



# AVIONICS FOR NEXTGEN

by Matt Thurber

## Is business aviation ready for NextGen?

Lucky pilots who get to fly the company's new business jet home will find that their introduction to the aircraft includes some new avionics, something to do with that off-heard term "NextGen" (Next Generation Air Transportation System). These products carry a confusing set of acronyms such as ADS-B, Fans, CPDLC, RNP and others, and some of what this stuff does is completely invisible to the pilot, while other uses require active pilot participation as well as training.

The rest of the fleet of older business jets will need upgrades to meet upcoming NextGen mandates, and while these are steadily becoming more available there are certification and availability issues that might affect operators of some business aircraft. Not all NextGen features are mandatory, but equipping the aircraft to certain NextGen

standards can improve the services available from ATC organizations.

Meanwhile, some NextGen services have already found their way into thousands of cockpits via ADS-B IN, either delivered by installed avionics or displayed on electronic flight bags (EFBs) or more likely using an inexpensive ADS-B IN receiver connected to a tablet computer. Some pilots have even begun flying RNP approaches, another NextGen capability that is becoming more ordinary.

Despite continuing criticism of the FAA's NextGen rollout and delays in adding NextGen capabilities in Europe, implementation of future ATC systems and products is accelerating, and today's pilots need to continue training and be prepared for what the future holds.

### Overview

For pilots and aircraft owners and operators, the impetus to participate in NextGen takes the form of equipage mandates, and there are four broad areas that need to be considered, helpfully explained in Ric Peri's "The View from Washington" column in the April 2014 issue of the Aircraft Electronics Association magazine, *Avionics News*.

**Surveillance**—The heart of NextGen is a modern GPS-based system that equips aircraft to transmit an accurate position to other aircraft and ground stations. Named automatic dependent surveillance-broadcast (ADS-B) OUT, this system

automatically broadcasts the aircraft's position, barometric altitude, identity and other information once per second. The word "dependent" describes the system's reliance on the aircraft's own GPS-derived position to broadcast the surveillance information to any capable receiver. (There is also ADS-C for "contract," where an aircraft and ATC share information exclusively via satcom over the ocean where there are no ground stations.)

ADS-B OUT equipment essentially consists of an accurate position source wired to an ADS-B-qualified transmitter. The sensor is a global navigation satellite system (GNSS) such as the U.S. Navstar GPS, Russia's Glonass

and eventually others (Europe's Galileo will likely be next). The GNSS must meet certain accuracy standards, and many aircraft with older GPS sensors installed will need to upgrade to something more modern to meet the ADS-B OUT mandate. A Waas-compatible GPS, incidentally, meets the ADS-B OUT requirements, but older GPS receivers could be qualified to the new standard if someone were willing to pay for testing. In most cases it will likely be less expensive to upgrade to a Waas GPS, which also offers the benefit of being able to fly Waas LPV approaches. Generally speaking, the GPS also needs to be capable of using satellite-based

augmentation system (SBAS) signals, which improve GPS accuracy.

ADS-B above 18,000 feet in the U.S. and elsewhere in the world at all altitudes works on a single frequency, 1090 MHz (known as 1090ES or “Extended Squitter”). In the U.S., aircraft that will never fly above 18,000 feet can opt to broadcast ADS-B OUT on 978 MHz (known as 978UAT or “Universal Access Transceiver”), which is less expensive to install and when coupled with an ADS-B IN receiver offers other benefits such as traffic and weather information. Frequencies in the U.S. are split because there was concern that the large number of aircraft in the region would overwhelm the 1090 MHz frequency, and the weather message structures sent via ADS-B IN are too large to transmit on 1090 MHz.

**Communication**—The communications element of NextGen revolves around datalink. This means that instead of keying a microphone and talking via a VHF, HF or satcom radio to air traffic controllers, pilots instead can send and receive text-like messages, known as controller-pilot datalink communications (CPDLC), and communicate via exclusive ADS-C messaging (contracts). The messages are either structured messaging, which means exchanging information by choosing from a set of pre-defined messages, such as a request for an altitude change, deviation and so on, or free texting, which allows exchange of non-structured messages.

Future Air Navigation System (FANS) is part of NextGen communications, used for airborne CPDLC and ADS-C messaging over remote and oceanic areas. Airlines have been using FANS for decades, and now FANS is finally becoming more available for business jets using lower-cost satcoms such as Iridium-based systems, just in time for upcoming FANS mandates over the North Atlantic. Iridium systems that meet FANS requirements are available from Gogo Business Aviation, International Communications

Group and TrueNorth Avionics.

Other NextGen datalink-related terms include Data Comm and Link 2000+. Data Comm is the FAA’s overarching term for the switch from analog communications (pilots and controllers talking on radios) to a datalinked future. Link 2000+ is Europe’s version of Data Comm, and this form of CPDLC is required above FL285 in European airspace (new aircraft since 2011, retrofit installations after February 2015). The FAA has yet to publish any Data Comm mandates. Generally, FANS-equipped business jets already meet Link 2000+ requirements, so no additional equipage will be needed to fly in European airspace. Aircraft equipped for FANS/CPDLC should eventually get better service from ATC in the U.S. when Data Comm goes live.

One of the early implementations of Data Comm in the U.S. will be pre-departure clearances (PDC). Instead of calling clearance delivery for a clearance and then reading it back, the pilot will obtain the clearance via onboard avionics. With the right equipment the clearance will be available to the FMS automatically, and the pilot simply has to accept the clearance and verify that the FMS has correctly added it to the flight plan. Trials of this new PDC capability have been done at Memphis, Tenn., and Newark, N.J., and rollout is expected at 51 metropolitan airports next year.

**Navigation**—New business jets and those getting upgraded with modern avionics have high levels of required navigation performance (RNP) capability built in. “RNP is Rnav [area navigation] with onboard navigation monitoring and alerting,” according to the FAA. Instead of routing aircraft on pre-defined airways, Rnav allows for more direct flights, saving time and fuel. RNP capability can make it possible for aircraft to fly off airways, and the aircraft’s RNP “level” specifies the accuracy of the aircraft’s RNP system, the FAA explained, “as a distance in nautical miles from the

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### Accord Technology

Accord Technology, which manufactures high-precision, lightweight and low-cost NexNav GPS sensors, plans to offer its GPS SBAS circuit-card assembly “GPS engines” to help multi-mode receiver (MMR) manufacturers and airlines meet ADS-B mandates. MMRs combine various navigation sensors for delivery to FMSs. Accord also plans to serve military operators, which field about 20,000 aircraft that will need upgrading if they are to continue flying in the National Airspace System.

### ACSS/L-3

ACSS has been at the forefront of preparing for NextGen mandates with its NXT series of transponders, which are FAA TSO approved. The NXT-600 was selected as standard equipment for Bombardier’s Q400 and ATR’s 42/72-600 and will begin flying on these aircraft in this year’s first quarter.

The company’s SafeRoute applications are hosted on ACSS’s 3000SP Tcas or its T3CAS, which combines Tcas, Taws, transponder and ADS-B into one LRU.

SafeRoute ADS-B IN features can be delivered on a variety of cockpit displays. The U.S. Navy selected the Tcas 3000SP coupled to the P-3 cockpit’s primary flight displays, as part of a P-3C, EP-3E and P-3 SPA upgrade program that is the first application of SafeRoute in a



ACSS SafeRoute application

intended centerline of a procedure, route or path.” In the U.S., for example, RNP approaches typically require RNP levels of 0.1 to 1.0, depending on the type of approach. Many RNP approaches are “authorization required” (AR) and thus require special approval and training.

**Situational Awareness**—ADS-B IN enhances situational awareness in two ways. The first is by enabling reception of traffic information—from other aircraft broadcasting their position via ADS-B OUT—for aircraft equipped with either a 1090ES or 978UAT receiver or both. (The 978UAT receivers can also receive traffic broadcast from ADS-B ground stations.) The second is by delivery of free weather information to aircraft equipped with 978UAT receivers. The 978UAT traffic element is called Traffic Information Services (TIS-B) and weather is Flight Information Services (FIS-B); both are “broadcast” features, hence the “B” designation.

The availability of ADS-B IN has led avionics manufacturers to offer additional products that take advantage of that information. For traffic, this is called Cockpit Display of Traffic Information. Gulfstream’s new G500/G600 will offer CDTI in the company’s Symmetry flight deck. ACSS, the L-3 Communications/Thales joint venture, has developed a suite of Safe-Route applications using so-called Universal-CDTI, which it developed in partnership with Astronautics. In addition to CDTI SafeRoute apps include merging and spacing, in-trail procedures, CDTI-assisted visual separation and surface area movement management. The latter enables pilots to view other aircraft and ground vehicles while taxiing on the airport. The others enable tighter spacing of properly equipped aircraft where non-equipped aircraft are typically kept far apart because controllers don’t know their exact position. These apps also allow for maneuvering while maintaining the tighter spacing.

ADS-B IN CDTI can be displayed on

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military aircraft. The P-3 application is also the first installation for SafeRoute displayed in the pilot’s forward field of view. All previous SafeRoute implementations were displayed on electronic flight bags, according to ACSS.

SafeRoute applications include interval management, in-trail procedures (ITP), cockpit display of traffic information assisted visual separation (CAVS) and surface area movement management (SAMM). Airlines have already certified and have been flying with these SafeRoute applications on A330s, 757s and 767s. Delta Air Lines uses ITP on three 767s, while the former US Airways is flying CAVS into Philadelphia International Airport on 20 A330s. The P-3s are using another SafeRoute application, enhanced visual acquisition (EVAcq), which “provides the crew traffic passive surveillance ranges beyond 100 nm,” according to ACSS.

ACSS sister company L-3 Aviation Products is also addressing the general aviation market with its Lynx MultiLink Surveillance System, a one-box ADS-B OUT solution. Lynx has an ADS-B rule-compliant GPS position source and it uses existing wiring and antennas to make installation simpler.

### Esterline CMC

One of the missing links in meeting NextGen avionics requirements is the rule-compliant GPS receiver, and this is especially a problem in the airline industry, where GPS was slow to take hold. Most airliners are equipped with MMRs, but airlines have been slow to upgrade MMRs with SBAS-quality GPS sensors, and this could complicate compliance with ADS-B OUT mandates.

Esterline CMC has a solution for this problem, an SBAS/Waas-capable precision GPS receiver, the IntegriFlight CMA-5024, which can be installed with an optional CMA-5025 control panel. The control panel allows pilots to select LPV or SBAS approaches, if the FMS doesn’t have that capability. Ground-based augmentation system (GBAS) capability will be added soon. The CMA-5024 and -5025 thus offers older aircraft an upgrade path to NextGen GPS requirements with the benefit of advanced



CMA-5025

approach capability.

“Our [solution] is designed for easy retrofit,” said John Studenny, Esterline CMC aviation GPS product manager, “whether it has an MMR or not. With one receiver it can feed RNP, ADS-B and GPS approaches.”

Studenny cited an example where airline Canadian North installed the CMA-5024 in one of its Boeing 737s. Absence of ILS approaches in the far north meant frequent flight cancellations during bad weather, but once the 737 was able to fly LPV approaches with the CMA-5024, he said, “that airline’s business tripled. They had been slaves to the weather.” By adding LPV capability, the airline was able to stick to schedules and customers soon took advantage and began traveling more frequently. “That’s a tremendous success story,” he said.

### FreeFlight Systems

In the Part 25 business jet market, owners and operators of older jets are facing a serious problem: with some business jet ADS-B upgrades costing well into six figures, enthusiasm for upgrading a jet worth \$1 million or less is dim.

FreeFlight Systems has been at the forefront of offering reasonably priced ADS-B upgrades for Part 23 aircraft and is now developing low-cost ADS-B equipment for the Part 25 market, specifically targeting lower-value business jets. The FreeFlight FTX-200 is a combined ADS-B rule-compliant transponder and GPS in one box that will sell for \$30,000 to \$40,000, including the installation kit and antennas.

“A lot of avionics manufacturers are tying FMS upgrades with glass cockpits. And owners are facing \$100,000 to \$700,000 to upgrade the entire cockpit,” said Jessica Power,

cockpit multifunction displays or on dedicated EFBs, such as the Astronautics Nexis and Esterline CMC units.

System wide information management (Swim) is part of the NextGen infrastructure, which “will enable cost-effective, real-time data exchange and sharing among users of the [NAS],” according to the FAA. One of Swim’s features will offer dissemination of aviation weather products to ATC and aircraft operators.

Nav Canada and NATS Control Centre (Prestwick, Scotland) have implemented a precursor to Swim, the Gander Automated Air Traffic System (GAATS+), which allows Canadian controllers in Gander to exchange messages “with advanced automation, allowing improved coordination between the centers,” including conflict prediction and alerts. Eventually, Gander and Prestwick will share information about ADS-B-equipped aircraft. The Aireon satellite-based ADS-B service network is expected to be operational in 2018, thus making it easier to track ADS-B targets over the ocean and remote regions, which are out of reception from ground-based ADS-B stations.

## Equipment Mandates

**ADS-B**—The mandate that affects most aircraft operators in the U.S., Europe and parts of the Asia-Pacific region is for ADS-B OUT equipment.

There are two key items that operators need to know about when considering ADS-B installations. First, two different RTCA standards apply to ADS-B transponders: DO-260A and DO-260B. In some parts of the world authorities want compliance with DO-260A, but U.S. and European mandates require compliance with the more stringent DO-260B standard. U.S. business aircraft operators should plan to meet the DO-260B standard. If the aircraft has a DO-260A transponder, it will need to be upgraded for operation in U.S. and European airspace after the mandates kick in. (DO-260A/B applies

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FreeFlight director of sales and marketing. “We were able to stop the bleeding for some folks facing six-plus figure [upgrades] and made it more digestible for a \$1 million airplane.”

FreeFlight is working with partners to certify an FTX-200 STC for the Hawker 400, 30-series Learjets and 500-series Citations. The installation will use either an existing control head in the cockpit or add a FreeFlight control head. FreeFlight also offers the FRX-250, which includes a 978UAT ADS-B IN receiver, so these aircraft can benefit from free FIS-B weather services.

FreeFlight is also working with airlines in Europe for 737 and 757 ADS-B OUT upgrades. “They don’t need to upgrade the FMS; they just need the transponder and GPS,” she said.



FreeFlight FRX-250

## Garmin

Aircraft equipped with Garmin G5000 Part 25 cockpits are already being delivered with Fans/CPDLC and ADS-B capability, and the G1000, G2000 and G3000 flight decks are easily upgradeable for ADS-B OUT. Garmin’s ADS-B IN solutions, including TargetTrend traffic and Surface Situation Awareness, are available on its ADS-B-capable

systems. TargetTrend shows relative motion of other traffic, while Surface Situation Awareness displays traffic on the airport surface.

Garmin also offers a simple ADS-B solution for older business jets, its GTX 3000 Mode 3 transponder combined with the GDL 88 datalink and Flight Stream wireless gateway. The GDL 88 has a Waas/SBAS GPS receiver, thus eliminating the need to upgrade existing FMSs and making the installation much less complicated. The Flight Stream wireless gateway facilitates display of ADS-B IN weather and traffic on the Garmin Pilot mobile app.

Garmin is working with dealers on STCs for this upgrade, including Executive Aircraft Maintenance (Citation V), Elliott Aviation (Hawker 750, 800A/XP, 850XP, 900XP, Beechjet 400A/Hawker 400XP) and Butler National (Learjet 35A, 60).

## Honeywell

Most ADS-B equipage for aircraft with Honeywell-based avionics is in newer aircraft, including the Gulfstream G450/550/650, Dassault Falcons, Pilatus PC-12 and AgustaWestland AW139, according to Scott Miller, director of marketing and product management for safety and information management. “Honeywell now has more than 700 aircraft certified with ADS-B that meets the mandate for Europe and the FAA,” he said. “Where we see the lag is with legacy fleets.” These include Cessna Citations, Hawker 800s and Learjets.

Certification of Honeywell’s transponder for ADS-B OUT for Airbus and Boeing aircraft is late, Miller admitted. While certification had been planned for last year, it has been pushed to



Garmin G5000

to the 1090ES datalink, while DO-282B applies to the 978UAT datalink.)

The other key item is the need for a Letter of Authorization (LOA) from the relevant regulatory authority. An LOA is not required in the U.S.; the LOA requirement stems from the International Civil Aviation Organization, and countries that have or are implementing ADS-B are hewing to ICAO requirements that specify the need for an LOA. Incidentally, no one understands why an LOA would be necessary for ADS-B operations, as the basic control pilots have over the system is the on-off switch, similar to a transponder. FAA regulations do require that ADS-B OUT be switched on at all times during flight.

ADS-B OUT is currently required in parts of Australia, Hong Kong, Singapore, Vietnam and Taiwan. ADS-B is available in the Hudson Bay region of Canada, but is not mandatory, although equipped aircraft will receive better services in that area.

In Australia, all aircraft flying IFR at or above 29,000 feet were required to be ADS-B OUT equipped beginning Dec. 12, 2013. Beginning Feb. 6, 2014, all new aircraft were required to have ADS-B OUT capability. All aircraft will need ADS-B OUT for Class A, B, C or E airspace in a 500-nm circle around Perth beginning Feb. 4, 2016. Then from Feb. 2, 2017 all IFR aircraft flying in Australian airspace must be ADS-B OUT equipped.

Canada is already using ADS-B for surveillance of aircraft flying in 4 million sq km of airspace over the Hudson Bay and northeast Canada/oceanic areas. Canada does not currently have an ADS-B mandate but is encouraging operators to equip to receive better services in ADS-B coverage areas.

In Hong Kong, Singapore, Vietnam and Taiwan certain routes above 29,000 feet require ADS-B.

In Europe, the ADS-B mandate will apply to Eurocontrol airspace. Equipment meeting the DO-260B standard will be required for new aircraft beginning

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2016. "That's close to the European forward-fit mandate in June 2016, but plenty of time for the retrofit market." For business aviation, equipment on Primus Epic and Primus 1000 and 2000 cockpits is certified and available via manufacturer service bulletins. Some aircraft may need GPS upgrades, and Honeywell is working on options to help owners of older business jets keep costs down, he explained.

On the Fans side, said Darshan Ghandi, director of marketing and product management, "We see a lot of interest from business and general aviation operators, both with Epic as well as some older Primus 1000/2000 systems." Fans equipment has already been certified and is flying on modern Epic cockpits such as in newer Gulfstreams and Falcons and is available for retrofit via manufacturer service bulletins. "Then

we've been focused, as we approach the 2017 [Fans] mandates, on the retrofit market," he said. "We're working with Gulfstream on the GIV and GV, then with Dassault on the Falcon C and EX [models]." Honeywell is also exploring Fans STCs for earlier Falcons and Bombardier's Challenger 601 series. Fans upgrades are available from Dassault for the 7X, 900 EX EASy and 2000 EASy II models, and Western Aircraft is one MRO that has completed several Falcon Fans upgrades.

Operators that buy the new Gulfstream G500/G600 and Falcon 5X will have cockpit display of traffic information, including display of surface traffic, built in.

A useful poster showing the status and availability of NextGen upgrades for business aircraft with Honeywell avionics is available on the company's mandates web page: <http://aerospace.honeywell.com/news/understanding-the-mandates-landscape>.

### Rockwell Collins

"NextGen readiness is a huge focus [for Rockwell Collins] for all markets," said Adam Evanschwartz, director of marketing for business and regional aviation. "We have solutions for [ADS-B, Fans, CPDLC], either available today or soon, well ahead of when they're needed." Global 5000s and 6000s and Gulfstream G280s—all with Pro Line Fusion-based avionics—are flying now with factory-installed Fans equipment.

On the retrofit side, Evanschwartz encourages business jet operators to look beyond the upcoming mandates for equipage needs, which could mean upgrading a flight deck from cathode-ray tube-based displays to LCDs, not just upgrading to the necessary new transponder for ADS-B OUT capability. The Rockwell Collins TDR-94D ADS-B OUT-compliant transponder is certified and available today, he said. The company has fielded more than 34,000 TDR-94D transponders, and these are upgradeable to the latest ADS-B configuration, although older units will require more work.

While older Pro Line 4 cockpits can be upgraded to provide ADS-B OUT, this might not be the optimum solution. Upgrading to Pro Line



**Honeywell's implementation of the ADS-B IN cockpit display of traffic information.**



June 8, 2016, and for aircraft being retrofitted for ADS-B OUT operations the date is June 7, 2020. This applies only to aircraft weighing more than 5,700 kg/12,566 pounds or with a cruise speed of more than 250 knots.

In the U.S., aircraft without ADS-B OUT will not be able to fly in airspace that currently requires a transponder after midnight on Dec. 31, 2019. Airspace where ADS-B OUT will be required is as follows:

Class B and Class C airspace; within 30 nm of major airports from the surface upward to 10,000 feet msl; above the ceiling and within the lateral boundaries of a Class B or Class C airspace area designated for an airport upward to 10,000 feet msl; Class E airspace within the 48 contiguous states and the District of Columbia at and above 10,000 feet msl, excluding the airspace at and below 2,500 feet above the surface; Class E airspace at and above 3,000 feet msl over the Gulf of Mexico from the coastline of the U.S. to 12 nm. The rule doesn't apply to aircraft lacking an electrical system and balloons and gliders, but they are restricted to remaining outside Class B and C airspace and below the altitude of the ceiling of a Class B or C airspace area designated for an airport or 10,000 feet msl, whichever is lower.

## Future Air Navigation System—

Fans was developed in the 1980s as a way to improve air traffic management using digital communications, navigation and surveillance techniques. Boeing developed its own solution, known as Fans 1, and Airbus's solution is known as Fans A, thus the current term Fans 1/A.

The lucky pilots mentioned at the beginning of this report are those who are flying newer aircraft coming out of the factory already Fans 1/A equipped—not only because these pilots can fly in areas where Fans is required but also because Fans equipment easily accommodates or includes other NextGen technologies such as the highly accurate GPS source and ADS-B OUT capability.

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*Rockwell Collins NextGen-equipped Vision flight deck in the new Bombardier Challenger 650.*

21 can incorporate not only ADS-B but also Fans, LPV approaches and radius-to-fix legs for RNP approaches, as well as synthetic vision. That doesn't mean, however, that Pro Line 4 can't be upgraded for most of those capabilities. Rockwell Collins and Jet Aviation are developing a Pro Line 4 Fans, ADS-B, LPV solution for the Challenger 604 that will be available this year. Older Falcons will have a Fans solution available this year, according to Evanschwartz.

For ADS-B OUT, Safran Engineering Services and Duncan Aviation are developing an approved model list STC using the TDR-94D for the Challenger 601-3A/3R, Learjet 60, Gulfstream G100, G200 and the Hawker 800 series.

## Universal Avionics

"Operators need to think about more than just ADS-B compliance," said Carey Miller, manager of business development for Universal Avionics. Along with its avionics dealer partners such as Chicago Jet, Universal has been at the forefront of the Fans retrofit market, offering both equipment and expertise that makes Fans possible for a variety of business jets. Universal manufactures not only the Fans-capable SBAS FMS with ADS-B OUT-compliant GPS receiver but also the UniLink CL-800/-801 communications management unit (datalink) and data-capable cockpit voice recorder.

Universal is modifying its FMS data-loading



## PART 23

The key NextGen mandate for Part 23 aircraft is for ADS-B, and there are plenty of avionics manufacturers serving this need with transmitters, receivers and transponders—among them Aspen Avionics, Avidyne, BendixKing, FreeFlight Systems, Garmin, L-3 Aviation, NavWorx and Trig Avionics. Their solutions range from the simplest—ADS-B OUT on 978UAT—to the more complex such as ADS-B IN on 978UAT and in and out on 1090ES. The latter allows the pilot to receive traffic information not only via TIS-B but also directly from ADS-B out-equipped aircraft broadcasting either on 978 or 1090 MHz.

Most of these systems are certified and available today. A typical installation of a Part 23 ADS-B IN and OUT system takes about 20 hours, according to FreeFlight director of sales and marketing Jessica Power, and that would include configuring the system to the transponder and control head and installing a Waas/GPS antenna on the top of the fuselage and an antenna on the bottom to receive the "IN" signals from ground stations.

—M.T.



a radar antenna to make one sweep of the sky. This benefit often allows an airplane to fly an instrument approach in an area where radar isn't available.

On October 28 the FAA held a "call to action" meeting with the aviation industry to discuss issues that are preventing more widespread adoption of ADS-B OUT equipment. Last September the Department of Transportation inspector general released an audit of the program that found the initial benefits of ADS-B OUT will be limited and that only a fragment of the industry—3 percent of major air carriers and 10 percent of general aviation users—have thus far equipped. A result of that meeting was formation of the Equip 2020 group, designed to allow the FAA and industry to work together to resolve issues that are delaying ADS-B equipage.

NBAA vice president of regulatory and international affairs Doug Carr, who attended the call to action, raised the issue of low-cost loans to help owners and operators equip for NextGen. The congressionally authorized NextGen GA Fund is designed to provide loans with low interest rates to help pay for NextGen upgrades. Paula Derks, president of the Aircraft Electronics Association, pointed out that AEA members are ready to install ADS-B OUT avionics, but "the FAA is dragging its feet on the incentive program by not approving the loan guarantee certificates for the NextGen GA Fund."

According to an FAA spokesman, however, any progress on these loans remains Congress's purview: "While the 2012 FAA Reauthorization included a provision intended to allow the FAA to enter into public-private partnerships including loan guarantees, the FAA requires specific language in an appropriation act before it can issue such guarantees."

AOPA is more concerned about the price of ADS-B installations, especially for owners of older general aviation aircraft. "The minimum investment of \$5,000 to \$6,000 to install ADS-B OUT equipment is 'far too high' for many

GA operators," AOPA president Mark Baker wrote in a letter to the FAA, "especially given that the general aviation fleet includes at least 81,564 certified, piston-powered, fixed-wing aircraft that are valued at \$40,000 or less, and that GA owners have no way to recoup their costs.

"We strongly believe there are alternative means to ensuring that plans for a satellite-based air traffic management system can be implemented with the widespread participation of the general aviation community," Baker wrote.

Not all agree with Baker. It has been pointed out that the FAA-mandated installation of mode-C transponders, which then cost about \$1,000, faced a similar argument about lack of benefits to aircraft owners. The current cost of basic ADS-B OUT equipment is roughly the same as that transponder when inflation is taken into account.

The pressing problem now is getting the fleet equipped in time for the 2020 mandate. In testimony before the House of Representatives Committee on Small Business last June, Tim Taylor, president and CEO of FreeFlight Systems, outlined this issue. "With approximately 2,000 days between now and January 1, 2020, we need to equip 60 to 70 aircraft per day—including weekends and holidays—or 85 to 100 aircraft per work day."

Commenting on this issue, Hal Adams, co-founder and COO of Accord Technology, told AIN, "Waiting on lower-cost avionics is a myth. Avionics have a minimum threshold of costs (non-recurring engineering) to accommodate [and] meet all the FAA requirements. As an industry, there may be one or two entries that will be somewhat marginally less in cost, but new solutions are not likely. This is not consumer electronics wherein AOPA thinks the price will just keep going down. If we had a market consisting of billions of potential buyers, we would still be unable to make drastic price drops because of the overhead of development and ongoing overhead that comes with certified avionics."

What Adams would like to see as a result of the Equip 2020 group is the FAA reaching out to the aviation industry "with a concise, cogent message that would energize the buying community: ADS-B/NextGen is a real benefit to participate [in]."

The ADS-B IN benefit of free weather information is exclusively a U.S. feature, and in a recent study conducted by the Massachusetts Institute of Technology International Center for Air Transportation, pilots showed appreciation for ADS-B IN traffic and weather.

The study drew responses from 1,407 pilots, 56 percent of whom reported having used ADS-B IN. Of those, 85 percent used portable systems, such as an ADS-B IN receiver providing data to a tablet computer.

It should be noted that not all traffic information will be received by an aircraft equipped with 978UAT ADS-B IN (whether portable or installed) unless that aircraft also broadcasts an ADS-B OUT signal to "wake up" the ground station, which then sends the TIS-B traffic information. The study found that pilots with ADS-B OUT benefitted more than pilots of ADS-B IN traffic. "A full 51 percent of respondents with both ADS-B IN and ADS-B OUT reported that ADS-B traffic had helped them avoid a midair collision, while only 19 percent of respondents without ADS-B OUT agreed. This, along with other responses, suggested a safety benefit from improved traffic avoidance for respondents who also fly with ADS-B OUT installed in their aircraft. While this issue is anticipated to dissipate as a greater percentage of the general aviation fleet equips with ADS-B OUT, the coverage limitations clearly limit the usefulness of ADS-B traffic information as currently implemented."

For pilots who have used ADS-B IN, weather services ranked highest in factors influencing their choice of equipment, followed closely by traffic services. Regarding the value of available FIS-B services, weather radar ranked highest, followed by Metars and TFRs. □