

# ADS-B In(side) and Out

BY JAMES WYNBRANDT

It is the foundation of the FAA's NextGen Air Traffic Control system. Automatic dependent surveillance—broadcast (ADS-B) will enable safer, more efficient use of the National Airspace (NAS) while offering an array of ancillary services: traffic alerts, terrain avoidance, real-time graphical weather displays and text messaging.

After years of study, the route to adopting the technology was unveiled late last year when the FAA announced its notice of proposed rulemaking (NPRM) for ADS-B implementation. General aviation advocates, however, have largely given the proposal a thumbs down. By the end of the comment period in early 2008, many of them had registered objections — not because they don't believe in the technology, but because they believe the proposed rules don't go far enough in exploiting its benefits.

"I think the NPRM has an almost detrimental effect," said Ric Peri, vice president of government and industry affairs for the Aircraft Electronics Association.

"It has really clouded what the true benefits of ADS-B are, and I think the consumer, as a result, may be discouraged from putting ADS-B in their aircraft, rather than encouraged to have all the benefits it brings into the cockpit," he said.

Alan Klapmeier, chairman

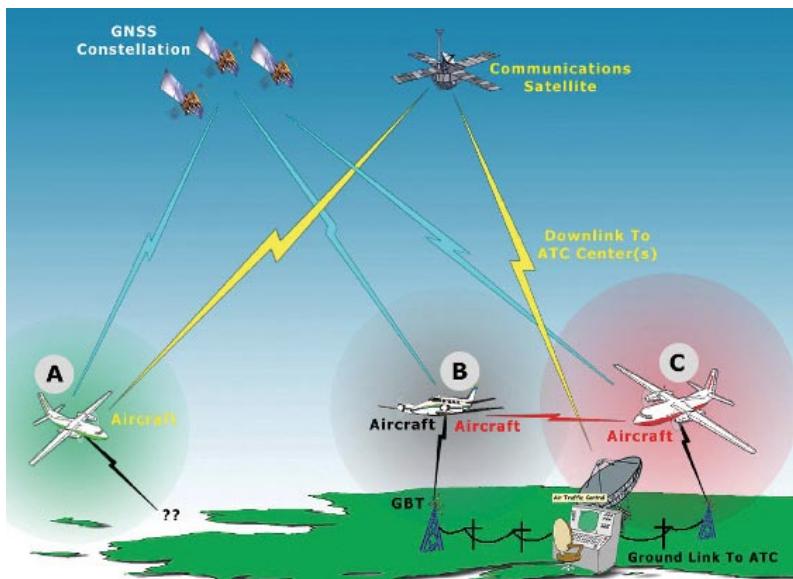


Photo courtesy of ADS-B Technologies.

and co-founder of Cirrus Design Corp. and current chairman of the General Aviation Manufacturers Association, said he considers "ADS-B to be the logical essential element to make the FAA comfortable with NextGen."

"[But] it's not being presented properly. It comes across a little too much as an end in itself," Klapmeier said. "If it was presented as, 'We should adopt this technology because these are the benefits,' I think people would accept it more easily."

Even its biggest boosters concede the lack of agreement about implementing ADS-B has left potential users feeling directionless.

"We pioneered the technology and believe in it wholeheartedly," said Bill Stone, technology prod-

uct manager with Olathe, Kan.-based Garmin International, which makes an ADS-B transceiver certified for light general aviation aircraft.

"But I'm sure the market is somewhat confused and not sure what they need to do to take advantage of the benefits that ADS-B provides," Stone said.

The clock on ADS-B implementation is now ticking. Under the FAA's plan, by the year 2020, aircraft flying in any airspace currently requiring a Mode C transponder — and then some — will be required to be equipped with ADS-B. But that doesn't mean you can sit on your hands and wait.

"I would hope the consumer is not myopically focused on

just meeting a proposed regulatory requirement,” Peri said, “and miss the next 12 years of advances in safety and technology.”

What pilots need is an understanding of the technology, the benefits, the issues of its implementation, and a strategy for navigating to and through the world of ADS-B.

### ADS-B Basics

The term “automatic dependent surveillance–broadcast” hardly rolls off the tongue or explains itself, so a little initial wariness is understandable.

Here’s what it means: ADS-B is a surveillance technology, a method of tracking aircraft (as are transponders and surveillance radar). It is automatic because the transmissions require no pilot action or interrogation (unlike a transponder). It is dependent on a GPS or other device onboard the aircraft to provide the aircraft’s position and vector data (speed, rate of climb, descent or turn, and other information), which the unit disseminates by broadcast.

Ground stations receive the data, then process and feed it to Air Traffic Control (ATC) facilities to present a picture of the airspace for air traffic controllers. The data also is processed and broadcast back into the air from ground stations for use in traffic avoidance and other applications onboard aircraft.

ADS-B has two basic components: ADS-B Out and ADS-B In. ADS-B Out is the broadcast component, the signal sent by the unit with the aircraft’s information. ADS-B In is the onboard reception component.

The incoming data from ADS-B In includes Traffic Information Service (TIS) for traffic avoidance and Flight Information Services (FIS), which includes weather data, text messaging, TFRs, NOTAMs and SUA information.

### UAT and 1090ES

To complicate matters, two ADS-B Out protocols exist in the United States: universal access transceiver (UAT) and the 1090 MHz extended squitter (1090ES). The protocol also determines the unit’s ADS-B In performance. UAT is the newer protocol and, unlike 1090ES, enables graphical displays of traffic, weather, terrain and other uploaded information in the cockpit.

“UAT has wide bandwidth, and in the future you’ll see a lot of services,” said Dennis Schmidt, president and founder of Sandia Aerospace in Albuquerque, N.M., which is designing a UAT ADS-B transceiver. “People are going to be very pleasantly surprised on what this system has to offer. As a pilot, to have all that information onboard is just tremendous.”

1090ES is an older technology. It is the ICAO standard, favored by the airlines and adopted in Australia, Canada, China, Europe, Mexico and other parts of the world. It is less expensive and answers the basic need for aircraft separation, which is a primary driver behind ADS-B’s development. However, it does not support the level of data transfer needed for graphical displays of weather and other information.

The FAA, recognizing 1090ES as the planetary standard and UAT as the superior technol-

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This data concentrator sends information to an aircraft controller’s console.



One of many combined remote ADS-B and multi-lateral receivers installed at equipped airports.

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ogy, has done something of a Solomon act: The agency has declared UAT will be the standard ADS-B protocol for aircraft operating at 24,000 feet and below. Aircraft operating above 24,000 feet will use the 1090ES protocol. Thus, aircraft capable of flying above 24,000 feet will need a dual-link solution to be UAT-compliant at altitudes 24,000 and below and 1090ES-compliant above.

Meanwhile, countries that have adopted ICAO's standards have yet to recognize UAT, and there is no guarantee they will not require 1090ES ADS-B to operate in their airspace once compliance is mandatory.

The need for dual-links in the United States also will apply to the handful of aircraft (such as Mooney's Acclaim and the Diamond D-Jet) with 25,000-foot service ceilings.

"They'll need to put a 1090 solution in place," said Tim Rayl Sr., director of marketing for business and regional systems at Cedar Rapids, Iowa-based Rockwell Collins. "That's more and more of an issue."

An attendant complication: ADS-B was intended to enable air-to-air broadcast and reception. This



This antenna is utilized for combined ADS-B and multi-lateral receivers.



This receiver and antenna system is installed at a field in Germany.

way, aircraft could receive traffic information without relying on controllers or equipment on the ground. But UAT cannot receive signals from 1090ES units, and vice versa. To compensate, ground stations in the U.S. will process the combined data before it is broadcast so it will be usable by both types of units.

### The Ground Network

In August 2007, the FAA awarded the ITT Corp., based in White Plains, N.Y., a contract to develop and build a nationwide network of ADS-B ground stations. Under the contract, ITT also will supply the FAA with the ADS-B data, and make TIS and FIS data available to aircraft.

The ground network component consists of 794 ground stations. These ground stations are less costly and provide wider coverage than radar, allowing more complete coverage of the NAS.

Initially, the system will be deployed around the Gulf of Mexico, Philadelphia, Pa., Louisville, Ky., and Juneau, Alaska. Nationwide ADS-B implementation is scheduled for 2013. By 2020, all aircraft operating in Class A, B and C airspace,

and airspace within 30 nautical miles of Class B and other designated airports, will require ADS-B. Aircraft flying above 10,000 feet, even if 2,500 feet above ground level or lower also will be required to have ADS-B. However, under the proposed rules, aircraft need only be equipped with ADS-B Out capability.

### The Benefits — and Drawbacks

ADS-B is much more accurate than radar and transponders, allowing reduced separation of aircraft, of particular benefit to airline traffic.

"The accuracy of radar at a distance is measured in miles," Stone said. "The (aircraft separation) standards are crippled because of antiquated surveillance technology. The accuracy of ADS-B targets is measured in meters. So, decreased separation standards can be established, but not until everybody's playing ball." That is, not until everyone is ADS-B-equipped.

"Nobody likes mandates," Stone said of the FAA's timetable. "But the only way we can progress is if we ensure the technology is utilized, so we can finally break away from 1950s

radar technology and move into the 21st century.”

However, the FAA plans to rely on its radar system as the migration to ADS-B progresses. And aircraft still will be required to have transponders, even if they are ADS-B equipped, under the FAA’s proposal. This is one of the rules drawing criticism from GA advocates, as it provides a reason for pilots not to upgrade to ADS-B — you will still have to carry your outdated equipment onboard, and find somewhere else in your panel to put an ADS-B unit.

Additionally, ITT will be allowed to charge users for the TIS and FIS data, another objection of GA advocates. Free, real-time weather and traffic information was among the promises of ADS-B long touted in the GA world, and it would be a powerful incentive to migrate. Moreover, by the FAA’s own estimate, it will cost from \$4,000 to \$17,000 to equip an aircraft with ADS-B.

Ultimately, ADS-B should save the FAA large sums of money through reduced expenditures for controllers and surveillance equipment. GA advocates are asking, “What’s in it for us?”

### **The Avionics**

Currently, only one certified UAT ADS-B system exists: Garmin’s GDL 90. But now that the FAA has laid out the path to the future — no matter how imperfect — expect avionics manufacturers to jump in.

Sandia, which is developing its UAT solution under contract to ITT, expects to debut an ADS-B unit at EAA AirVenture in 2009.

Aircraft operating above 24,000 feet have little need for a UAT unit today. However, a number of manufacturers make 1090ES products, including Garmin, Honeywell and Rockwell Collins.

Meanwhile, some experts suggest there’s no reason to hold back, even with the lack of choices available.

“There are limited areas where you can get ADS-B benefits today,” Rayl said.

Garmin’s GDL 90 has a list price of \$7,995, and is advertised by some resellers at a \$1,000 discount. The output can be displayed on a multi-function display, a Garmin panel-mounted installation, such as the GNS 430, GNS 530 or G1000, or a portable Garmin GPS, such as the 496.

Neil Nederfield, owner of C&W Aircraft Services in Caldwell, N.J., which has experience installing the GDL 90, estimates installation takes from six to 20 hours.

“It depends on the aircraft,” Nederfield said. “If it’s mounted up in the nose avionics compartment, like in a (Beechcraft) Baron, it’s relatively simple to install. But if you have to build a radio rack and mount it in the tail and pull the whole interior, it could go as high as 20 hours.”

Embry Riddle Aeronautical University has installed the GDL 90 in some of its aircraft, and the University of North Dakota is putting the units in its training fleet. The Civil Aviation Flight University of China also made a recent purchase, according to Garmin, which estimates between 1,200 and 1,500 of the ADS-B systems currently are in use.

### **The Future**

It may be confusing and some of the rules might seem ill-conceived, but ADS-B is on the way.

“I’m not aware of any opposition to the concept of ADS-B,” said Randy Kenagy, chief of staff for government affairs at AOPA, which is on record as disagreeing with several aspects of the NPRM.

“I think there are a lot of questions about the correct transition strategy to get from radars to where ATC needs to be in the future. And that will lead to a healthy dialog over the next weeks, months and maybe years,” he said.

If you want to keep using the NAS, eventually you’re going to have to move up to ADS-B. But as more products and services come online taking advantage of this new technology, chances are it’s a change you will gladly make.

“I think it’s going to be a great system,” Schmidt said. “I think it’s going to be a real boon to aviation and to safety.” ■