011	\$175.2 million
Fiscal Year 2012	\$284.2 million

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

**Table 1. ADS-B Key Milestones**

<b>Milestone</b>	<b>Projected Completion Date</b>
Notice of Proposed Rule Making Issued	To be completed October 2007
Critical Design Review for the Ground System	To be completed February 2008
Key Site for “Initial Operating Capability” of Broadcast Services at Fort Myers	To be completed August 2008
Final Rule Published on “ADS-B-Out”	To be completed November 2009
“Initial Operating Capability” in the Gulf of Mexico for Surveillance and Broadcast Services	To be completed December 2009
“Initial Operating Capability” at Philadelphia for Surveillance and Broadcast Services	To be completed February 2010
Complete ADS-B National Airspace System-Wide Infrastructure Deployment	To be completed fiscal year 2013

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

## **Table 2. Cost Differential From FAA Ownership and Service Approach**

Table 2 data compares the cost for relying on traditional acquisition versus a service contract for ADS-B.

- With the traditional government-owned approach, Facilities and Equipment Costs would be \$1,799,300. With the service provider approach, they would be \$1,445,200. Expected cost savings would equal \$354,100.
- With the traditional government-owned approach, In-Service Management Costs (Operations & Maintenance) would be \$1,946,300. With the service provider approach, they would be \$1,478,700. Expected cost savings would equal \$467,600.
- Totals: With the traditional government-owned approach, the total for both Facilities and Equipment Costs and In-Service Management Costs would be \$3,745,600. With the service provider approach, the total would be \$2,923,900. Total expected cost savings would equal \$821,700.

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

## **Table 3. Elements of the ADS-B Contract**

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 data breaks out the contract elements with associated costs.

1. Development and Installation Supplies and/or Services: The contract type for these services is a cost plus incentive fee contract. The cost for these services is \$207,576,480.00.
2. Equipment Charges Supplies and/or Services: The contract type for these services is a firm fixed price contract. The cost for these services is \$30,952,941.00.
3. Engineering Services: The contract type for these services is a time and materials contract. The cost for these services is \$4,500, 000.00.

The cost subtotal for these three items is \$243,029, 421.00.

1. Options Supplies and/Services (for Segments 1 and 2): The contract type for these services is a subscription charges contract. The cost for these services is \$1,502,634,179.00.
2. Program Management Supplies and Services (for Segments 1 and 2): The contract type for these services is a firm fixed price contract. The cost for these services is \$84,823,266.00.

3. Engineering Services (for Segments 1 and 2): The contract type for these services is a time and materials contract. The cost for these services is \$34,504,404.00.

The cost subtotal for these three items for the period of fiscal year 2010 through fiscal year 2025 is \$1,621,961,849.00.

The grand total for all of these ADS-B contract elements is \$1,864,991,270.00.

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