Automatic Dependent Surveillance-Broadcast (ADS-B)

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What is ADS-B?

Simply put, ADS-B is the future of air traffic control. Instead of using radar data to keep aircraft at safe distances from one another, in the future, signals from the Global Navigation Satellite System will provide air traffic controllers and pilots with much more accurate information that will help keep aircraft safely separated in the sky and on runways.

Eventually, with ADS-B, some of the responsibility for keeping safe distances between aircraft will shift from air traffic controllers on the ground to pilots who will have displays in the cockpits pinpointing all the air traffic around them, along with local weather displays.

How does ADS-B work?

ADS-B works by having aircraft transponders receive satellite signals and using transponder transmissions to determine the precise locations of aircraft in the sky.

The system converts 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.

The code containing all of this data is automatically broadcast from the aircraft's transponder once a second.

Aircraft equipped to receive the data and ADS-B ground stations up to 200 miles away receive these broadcasts. ADS-B ground stations add radar-based targets for non-ADS-B-equipped aircraft to the mix and send all of the information back up to equipped aircraft — this function is called Traffic Information Service-Broadcast (TIS-B). ADS-B ground stations also send out graphical information from the National Weather Service and flight information, such as temporary flight restrictions — this is called Flight Information Service-Broadcast (FIS-B).

Pilots see this information in their cockpit traffic display screens. Air traffic controllers will see the information on displays they are already using, so little additional training will be needed. ADS-B signals are transmitted once per second, providing a more accurate tracking system for pilots and controllers.

What are the benefits of ADS-B?

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. 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 will help reduce the risk of runway incursions. Both pilots and controllers will see the precise location on runway maps of each aircraft and even equipped ground vehicles, along with data that shows

where they are moving. These displays are clear and accurate, even at night or during heavy rainfall.

ADS-B will also increase capacity, because the more accurate tracking means aircraft will be able to fly safely with less distance between them. And, because ADS-B accuracy also means greater predictability, air traffic controllers will be better able to manage the air traffic arriving and departing from congested airports, resulting in even more gains in capacity.

With its combined increases in safety, efficiency, and capacity, and reductions in cost, 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.

Why adopt ADS-B?

Although radar technology has advanced, it is essentially a product of 1940s' World War II technology. Radar occasionally has problems discriminating airplanes from migratory birds and rain "clutter." Secondary surveillance systems can determine what objects are because they interrogate transponders; however, both primary and secondary radars are very large structures that are expensive to deploy, need lots of maintenance, and require the agency to lease land on which to situate them.

ADS-B, on the other hand, receives data directly from transmitters, rather than passively scanning for input like radars, so does not have a problem with clutter. ADS-B ground stations are inexpensive compared to radar, and are the size of mini refrigerators that essentially can go anywhere, so they minimize the required real estate. In addition, ADS-B updates once a second and locates aircraft with much higher precision.

ADS-B also provides greater coverage, since ADS-B ground stations are so much easier to place than radar. Remote areas where there is no radar now, like the Gulf of Mexico and remote areas in Alaska, will have precise surveillance coverage with ADS-B.

What has been done to lay the groundwork for ADS-B?

The FAA established the Capstone and Safe Flight 21 programs as joint government/industry initiatives to demonstrate the capabilities of advanced surveillance systems and air traffic procedures using ADS-B in a real-world environment.

To get preliminary assessments of the costs, benefits, operational safety and security, and architectural requirements for ADS-B, the FAA conducted a series of operational evaluations in Alaska and the Ohio Valley. RTCA (a scientific advisory group that assists the FAA on technical issues) developed the initial avionics standards for the new system, and the FAA conducted three joint government/industry meetings in 2001 to gather user and industry feedback.

Using the results of these evaluations, the FAA conducted a broad assessment of ADS-B technical link performance from 1999 through 2001 that resulted in the FAA's ADS-B "link decision" in June 2002. The link decision selected two ADS-B frequencies for use in the national airspace system — the 1090 Extended Squitter (1090 ES) and Universal Access Transceiver (UAT). The 1090 ES can be used by commercial aircraft, while UAT was selected for general aviation and vehicles.

Revisions and development of additional ADS-B avionics standards by RTCA followed in 2003 and 2004.

On September 9, 2005, the FAA officially committed to establishing ADS-B as the basis for air traffic control in the future. Moving to ADS-B will allow the agency to eventually decommission some of the current secondary radars in favor of a system that uses precise location data from satellites and provides greater benefits to everyone who uses the national airspace system. A reduced network of secondary radars will be maintained at high-density airports to ensure a back-up in case of a GPS outage.

What are the next steps?

The FAA has $165 million for fiscal years 2007 and 2008 to begin implementation of ADS-B in the national airspace system. This includes supporting and expanding the current ADS-B infrastructure in pockets of the United States and along the east coast, and integrating ADS-B surveillance into the FAA's current air traffic control systems.

With ADS-B, the FAA plans to let a vendor install and maintain the equipment, and the agency will pay "subscription charges" to the vendor, just as the agency today buys telcom services from telecommunications companies. This will reduce costs and give the agency greater flexibility. The agency issued its Request for Offers in March 2007 and expects to award the service contract in August 2007. The ground infrastructure should be ready for commissioning in 2010, with nationwide coverage expected to be completed by 2013. As the ADS-B infrastructure expands, vendors will likely use the system's capabilities to offer even more services to private pilots and airlines.

The agency also is working to issue a notice of proposed rulemaking that will mandate the avionics necessary for implementing ADS-B across the national airspace system. Under the proposal, operators would equip their aircraft with avionics based on the airspace in which they plan to operate. The FAA plans to issue this proposal in the fall of 2007 and expects the rule to be finalized in late 2009.

The full evolution of ADS-B will take up to twenty years, taken in four manageable segments of avionics equipage and ground-station installation, with half of the current system of radars maintained throughout to provide a back-up to the satellite system. However, benefits in improved safety and capacity, and better efficiency for users, will accrue with each step of the implementation.

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