

Making the Case

The business case for early equipage of aircraft with ADS-B is being beefed up

GRAHAM WARWICK/WASHINGTON

Build it and they will come, the saying goes, and as the FAA deploys its ground infrastructure, the question being asked with increasing urgency is when will operators equip to use Automatic Dependent Surveillance-Broadcast?

Show us the benefits, and help us with the costs, then we'll equip, is the airlines' response. Operators are also waiting for avionics requirements to stabilize, fearing early adopters will have to upgrade equipment one or more times before ADS-B is fully operational.

Unlike previous modernization efforts where most of the cost was in ground infrastructure, the FAA's Next-Generation Air Transportation System (NextGen) will require significant outlays by users to equip their aircraft. That shift in burden is focusing attention on the business case for equipage, and how quickly and reliably the benefits will return the investment. As a key enabling technology for NextGen, the rate of ADS-B adoption will set the pace for modernization. Too slow and the threatened consequence is gridlock.

The central dilemma for users is the mismatch in timescales for the ADS-B Out (transmit) capability required by the FAA for airspace surveillance and the ADS-B In (receive) applications that will bring advanced operational capabilities to the cockpit. "Out drives the equipage, In provides the benefit," acknowledges Vincent Capezzuto, FAA director of broadcast services.

The FAA's final rule, planned for April 2010, will mandate ADS-B Out installation by 2020. But operators want benefits sooner, to justify the cost of equipping, and that means accelerating ADS-B In. At the FAA's request, standards body RTCA established a task force in February to deliver by August a prioritized list of NextGen operational capabilities to be implemented by 2018, along with strategies for encouraging equipage and maximizing benefits.

Meanwhile, the FAA's infrastructure deployment "is laid out as an ADS-B Out

program with ADS-B In capability," Capezzuto argues. The first elements of the system to be declared operational—the ability to broadcast traffic and flight information, which the FAA calls "essential services"—are the start of ADS-B In, he says, and will enable improved situational awareness in the terminal area.

The FAA is also targeting specific operator circumstances where ADS-B can provide early benefits, and a template for wider deployment of the capabilities. The model is the work done by ADS-B pioneer UPS Airlines at its Louisville, Ky., cargo hub. UPS was the launch customer for avionics company ACSS, an L-3 Communications & Thales Company, and its SafeRoute suite of ADS-B In applications, which include cockpit display of traffic information (CDTI); surface area movement management (SAMM), merging and spacing (M&S) and CDTI-as-

sisted visual separation (CAVS). SAMM displays airborne and ground traffic in the terminal area on an airport moving map, while M&S optimizes runway capacity by allowing pilots to achieve and maintain a specified time interval between arriving aircraft.

SafeRoute was certificated on the airline's Boeing 757s in June 2007 and its 767s in July 2008, and UPS continues to build experience and mature procedures. Results so far are promising. Crews like the airport moving map and UPS has seen some of the expected fuel savings from merging and spacing on continuous descent approaches.

UPS initiated 50 merging and spacing flights in 2008, 36 of them successful, including one three-ship flight. Collective fuel savings for the last 25 min. of flight have been 21% for the 757 and 31% for the 767. "This is not robust data. We can't fully explain it," she says. "We will continue to mature arrival procedures from the west using 11 equipped aircraft, to get more robust fuel-saving numbers."

Separation between the lead and trail aircraft has varied from 4.8-7.3 naut. mi. at 150 or 145-sec. intervals, largely because of differences in pilot technique as well as headwinds. "We'll have to work to reduce variability," she says. The goal is to reduce the interval to 120 sec. to achieve Louisville's maximum capacity of 60 arrivals an hour on two runways.

Louisville controllers have been very cooperative, Lee says, but merging and spacing flights have not been frequent enough for them to get completely comfortable. "They're [used to] talking to us," she says. "And they have to be comfortable with us going to smaller intervals."

Building on UPS's experience, the FAA has signed a five-year memorandum of agreement with ACSS and US Airways to produce NextGen solutions for specific areas. The focus is on Philadelphia, with New York LaGuardia, Charlotte, N.C., and East Coast offshore airspace expected to follow, says Ron Thomas, the carrier's director of flight technical operations.

Under the agreement, an ADS-B working group is looking at surface conflict indication and alerting (SURF-IA) and in-trail procedures in addition to the M&S and CAVS tools already used by UPS. Under a \$6.3-million FAA contract awarded to ACSS to demonstrate runway incursion prevention, 20 US Airways Airbus A330s will be equipped with ADS-B, Class 3 electronic flight bags (EFB) and SafeRoute software.

The SURF-IA demonstration planned for Philadelphia in October-November will in-



ACSS's SafeRoute suite of ADS-B In software applications includes an airport moving map showing airborne and ground traffic, as here on an electronic flight bag.

volve one of the A330s and an ACSS-owned King Air also equipped with ADS-B and EFB. The SAMM airport moving map application will be modified to provide runway and taxiway conflict indications and alerts.

Tests will look at indications in normal operations: the A330 taxiing toward or parallel to the occupied runway; holding on the runway while another aircraft crosses down field; or the King Air approaching the runway where the A330 is in position and holding. Alerting tests will look at non-normal operations: the A330 taxiing toward the occupied runway and crossing the hold line; an aircraft entering the runway after the A330 initiates takeoff; the King Air on approach to a runway with conflicting traffic; and the King Air landing as traffic enters the runway ahead.

Thomas says proposed ADS-B tests include merging and spacing flights into Philadelphia. These would be initiated by the airline's operations center as air traffic control does not have the capability. "When they do, we will transfer it over," he says. Also planned are tests of in-trail procedures using ADS-B to allow the aircraft to change altitude outside radar surveillance. An Airbus test in 2008 showed the potential for a 350-lb. fuel-saving per Atlantic crossing. "We would like to validate that," he says.

The FAA is now negotiating an agreement with United Airlines to develop fuel-saving oceanic in-trail procedures on South Pacific routes between Australia and the U.S. About a dozen Boeing 747-400s would be equipped with ADS-B, with the FAA sharing some of the cost. United has 17 747-400s and 10 777s already equipped, says chief technical pilot Rocky Stone, primarily because of Nav Canada's decision to exploit existing ADS-B equipage to provide preferential routing through non-radar airspace over Hudson Bay.


With 70% of relevant aircraft using high-level airspace over Hudson Bay already carrying the required avionics, Nav Canada and its customers decided it would be cheaper to install ADS-B ground stations rather than radars to provide surveillance. Nearly 35,000 flights a year between the U.S. West Coast and Europe fly over Hudson Bay, where non-radar separation is 20 naut. mi. lateral and 30 naut. mi. longitudinal. ADS-B reduces this to 5 naut. mi., allowing Nav Canada to offer equipped aircraft fuel-saving trajectories.

"Our intent is to segregate airspace, but that needs a certain equipage level," says Nav Canada's Russ Bowie, director of air navigation service design. "At 70% eligibility we will segregate Flight Level 350-400 for ADS-B-only traffic." Eligibility means the aircraft are equipped, approved and their transponder address registered with Canadian controllers. "We have to ensure aircraft are eligible or they are not displayed as ADS-B targets," he says. "Only a fraction of equipped aircraft are eligible now, but we expect quite a few more in the next few months."

Boeing is encouraging the FAA to find similar ways to use current equipage while refining standards for both ADS-B In and Out. "We need to find benefits sooner and take care of In and Out in one standard," says Michael Lewis, director of business development for air traffic management initiatives. "The current ADS-B Out situation is that airlines must equip by 2020 to a TBD standard for TBD operational use and may see TBD benefits. The ADS-B In situation is less clear."

There are several standards of ADS-B-capable 1090-MHz. transponders already in use, from the early DO-260 units in the 747 and 777 to the current DO-260A in the A380 and 787. Europe is to base its 2015

ADS-B mandate on the latest version of DO-260A, but the FAA's mandate could call for a new DO-260B specification that will not be approved until the end of this year.

"There are hundreds of aircraft equipped to DO-260-like requirements. Other countries are moving to exploit this current equipage, the U.S. is not," says Lewis. The FAA's plan will require updates to all aircraft and delay the start of in-production equipage by around two years, he argues, pointing out that the 787 and 747-8, which have yet to enter service, will have to be upgraded. "We need to take advantage of equipage out there and get to a critical mass of initial users to help the business case close." 

On the Cover

As the FAA deploys its Automatic Dependent Surveillance-Broadcast (ADS-B) infrastructure, it is working with airlines and industry to develop new uses for the technology, including runway incursion prevention. Avionics company ACSS, an L-3 Communications & Thales Company, is exploring how to include an alerting feature in its SafeRoute suite of ADS-B applications, and our cover image from ACSS shows how a cockpit display of traffic information might warn the pilot of an incursion. The own-ship symbol is shown as an aircraft outline on an airport moving map. Traffic taking off and posing a threat to the aircraft is shown as a red directional chevron. The runway is also shown in red, to provide additional awareness of the threat.



US Airways Airbus A330 equipped with ADS-B, EFB and SafeRoute will demonstrate surface conflict indication and alerting at Philadelphia International Airport this year.