ADS-B THEIR WAY:

Australia's Ambitious Plans Generate Homegrown Solutions

BY DAVE HIGDON

In the United States, the requirements for, adoption dates and transition structure for modernizing air traffic services remain subjects for an intertwined pair of debates: how to implement automatic dependent surveillance–broadcast equipage; and how to shift air traffic management from a system built around a radar-oriented, ground-guidance centric system to one employing GPS and ADS-B.

The goal, of course, is to employ these technologies in ways that capitalize on the distinct differences and unique advantages of these technologies to provide the greatest benefit.

The questions are proving complex to answer, in line with the goals of NextGen: better speeding aircraft to their destinations, safely, swiftly, efficiently, in all types of weather in a sky carrying more aircraft over the next century.

In Australia, however, authorities, users and suppliers seem farther ahead and more on track moving forward with the adoption and changeover.

Leading the way in demonstrating this commitment and progress is the ongoing installation of ground stations across Australia. Those stations already provide coverage over a considerable percentage of the country for traffic above FL250.

However, a tax-law interpretation and revenue woes appear to have put the brakes on plans to extend coverage to the majority of the country for flights below FL300 — at least for the short-term. Longer term, the goal remains unchanged. But how, when and at whose costs are in question.

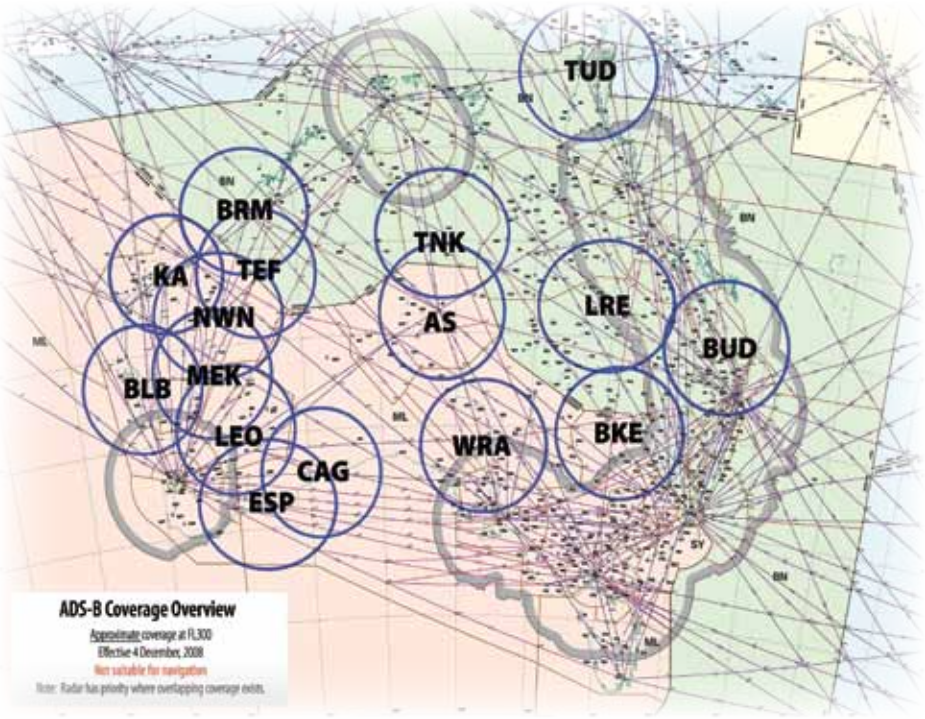
ADS-B: THE BASICS

Unless you've been living and working wholly outside aviation for the past few years, you've likely heard the term ADS-B (automatic dependent surveillance–broadcast) many times in the past decade.

Simply put, ADS-B is destined to become the backbone of modernized air traffic control systems in the United States, Europe and Australia.

At its simplest, airborne ADS-B equipment broadcasts a snapshot of an aircraft's GPS-derived speed, direction and altitude — either GPS or barometrically derived. This message is broadcast about once per second, providing 60 updates a minute, versus as few as one update every few seconds for ground-based radar This is ADS-B Out.

Any aircraft within range of an



ADS-B-equipped aircraft can receive and process this message if the receiving aircraft also has ADS-B In equipment: a receiver and a graphic display on which to see the other ADS-B aircraft.

In addition, the ADS-B Out signal is received by a network of ADS-B ground stations and relayed via satellite data-link to air traffic control facilities, where the messages from ADS-B Out-equipped aircraft and radar images are assembled and presented on controllers' screens to portray the entire traffic picture.

In the United States, the FAA plans to install a network of more than 200 ground stations to provide border-to-border coverage for controllers. Coverage already exists over large sections of the East Coast, all of Florida and a rapidly expanding part of the Gulf of Mexico coast and the Gulf itself.

Completion of the network is expected by 2012, with initial continent-wide operational capability by 2013. An FAA proposal to require ADS-B Out equipage by all aircraft operating in Class B and Class C airspace and above 10,000 msl is being reworked following widespread community dissatisfaction with the agency's original proposal.

In Europe, the European Commission has mandated the switch to ADS-B for commercial operations by 2015 — five years ahead of the FAA's current proposals for the U.S., but still two years behind Australia's deadline for high-altitude service.

Airservices Australia's original

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proposal for equipment requirements for lower-altitude participation met with its own controversy and debate. However, in Australia, as in the U.S., ADS-B remains on track to become the new backbone for ATC and eventually allow for the elimination of expensive ground-based radar systems for tracking air traffic.

HIGH-FLYING PROGRESS CONTINUES

Australia's plans to make ADS-B use mandatory from 2013 remains in place for high-altitude operations.

Evidence of this continuing commitment exists in the country's rapid pace of installing more than 50 ADS-B ground stations across the middle, largely unoccupied section of the country.

The installation of the initial 28 stations was nearly two-thirds complete by the end of 2008. A total of 18 stations were operational in December 2008; the final 10 stations are expected to be operational by year's end.

Each of the ADS-B stations offers a maximum range of about 200 miles for high-altitude aircraft. Line-of-sight limitations reduce the range as aircraft fly lower, with range reduced to about 20 miles at ground level.

The agency opted to locate the ADS-B stations on the same sites already boasting VHF communications relay stations, from which they can relay the messages received from aircraft to the ATC network.

The completed 28-station ADS-B network will provide total ATC surveillance coverage across the nation for approved aircraft flying at about FL290 and higher.

By completion of the first stage of Australian ADS-B implementation in December 2013, ADS-B Out capability will be mandatory for all aircraft flying at or above FL290.

Australia continues to develop its expertise in using ADS-B thanks to efforts to promote installation of the system. As a result, the number of Australian aircraft flying with at least ADS-B Out continues to grow steadily. As of February 2009, Australian officials reported nearly 700 aircraft flying with approved ADS-B installations — aircraft ranging from a Jabiru ultralight to business-turbine aircraft.

DIFFERENT PACE FOR LOWER SPACE

While Australia is moving briskly in the transition to high-altitude coverage, the pace is much different regarding extension of equal coverage for users flying aircraft at lower altitudes down to about 10,000 msl.

The network the country's ATC authority, Airservices Australia, is installing currently provides coverage across not quite half the landscape at 10,000 msl, and much less at 5,000 msl.

The original plan to match for aircraft flying below FL290 to the timetable for the higher altitude came under scrutiny and, in the last quarter of 2008, the timetable was changed to harmonize with the timetables of North America and Europe.

At the time, according to Airservices Australia, it would "pro-

Australia's GBAS & GRAS: Taking GPS to a Higher Precision

Years ago, before the deployment in the United States of the wide-area augmentation system, the FAA and industry discussed the benefits of local-area augmentation systems and differential GPS stations for precision-approach capability based solely on satellite signals corrected locally.

In Australia, the country is moving ahead with its own versions of similar technologies. Working with Honeywell, Australia has been testing two complementary systems that augment GPS signals, one of them designed to provide a low-cost, equal accuracy replacement for the ILS systems used at the nation's major airports.

The ground-based augmentation system is, as its name states, a ground-based system providing a geographically referenced, correct GPS signal, much like a LAAS or D-GPS station.

The GBAS, as deployed by Australia, delivers an ILS-like look at airborne GPS navigators to provide the same level of precision guidance to the runway end. However, an airport needs a different ILS for each runway end for precision-approach capability.

In contrast, a single GBAS can provide simultaneous precision-approach capability to as many as 48 runway ends within about 23 miles.

According to Airservices Australia, the GBAS exceeds the precision-approach requirements of the International Civil Aviation Authority.

The GRAS, or ground-based regional augmentation system, functions more like the wide-area augmentation system, providing more accurate GPS guidance for en-route and near-precision-approach capability to all the runway ends within the coverage area of each GRAS ground station.

Combined, these two technologies should allow Australia to move forward with improving inclement-weather access to a wide range of airports at costs well below those for other solutions, such as ILS and LOC units. ❑

ceed with the replacement of enroute radars and ground nav-aids as necessary to ensure the integrity of Australia's air traffic control system."

As of March 2009, however, the program to expand ADS-B service and requirements for lower altitudes was put on hold after the determination that a funding plan to assist general aviation aircraft owners with the cost of equipping conflicted with Australian tax regulations.

The service noted, "The timing and scope of future steps will be progressed through normal regulatory processes and will take into account outcomes of the government's Green and White Paper aviation policy development process."

Now, Airservices reportedly is waiting on direction from the government on how to proceed with an ADS-B program for the lower airspace.

While it's possible recreational and general aviation aircraft will be required to employ ADS-B Out equipment —most likely at the owners' cost — the timetable is in question and won't be accelerated. The harmonized timetable makes it possible for a requirement to be set for 2020.

While the actual timetable for most users continues to evolve for Australia's officials and users, a homegrown avionics supplier has created equipment designed to meet the needs of the recreational and casual user — and the Australian government has issued a TSO for this equipment.

STALLED PROGRAM WILL COST

The decision to hold off on expanding ADS-B service to cover more territory at lower altitudes comes with a cost, according to Airservices Australia.

One important aspect of the nation's ambitious ADS-B plan stemmed from the money that would be saved from timely implementation and, in turn, decommissioning radar sites and navigation equipment as the new technology began to take up the load of delivering its radar-like surveillance capabilities.

According to Airservices, holding the program at completing the high-altitude network means the nation

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now must begin an effort of upgrading aging radar equipment, money that might have gone toward implementing the rest of the ADS-B plan.

Between industry concerns about the costs and benefits for users of lighter general aviation aircraft, the tax-regulation conflict and budget constraints, proceeding is just not possible right now, according to Airservices.

However, Airservices Australia noted it is still committed to ADS-B as the future technology to satisfy ATC surveillance. But how and when progress will resume, and in what fashion, remains unclear.

DIFFERENCES IN EQUIPAGE, DIFFERENCE IN NETWORK

Australia opted to employ the 1090 extended squitter technology for delivering the ADS-B message package needed to support the system.

This solution, so far, applies high and low.

Many other countries have adopted the 1090ES standard, countries where commercial flying dominates the sky.

Critics of 1090ES claim the system is less robust and less capable of carrying extra data, as well as being unable to deliver some worthwhile products to cockpit displays of aircraft with ADS-B In — products such as weather.

In the U.S., the FAA opted for a conflicted solution: the 1090ES solution for high-altitude aircraft flying above FL240 and a different technology known as the universal access transponder, or UAT, to underpin ADS-B for altitudes predominantly used by non-jet aircraft.

The exact view of the final solution remains in play because the FAA has yet to move forward with final rules after a 2008 notice of proposed rule-making on ADS-B met with considerable resistance from stakeholders.

As Australia's program for covering lower altitudes seemed headed for requiring 1090ES, light-aircraft avionics maker Microair designed and won TSO for an ADS-B/Mode S transponder/WAAS GPS unit, which provides a low-cost, lightweight solution for an ADS-B Out requirement for light aircraft. The Microair solution employs 1090ES and at a cost below previously available solutions.

Australia's embrace of 1090ES as a universal solution also simplifies the equipment requirements for the ground stations and the network carrying the load of receiving and processing the ADS-B Out messages from aircraft.

Under Australia's approach, all aircraft with ADS-B In would be able to see the messages from all in-range ADS-B Out-equipped aircraft; they would all be using 1090ES, as the program currently is envisioned.

The bifurcated approach in the U.S. means aircraft with 1090ES wouldn't be able to "see" other aircraft with the UAT, and vice versa. For the two different technologies to "see" one another, it requires a translator at each ground station to see and rebroadcast the ADS-B signals of both types.

Conversely, the UAT system offers the advantages of supporting weather, messaging and other data-link communications with high appeal to operators of lighter aircraft.

ADS-B AT WORK FOR AUSTRALIAN AIRPORTS

Late in 2008, Airservices Australia awarded Sensis Corp. the contract for its fourth advanced surface movement guidance and control system at Perth Airport, the fourth of the country's four busiest airports to get the system.

Sensis' A-SMGCS merges inputs from multiple surveillance sources to provide controllers with real-time, high-accuracy vehicle and aircraft tracking, along with advanced collision prediction and alerting functions employing both visual and aural alerts.

Ground vehicles moving in the aircraft-movement area will be equipped with Sensis Mode S transponder equipment, which uses precision GPS position data to broadcast the ADS-B Out 1090ES signal.

The Sensis A-SMGCS employs multiple unidirectional aircraft transponder sensors to triangulate aircraft position, as well as X-band radar and ADS-B Out-equipped vehicle systems and aircraft transponder returns to paint a complete picture of ground vehicles and aircraft both in the air and on the ground.

From this data, the system monitors and analyzes the data to detect potential conflicts, with the alarms a result of the system's collision-predictive capability. The alert system covers more than 40 different collision-potential scenarios, according to the company.

With all four of Australia's busiest airports equipped with the Sensis A-SMGCS system, Airservices Australia will benefit from the deployment of another Sensis product that uses he ADS-B air and ground data. It's called Aerobahn.

Aerobahn combines airline flight schedule information and corresponding operational data with ground surveillance data from the A-SMGCS, allowing Airservices to see a real-time, highly accurate view of surface operations, which can be shared with airport stakeholders.

With this capability, Airservices Australia can understand, in real-time, ground and terminal operations at each of Australia's four major airports. ❑

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