Adapting ADS-B

Choices Growing Beyond Slim to Ample

BUYER'S GUIDE

BY DAVE HIGDON

Ours is the Age of Aviation Transition, the period between our future Next Generation Air Transportation System, colloquially known as "NextGen," and the current system, destined to become "OldGen" in the same vernacular.

Today, we still need Mode-something transponders of the 4,096-code variety, Mode C at a minimum. We can, however, opt now to equip for tomorrow's NextGen through an array of available solutions.

Although the "OldGen" Mode C and Mode S remain the dominant technologies allowing controllers to see and guide aircraft by radar return, aircraft owners who chose to adopt early can realize real-world operational benefits — at least in those parts of the country already operational with automatic dependent surveillance-broadcast, or ADS-B, the golden child of NextGen.

ADS-B at the Air Traffic Control level already is live in the Gulf of Mexico, southern Florida, much of the Eastern Seaboard, around Philadelphia, large swaths of Alaska, including Anchorage and Juneau, and the Ohio River Valley.

The FAA declared initial operating capability of ADS-B at Anchorage Center for air traffic separation services in Juneau on

April 28, 2010, not long after making the same declaration for Philadelphia. Juneau represented a milestone as the last key piece of ground infrastructure the FAA needed to finish before publishing its final rule setting the stage for the years-long transition to ADS-B Out in most airspace — taking over where the transponder serves today. The rule will culminate a process that began a decade ago with ADS-B test programs in Alaska and the Ohio River Valley.

According to the FAA's lead contractor on ADS-B, ITT Corp., by September 2010, it expects to deploy and activate broadcast and surveillance services for a total of 19 en route "service volumes," as they call the different areas. The 19 include Jacksonville, Fla.; Boston, Mass.; Albuquerque, N.M.; Seattle, Wash.; Cleveland, Ohio; New York, N.Y; Atlanta, Ga.; Washington, D.C.; Los Angeles, Calif.; Chicago, Ill.; Oakland, Calif.; Minneapolis, Minn.; south Alaska; and Juneau, Anchorage-Fairbanks, McGrath, Yukon, Nome, and Kotzebue-Northern, all in Alaska.

And these areas are beyond the "critical service" declarations at the four test locations: the Ohio River Valley region around Louisville International in Kentucky; the Gulf of Mexico; Philadelphia International Airport; and Juneau.

Critical services provide GPS-derived aircraft position to air traffic controllers' screens and its use for traffic separation. In theory, expanding the system across the country will allow the FAA to eliminate secondary surveillance radar in most locations. From this, it appears the rollout of ADS-B continues to accelerate.

If the FAA fulfills its plans on schedule — something looking more than probable as of this writing — the entire country will be fitted, functioning and operational with ADS-B by 2013. From that point forward, the system should be deployed anywhere you chose to fly, providing direct benefits to the FAA and indirect benefits to system users. By 2020, the mandate for ADS-B Out will be required for any aircraft flying above 10,000 msl in Class B or C airspace — pretty much anyplace a Mode C transponder is now required.

The promise of the changeover is considerable — if the FAA and users can make it happen together.

Benefits demonstrated include higher refresh rates and higher accuracy; allowing reduced traffic separation and expanded runway capabilities; the ability to get accurate positioning in airspace where radar previously could not serve; and the ability of properly equipped aircraft to receive accurate, real-time traffic and data-link weather products — without a stand-alone collision-avoidance system, weather data-link receiver or weather service subscription costs.

For aircraft operators to enjoy the promise of direct benefits in the cockpit, such as the weather and traffic promised, they must not only fulfill the FAA's mandate for ADS-B Out — so controllers can see the plane — but also equip craft to receive services via a broadcast link called ADS-B In.

As the roll-out process continues, expect a surge in suppliers as more companies bring to market their own ADS-B solutions, both Out and In. This phenomenon already is playing out in the availability of new in-aircraft and portable ADS-B systems.

The ADS-B System

Testing of ADS-B and GPS as a positioning source for pilots and controllers began in 1999, in Alaska, under a partnership of commercial operators, the MITRE Corp.,

Continued on following page...

ADAPTING ADS-B

Continued from page 49

the Alaska Pilots Association, some avionics manufacturers, the University of Alaska, the state and the FAA. Aircraft were equipped to use a baseline ADS-B network to relay position data to controllers in Anchorage, and between the aircraft themselves.

During the ensuing five years, accidents fell by 40 percent. In the Ohio River Valley, UPS and the FAA worked together on a similar experiment, this one geared more toward improving traffic flow and position information.

By 2005, the agency seemed convinced. A plan was created. The contracts began in 2007; by fall of 2008, the first service went on-line. And so it grows from there.

Eventually, the ADS-B system will involve:

- 794 ground stations
- Four data-control stations, one each at Boston, Mass.; Atlanta, Ga.; Phoenix, Ariz.; and Seattle, Wash., all at AT&T Data Hosting Centers
- Two network operations centers, the primary in Oakton, Va., and a back-up site in Middletown, N.J.
- 271 FAA service delivery points: the FAA ATC towers, Tracons and en-route centers

This chunk of work will continue beyond the initial 300 or so sites needed to establish the basic foundation of ADS-B across the nation. The airborne side, what the airplane needs to use the system comes in 2020, well, that's the owners' turf to pick.

Many nations are tilting toward dedicated use of one of the three available technologies that can provide ADS-B. In the United States, with many times more aircraft, flights, airspace, users, varying budgets and needs, the FAA decided to offer a choice between two of those approaches: one predominantly for users of piston-powered planes; the other for higher-flying, turbine-aircraft operators. The approach embraced by Australia, Canada, Europe and others is the Mode S transponder using 1090 MHz with a data-link channel called "extended squitter."

The lower-flying, piston-powered operator can select something called the universal access transceiver — essentially a two-way link using 978 MHz. The UAT offers the added benefit of providing a receiving function for aircraft owners interested in the full potential of ADS-B technology.

A WAAS-certifiable navigation engine must be involved in the ADS-B system to provide the precision position data on which in-flight gains depend, such as 3-mile IFR separation in place of 5-mile.

Both of these technologies provide an ADS-B Out solution. So far, only one offers both Out and In — and that one, the 978 MHz UAT, can be employed as an ADS-B In solution for aircraft using a 1090ES Out solution.

Airborne ADS-B

To link the aircraft and the ADS-B ground network in either approach requires input from a GPS to provide basic data for delivery: position, altitude, airspeed and energy vector — which way the plane is flying and whether it's changing altitude.

A panel-mounted GPS can fulfill this role through a serial link to the ADS-B box, or the ADS-B hardware can contain a built-in autonomous GPS sensor. The transponder or transmitter broadcasts this data five times a second for use by ADS-B-equipped aircraft and the ground network connected to the controllers' screens.

To enjoy ADS-B's promised cockpit benefits, the aircraft also must be equipped to receive — what's called "ADS-B In." The ADS-B In solution can be integral to the UAT or a different receiver capable of feeding the information from the data-link channel to a multi-function display.

ADS-B In products can include live position and movement readouts for other aircraft. The In channel on a UAT can receive position data directly from other UAT aircraft, as well as other traffic, as relayed from the same FAA feed controllers see.

And there's weather information. These services fall under the flight information service-broadcast (FIS-B) and traffic information system-broadcast (TIS-B).

To use ADS-B In, the aircraft must be equipped to receive and show the data — which means some form of display is needed. If you've got a display already — even one built into another piece of avionics, such as the Garmin GNS 430 — you're already in the position to use ADS-B In.

Universal Access Transceiver

The Class A universal access transceiver provides a complete solution for adding ADS-B Out and In to an aircraft. It both sends and receives — hence the word "transceiver" in the name.

There also are stand-alone 978 ADS-B Out transmitters and stand-alone ADS-B In receivers. UATs can be stand-alone, with an integral WAAS/GPS engine, or dependent on position data from an external WAAS/GPS.

First certified nearly a decade ago to provide radar-like services, UAT has provided the basis for the

Continued on page 52...

ADAPTING ADS-B

Continued from page 50

five-mile separation of aircraft operating over Alaska through the Capstone project, where ADS-B Technologies LLC first put it to work.

Some observers peg UAT as the more robust of the two technologies, offering more flexibility and capability. Some go so far as to say they expect UAT to become the dominant standard in the world. China and nations in Africa are embracing UAT for their radar-like separation needs — without the radar, of course.

In the FAA's original proposal, the agency held out UAT as the ADS-B solution for aircraft normally operated at or below FL180 — 18,000 feet — but usable to FL240.

In addition to its ADS-B Out/In capability, the Class A UAT's wide bandwidth simultaneously provides the channels for receiving FIS-B products — weather, forecasts, METARs, TAFs, etc. — as well as TIS-B, plus proximate traffic directly from other UAT ADS-B aircraft. Ground stations will translate traffic for UAT TIS-B distribution from the remaining ground-based radar and from aircraft using the other ADS-B technology: 1090ES.

1090ES

If you're already flying around with a Mode S transponder, it's possible you're only an enhancement away from making it functional as a transponder working in as a 1090ES solution — that's 1090 MHz, the transponder frequency, with the Mode S enhanced with extended squitter, which is the "ES" part of the equation.

The FAA identified 1090ES as the ADS-B technology preferred for aircraft normally flying above FL180, but it would be legal for all altitudes, according to the FAA's original NPRM.

Even if you don't have a transponder upgradeable to provide the ES data-link channel, you can find numerous options with a new 1090ES Mode S transponder. Again, the 1090ES solutions need input from a WAAS/GPS to fulfill the ADS-B Out needs the FAA has laid out.

The 1090ES can receive and route TIS-B to a display, but not FIS-B, meaning the ADS-B In capabilities are limited to what the Mode S system supports. Again, a display is needed to show traffic.

A stand-alone 978 MHz receiver with the data-link capability can serve up the entire ADS-B In data package: traffic, weather, etc.

A third method exists for fulfilling the ADS-B Out requirement, one that builds on the Mode S capabilities inherent in the devices: collision-avoidance systems. Several turbine-oriented TCAS — traffic-alert and collision-avoidance systems — can be enhanced to fulfill the expected ADS-B Out mandate and, through TIS-B, expand the range of traffic they can display.

Regardless of the technology you favor for adding ADS-B, a WAAS/GPS position source must be part of the solution.

Partial Solutions

The following items address options for some existing systems to adapt one part or another of the ADS-B equation. We present them here to show options exist for some aircraft already equipped with the base equipment needed to employ these partial solutions.

Continued on page 54...

ADAPTING ADS-B

Continued from page 52

ACSS

Aviation Communications & Surveillance Systems — ACSS — is a joint operation of L-3 Communications and Thales, offering its RCZ-852 Mode S transponder with 1090ES as a stand-alone solution for the Mode S transponders integrated into the avionics suites of about 2,500 regional and business turbine-powered aircraft.

The RCZ-852 is compatible with TCAS I and TCAS II systems and has been tested for the high-stress environments of helicopter and propeller-driven aircraft, in addition to its demonstrated role in turbine aircraft. In line with the avionics suites it is designed to work with, the RCZ-852 is a 28-volt-only unit designed for remote mounting to work with a panel-installed controller.

For more information, visit www.acss.com.

Avidyne

Last year, Avidyne announced an ADS-B enhancement available for all TAS600 series traffic advisory system installations and the addition of this enhancement for new units.

Avidyne's TAS600A series enhancement adds ADS-B In functionality to all existing TAS600 series traffic systems. According to the company, this means TAS600A users will benefit from getting TIS-B data-link traffic on their TAS displays, in addition to the aircraft detected and displayed by the TAS itself. All TAS600 series units can be upgradeable to the TAS600A.

For more information, visit Avidyne at www.avidyne.com.

Honeywell

When enhanced with ADS-B In, Honeywell's anti-collision system, the TPA-100 TCAS processor, can detect and display traffic out beyond 100 miles through the addition of TIS-B targets to the traffic detected by the TCAS system.

For more information, visit www.honeywell.com.

Sandia Aerospace

Working in conjunction with prime ADS-B contractor ITT Corp., Sandia Aerospace is developing its own low-cost UAT solution for ADS-B.

According to Sandia, the work will result in a UAT providing both Out and In, and in two forms, both a panel-mounted unit and a remote-mounted solution, to fit the requirements of the specific aircraft.

According to Sandia, the panel-mounted version is scheduled for sometime in 2011.

For more information, visit www.sandia.aero.

UAT Options, 1090ES Options

The accompanying Buyer's Guide graph offers UAT options and 1090ES options.

By definition, the universal access transceiver is an Out and In ADS-B solution; 978 MHz-band options exist that split Out and In into individual boxes, usually at lower prices than a full-feature UAT.

Remember, outside the TIS-B feed supported by the system, 1090ES is an Out-only option.

An operator can take a second step and also equip for ADS-B In — with a UAT-band receiver, for example.

Buyer's Guide graph begins on page 56...

AEA BUYER'S GUIDE TO ADS-B: PRODUCT CHARTS

MODEL/TYPE	FUNCTIONS	SPECS	PRICE
BECKER AVIONICS www.beckerusa.com  BXP6403 1090ES Mode S transponder	ADS-B Out	250 watts 6.25 x 1.65 x 11.25 in 2.1 pounds	from $3,100
FREEFLIGHT SYSTEMS www.freeflightsystems.com Rangr Line FDL-978TRX UAT	ADS-B Out & In	1.6 x 5.1 x 6.5 in Under 2 lbs.	Not set
FREEFLIGHT SYSTEMS www.freeflightsystems.com  Rangr Line FDL-978TX UAT Transmitter	ADS-B Out only	1.6 x 5.1 x 6.5 in Under 2 lbs.	Not set
FREEFLIGHT SYSTEMS www.freeflightsystems.com Rangr Line FDL-978RX UAT Receiver	ADS-B In only	1.6 x 5.1 x 6.5 in Under 2 lbs.	Not set
GARMIN www.garmin.com  GDL 90 UAT	ADS-B Out & In Integral GPS, 15 channel	40 watts 3.5 x 7.4 x 12.6 in. 6.4 lbs	$7,000
GARMIN www.garmin.com  GTX330 ES 1090ES Mode S transponder - Garmin's panel-mounted 1090ES Solution	ADS-B Out	250 watts 6.25 x 1.65 x 11.25 in. 4.2 lbs	$5,000

MODEL/TYPE	FUNCTIONS	SPECS	PRICE
GTX33 ES 1090ES Mode S transponder - Garmin's panel-mounted 1090ES Solution, controlled through CNX 80, GNS 480, G1000	ADS-B Out	250 watts 6.92 x 1.78 x 11.05 in. 4.31 lbs	$4,500
KT-73 w/ES Mode S transponder	ADS-B Out	6.25 x 1.63 x 10.82 in. 3.63 lbs	$5,600
TDR94D Mode S transponder Remote mount	ADS-B Out	250-625 watts 3.33 x 4.9 x 12.50 8.5 lbs	about $34,000
TT21 & TT22 Mode S transponder Remote mount, panel controller	ADS-B Out	130 & 250 watts 2.5 x 1.7 x 5.5 in. (remote box) 2.45 x 1.7 x 2 in. (controller) 1 lb.	$2,100/ $2,400
TT31 Mode S transponder Standard panel mount	ADS-B Out	240 watts 6.25 x 1.63 x 10.82 in. 3 lbs	$3,000

GARMIN
www.garmin.com

HONEYWELL
https://commerce.honeywell.com

ROCKWELL COLLINS
www.rockwellcollins.com

TRIG AVIONICS
www.trig-avionics.com

TRIG AVIONICS
www.trig-avionics.com