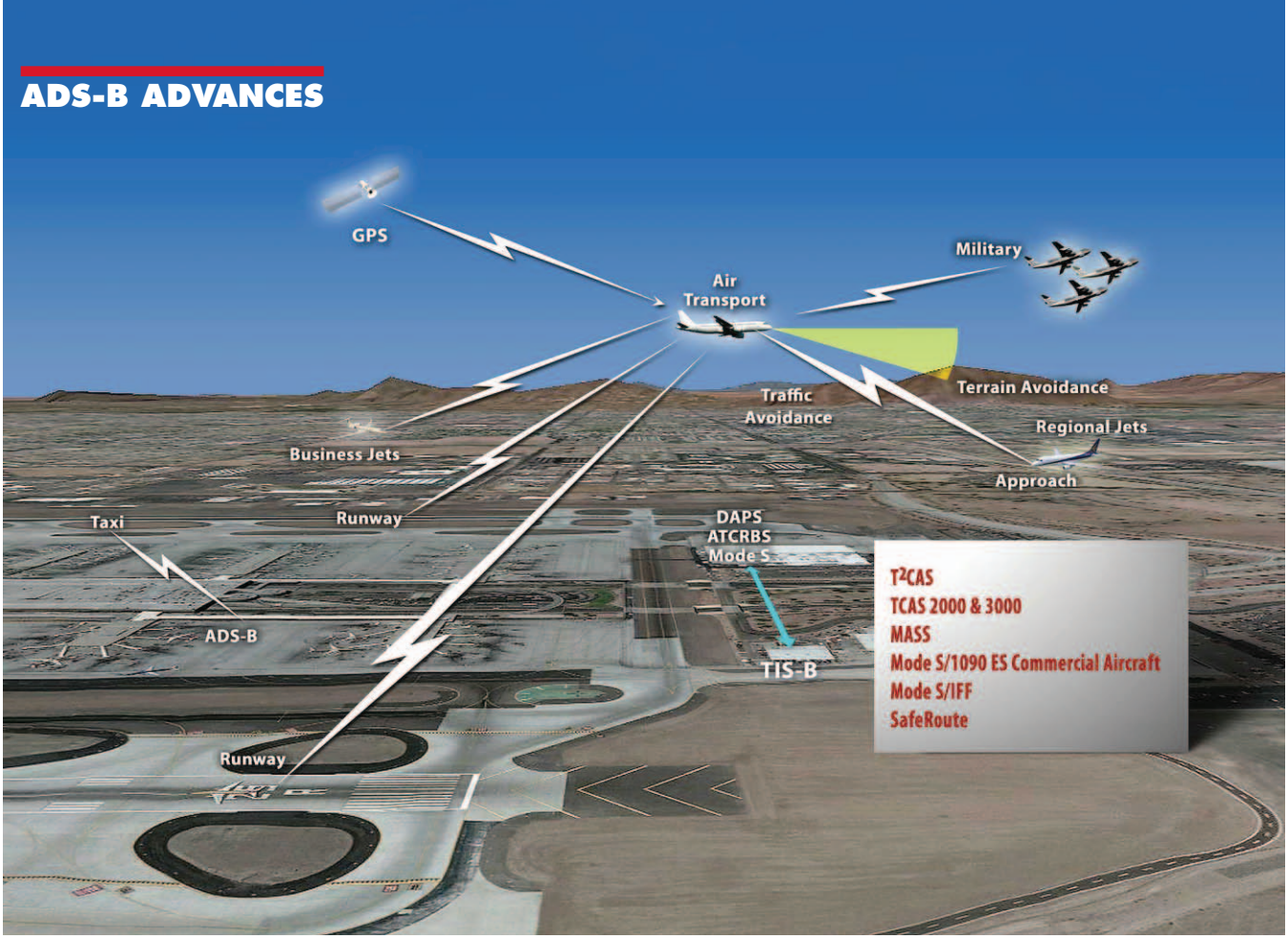


Integrating ADS-B with NGATS

Enhanced situational awareness and real-time traffic displays define ADS-B for tomorrow.

By David Bjellos
ATP/Helo. Gulfstream IVSP, Bell 407

Pilots will take a more proactive role as ADS-B technology enters the cockpit. Precise in-trail spacing, TAWS and runway incursion prevention are the cornerstones of NGATS.

It goes without saying that the logjams we all experience when we fly will only increase as manufacturers continue to produce new equipment and our robust economy fuels the capitalists to expand and prosper. FAA's plan for upgrading the National Airspace System (NAS), as outlined in the Next Generation Air Transportation System (NGATS), promises to deliver unparalleled situational awareness and assistance to pilots. The cornerstone of NGATS technology is automatic dependent surveillance–broadcast (ADS-B). Greater accuracy for both pilots and controllers will ensure greater safety margins in the coming years.

ADS-B is the integration of new software and hardware that will allow pilots a real-time view of proximate traffic, both on the ground and airborne, and is dependent on both satellite and terrestrial-based transceivers. It is a level of magnitude higher resolution and accuracy than current TCAS II, and will enhance both ATC and pilot/ controller capabilities to levels far beyond what is currently in place.

ACSS, UPS and ADS-B integration

ADS-B began its testing phase during the Capstone project in Alaska. Success there prompted FAA to invite a large common-fleet-operator of jet aircraft to evaluate the system in the NAS.

UPS volunteered and proved an ideal test bed, given the company's night flights, intense hub activity and ability to equip the bulk of its aircraft in cooperation with FAA and industry. Knowledge gained from NASA, FAA, UPS, Boeing, Eurocontrol and Mitre Corp (a non-profit organization working with DoD and FAA) in these evaluations has provided enough data to show large-scale feasibility. UPS aircraft display traffic on Class 3 EFBs using a function known as cockpit display of traffic information (CDTI). Eventually, as ADS-B becomes mainstream, data will be displayed

ACSS produces safety avionics equipment for airliners and bizjets, including TCAS, TAWS, Mode-S transponders and the only operational ADS-B system in use in the NAS—SafeRoute, used by freight carrier UPS. (Inset) Class 3 EFB displays ADS-B traffic to Boeing 767 pilot.

Photos courtesy UPS

on our current PFD/ND screens, much as TCAS and terrain are now.

SAMM and M&S

SafeRoute, which is the system being installed on the UPS fleet, was developed by Aviation Communication & Surveillance Systems (ACSS)—a joint venture of L3 Communications and French avionics producer Thales. ACSS recently received supplemental type certification (STC) and technical standard order authorization (TSOA) from FAA.

Two unique features of the SafeRoute system bear notice. The first is surface area movement management (SAMM), which shows the flightcrew a display of an airport surface moving map which includes real-time movement of their aircraft position and that of other ADS-B equipped aircraft—both on the airport and airborne—within their field of view.

In locations like SDF (Intl, Louisville KY), where UPS has a major hub for its nightly freight movements, this has helped considerably, especially during periods of reduced visibility. Pilots can navigate their aircraft better on taxiways with reference to the airport map and other traffic that they may not even see. In fact, as opposed to the relative inaccuracy of TCAS, SAMM's ADS-B positioning allows pilots to view approaching aircraft on final approach for a specific runway while in position or holding short of the runway. While not a substitute for ATC, this function could possibly have prevented the crash that occurred at LAX (Intl, Los Angeles CA) some years back between a Boeing 737 and a commuter aircraft waiting for departure. That mistake changed the rules for position-and-hold for everyone—SafeRoute SAMM could eventually add another layer of protection to the growing traffic at major airports.

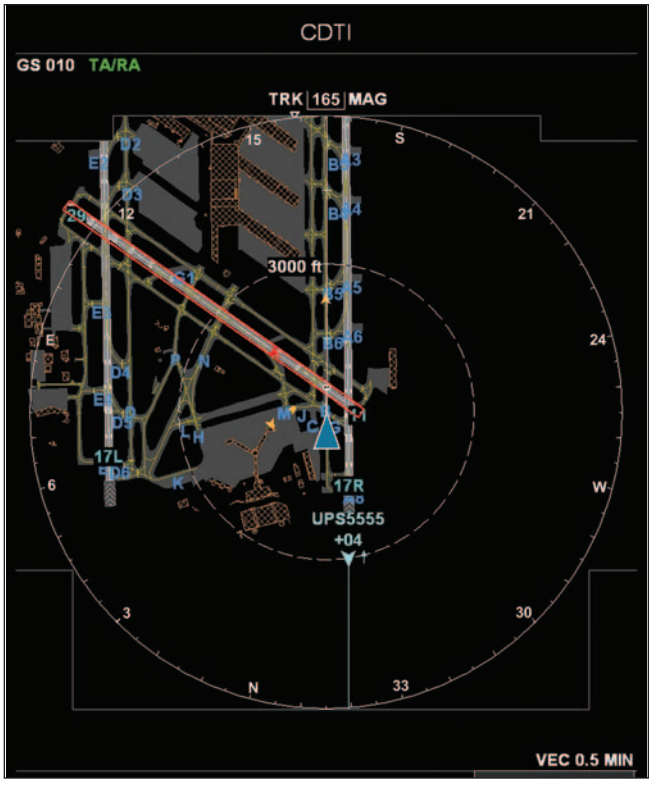
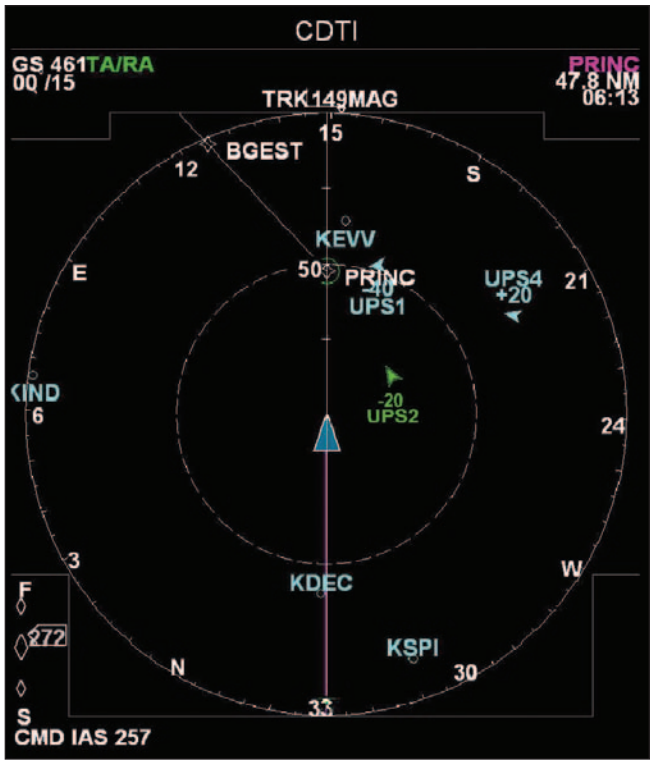
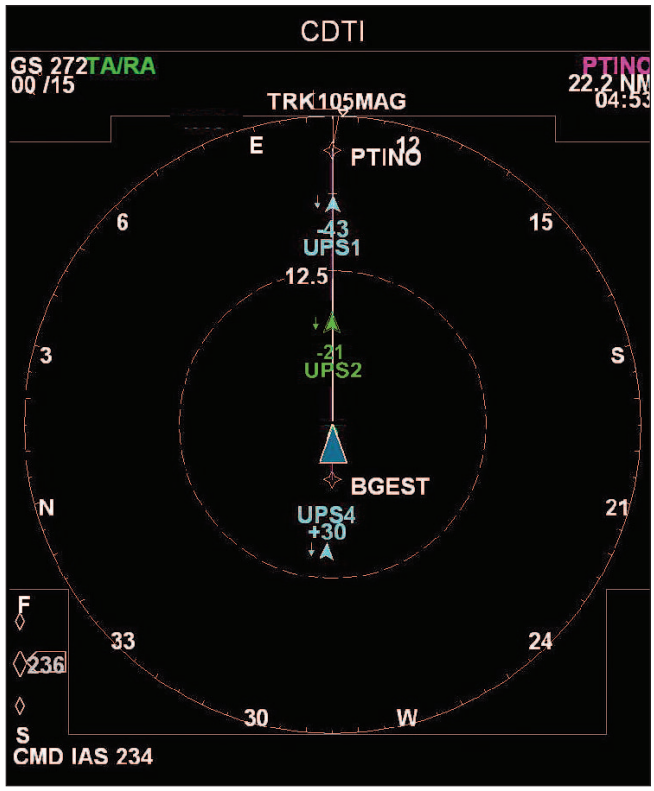


Illustration of a red caution situation during taxi. A synergistic approach to improving spacing, flow control and runway incursions—currently the principal topic at FAA for accident mitigation—is at the heart of ADS-B. UPS has adopted a practical and positive approach to testing a system that will have far-reaching rewards.

The second unique feature of SafeRoute is known as merging and spacing (M&S). Airborne, M&S provides a speed command to the flightdeck that allows the crew to adjust the aircraft speed in order to maintain a specified spacing interval from an ADS-B equipped traffic-to-follow (TTF) aircraft. By following the speed command advisory, arriving aircraft are able to achieve consistent low-vari-



A scenario in which "own ship" has been instructed to merge behind UPS2 at the PRINC waypoint. The icon for UPS2 is shown in green. The outline indicates that this is the traffic to follow. The lower left corner of the display shows the recommended target speed to be flown in order to achieve the specified spacing, along with a fast/slow indication for the pilot. In this scenario, "own ship" is too close to the lead aircraft and should decelerate to obtain the proper in-trail spacing.



In this scenario, "own ship" has merged behind UPS2 and is actively controlling its speed to maintain proper spacing behind it. As in the previous illustration, the lower left corner of the display shows the recommended target speed required to maintain the specified spacing, and a fast/slow indication for the pilot. "Own ship" is now essentially at the proper in-trail spacing.

ance spacing between aircraft pairs that will result in increased capacity and efficiency within the terminal space. This feature works well when all the aircraft bound for a particular destination are ADS-B equipped—for example, LAX, landing west, with multiple STAR/ILS finals stretched out nearly 100 miles. But it can work for a mix of traffic as well, especially when an airport, such as DFW (Intl, Dallas–Fort Worth TX) or ORD (O'Hare, Chicago IL), has numerous arrivals from various compass points.

ADS-B equipped arrivals could take advantage of preferred routings and non-ADS-B aircraft would follow traditional STARs. ATC could begin by pairing ADS-B aircraft for arrivals and pair non-ADS-B aircraft to parallel runways.

SafeRoute is compatible with a continuous descent arrival (CDA) which allows a power-off descent from cruise altitude down to about 1000 ft agl. Performing a CDA arrival and reduced low-altitude vectors through M&S will enhance fuel savings significantly.

In the future, regulations may allow for pilot-controlled spacing at designated waypoints, such as the last 20–50 miles of a published STAR to ILS-type approach. The UPS trials validated the economic value of the CDA concept and identified the advantages to ADS-B equipped aircraft. Imagine an orderly flow into and out of the major US hub airports—even during periods of reduced visibility. Our ancillary use of GA airports such as DPA (DuPage, Chicago IL), TEB (Teterboro NJ), TTN (Trenton NJ) and VNY (Van Nuys CA) can only improve. Clearly, ADS-B technology is going to change the way we do business in and out of the cockpit.

Rotorcraft operations—Gulf of Mexico ADS-B region

A fact that may be little known outside the world of Gulf of Mexico rotorcraft operators is that 650 helicopters fly more than 7500 trips daily to and from oil platforms without the benefit of radar, separation services or communication with ATC facilities. Pilots accustomed to overland flying have at their disposal numerous ATC benefits—the flight following, weather briefings and Notams that we often take for granted. Gulf helicopter pilots lack everything except their own experience and are at the mercy of the weather in an often hostile flight environment.

Helicopter Association Intl Pres Matt Zuccaro will soon sign a memorandum of understanding with FAA, paving the way for ADS-B ground installations in the Gulf region and eventual full coverage for this segment of industry.

As the importance of domestic oil increases, inclusion and certification of ADS-B in the Gulf of Mexico will further strengthen the US's stated position of intending to reduce its dependence on imported oil. Zuccaro believes that, given the unique environment and low altitudes flown by oil industry helicopters, they will probably stand to reap the greatest benefit of all operators from this technology—at least initially.

Photos courtesy Eurocopter

TexAir Eurocopter EC120 repositions from a Gulf of Mexico oil platform in VMC. Weather in the region is unpredictable, and rotorcraft operators will benefit greatly from ADS-B for traffic and flight following.

Photo by Jack Sykes

The fixed-wing community will also benefit from initial applications of ADS-B. Once the system proves its value, full-scale deployment will likely commence for all NAS users. Every major jet aircraft OEM is prepared to install or retrofit ADS-B in the cockpit, and suppliers are ready with hardware and software. (Above) Bombardier Global Express XRS Honeywell Primus 2000XP avionics suite.

Airservices Australia—ADS-B in action

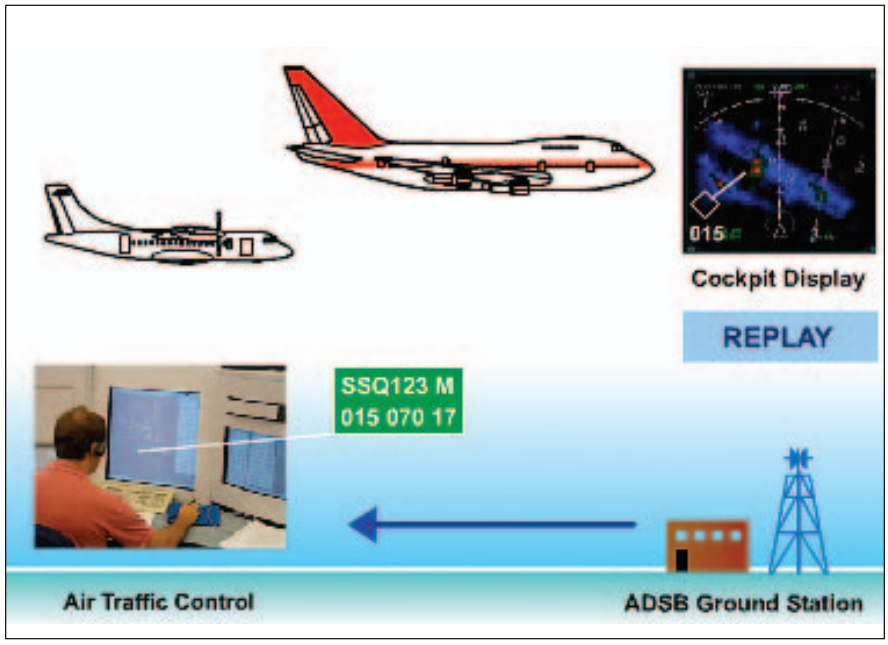
In Australia, reliance on conventional radar may soon be a thing of the past, according to Airservices Australia and SITA, who are implementing and certifying ADS-B across the entire country. A specific ICAO recommendation that the Asia Pacific region make the transition to ADS-B coverage has begun—28 ground stations having been commissioned as well as computer upgrades to ATC centers to monitor high-altitude flights as part of the Upper Airspace Programme. Approval is expected in 2008.

Australia will be the first country to convert its traditional terminal radar and enroute traffic control to ADS-B technology. Already, trials have shown that the system is fully functional and capable of handling current and future flights across the outback, where previously coverage was nonexistent. Indonesia has also begun installing 5 ADS-B ground stations, collocated with SITA transmitters, and will begin trials shortly.

Costs—political and monetary

Without question, ADS-B technology in all its varied forms is appealing—and will most certainly be more cost-effective than traditional (outdated) radar centers and ARTCCs. The technology was first introduced in the 1990s. Some people referred to it (incorrectly) as Free Flight. FAA originally planned implementation in 2001, but this has been delayed twice—first to 2007, now to 2012.

The current congestion in and around Chicago, New York, Washington and other major hubs could profit from introduction of this system and its associated benefits, but there remains the question of cost. The airlines have only now begun recovering from the claimed effects of Sep 11—and, at an estimated installation cost of $50,000 per aircraft, ADS-B remains elusive. Debates over funding and user fees, and how to pay for the NAS upgrade are akin to arguing over the bar tab on the SS *Titanic* as she lists further and further. Without question, the US domestic ATC system needs an upgrade, and ADS-B offers a real-time, available alternative to ever-crowded skies and further delays.



Australia will soon transition to a fully operational ADS-B system. All of the country's radar facilities and terminal controls have been upgraded and full certification is expected by 2008. The Australian Government has consistently pursued this commitment toward air safety.

David Bjellos is the aviation manager for a private corporation in south Florida whose flight department was the first in south Florida to achieve IS-BAO certification. The company operates a Gulfstream IVSP, a Dassault Falcon 2000, 2 Bell 407s and a Eurocopter EC120.