COCKPIT avionics

Part I: The U.S. ADS-B mandate

by Matt Thurber

The deadline for equipping your aircraft with ADS-B is only 36 months away. Aircraft owners and operators hoping that the FAA is going to delay the implementation of the upcoming mandate might want to think carefully about what they plan to do after midnight Dec. 31, 2019. Come 12:00:01 a.m. Jan. 1, 2020, aircraft without ADS-B OUT will be prohibited from flying in much of the airspace covering the U.S. The FAA has clearly said that the ADS-B OUT rule will not be delayed. The bottom line: if you want to fly in airspace that currently requires a transponder after midnight Dec. 31, 2019, your aircraft will need rule-compliant ADS-B OUT.

At a meeting a few months ago held by a regional business aviation group, one of the avionics shop managers expressed concern that some pilots he had spoken with had zero knowledge of ADS-B OUT and the rapidly approaching deadline. These were pilots flying business jets whose owners had made no plans for the upgrade, and this shop manager was surprised that these pilots not yet even begun the education process.

While the number of aircraft that have been upgraded for ADS-B OUT is climbing, the most recent statistics suggest that the fleet of 150,000 or so airplanes that will need this new capability is nowhere near where it should be to meet the deadline. There will be grounded aircraft on Jan. 1, 2020.

According to the FAA's latest figures, as of the beginning of last month, 27,304 aircraft in the U.S. are equipped for ADS-B OUT. These numbers include 5,165 "non-performing emitters," which are aircraft (primarily light) with ADS-B signal outputs that don't meet the minimum requirements, likely because of installation errors or equipment problems.

The number of GA aircraft equipping for ADS-B OUT isn't growing very quickly but it has climbed from 1,000 per month at the beginning of June to 1,500 per month. Yet there are just 36 months remaining until the deadline, and likely 125,000 aircraft to go, which averages out at 3,500 per month needing upgrades.

The business aircraft side (turboprops and jets) is facing some challenges as far as compliance is concerned, according to Carey Miller, manager of business development at Universal Avionics. He plumbed registry databases to determine how many aircraft are likely to need to be ADS-B OUT equipped and found that 19,000 jets and turboprops are affected. For comparison purposes, Miller looked at the last major business aviation

ADS-B OUT compared to RVSM

RVSM	ADS-B OUT
~6,500 corporate A/C	~20,000 corporate A/C
FAA was not ready	FAA ready
~36 months to equip all operators (incl. 12 mo. after)	38 months left to equip
Operate below FL290	Not equipped in time: **Grounded**

SOURCE: UNIVERSAL

mandate, the requirement for RVSM upgrades after the rules changed to lower altitude separation minimums above FL290. The RVSM mandate didn't affect as many aircraft—a lot of turboprops didn't need the upgrade—but the amount of work needed was analogous to ADS-B OUT, he discovered.

The most telling part of Miller's analysis is that only 6,500 business aircraft needed the RVSM upgrade to meet that mandate's deadline. That is roughly a third the number that need to be ADS-B equipped by midnight on Dec. 31, 2019. Avionics manufacturers, engineers and installers geared up massively to help their customers meet the RVSM deadline. Unlike the ADS-B mandate, Miller pointed out, there was a way for non-RVSM airplanes to continue flying, by using waivers and the occasional clearance through RVSM airspace or the more common although far less expedient option of flying below FL290. Even today, pilots sometimes have to resort to flying low while waiting for a delayed letter of authorization (LOA) for RVSM operations. Fortunately, the FAA opted not to require an LOA for ADS-B OUT, which makes eminent sense because operationally it is no different from a transponder, and the only control pilots have is an on-off switch.

During the RVSM upgrade process, the bulk of the work took place 24 months before and 12 months after the deadline, according to Miller. Unlike ADS-B, the FAA wasn't ready for the sudden influx of supplemental type certificate (STC) approvals, he explained. "It was way behind. This time the FAA is ready. The ground infrastructure is done, the agency has [allowed] certifications to be done under field approvals if it has the data and there is no LOA required. The FAA is also offering financial incentives [rebates for light aircraft]. From what I've seen, the FAA is doing everything it possibly can to help out." Nevertheless, the data show that getting all of the 19,000 business aircraft ADS-B OUT compliant by midnight Dec. 31, 2019, is going to be impossible. "There is no way corporate operators will be able to get it done," Miller said.

The one olive branch that the FAA is not holding out is the possibility of delaying the ADS-B OUT mandate. Even though some airspace in the U.S. falls outside the mandated coverage area, corporate operators typically fly in areas that will require ADS-B OUT and definitely in Class A airspace (above FL180), where it is unquestionably required.

The FAA also will not allow portable ADS-B OUT transceivers. The FAA system for monitoring ADS-B signal quality has seen degraded performance in some aircraft with poor antenna location, and a number of these were using portable devices, the agency explained. Each ADS-B OUT system transmits a mode-S transponder code, which is assigned to the aircraft in which the equipment is installed. For portable receivers to work, a new code would have to be programmed every time the system was moved to another aircraft, which opens the possibility of input errors. This could "prevent proper target correlation within ATC automation systems (target drops/traffic conflict alerts), which have resulted in higher workload and unnecessary distractions for pilots and controllers," according to the FAA.

Finally, the FAA doesn't like the idea of suction-cup GPS antennas for these units blocking pilots' view and wires to and from the unit for the antenna and power supply snaking around the cockpit. This last point is debatable, because there are plenty of aircraft, some of them business jets and turboprops, flying around with portable ADS-B IN receivers using external GPS and ADS-B antennas and there doesn't seem to be a serious safety issue.

The ADS-B rules do allow for the possibility of a one-time deviation in certain circumstances, such as the need to fly to an airport of ultimate destination, with intermediate stops, with inoperative ADS-B OUT, or even in a non-equipped aircraft. But ATC has the authority to decide and "to deny such requests when deemed appropriate," according to the FAA.

Got Equipment?

Once the decision to equip for ADS-B OUT and the other major NextGen opportunity, Future

Where is ADS-B required?

Here is where aircraft will be required to have ADS-B OUT equipment (basically an upgraded transponder and current GPS receiver).

United States: Class A, B, and C airspace. 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 agl. Class E airspace at and above 3,000 feet msl over the Gulf of Mexico from the coastline of the U.S. out to 12 nm. Around those airports identified in Part 91, Appendix D.

Europe: the European ADS-B OUT mandate takes effect on June 7, 2020, but it applies only to aircraft weighing more than 5,700 kg (12,566 pounds) or with a maximum cruising true airspeed of greater than 250 knots.

Australia: By February 2 this year, all aircraft must be ADS-B OUT-equipped to fly IFR. However, there are some exceptions for Australian-manufactured aircraft (built before Feb. 6, 2014) that apply until Jan. 1, 2020. Foreign-registered aircraft flying IFR "may fly in Australian airspace, including oceanic control areas, but must fly below 29,000 feet in continental airspace unless they receive a clearance from ATC. They will need to be equipped with ADS-B when the instrument expires on June 6, 2020," according to Airservices Australia.

Hong Kong: Required in all airspace FL290 and above.

Indonesia: Required in all airspace FL290 and above starting Jan. 1, 2018.

Mexico: Proposed, to begin Jan. 1, 2020, Class A, B, C, E above 10,000 feet, possibly earlier in some Gulf of Mexico airspace.

Singapore: Required on some airways.

Sri Lanka: Required in Colombo terminal control area FL290 and above.

Taiwan: Required all airspace FL290 and above.

Vietnam: Required on some airways.

Air Navigation System (Fans), is made then the question of determining how to equip comes up. For a few years after the ADS-B OUT rules were issued in 2010, there weren't a lot of choices for upgrades, and prices, especially for business aircraft, were in some cases shockingly high. That situation has settled somewhat. For popular aircraft there are many options, and for nearly all the affected aircraft, there is at least one solution available. Prices have settled to what industry experts assert are the lowest levels possible, so there is no benefit in waiting in the hope that a lower-cost solution will be offered in time to meet the deadline.

All of the business aircraft manufacturers have stepped up with service bulletins and upgrade packages for their in-service fleets. Gulfstream, for example, worked with Garmin to develop ADS-B OUT AND IN for the G150 and G200. Bombardier is helping operators of its legacy jets connect with third-party STC developers for ADS-B upgrades, when necessary. Textron Aviation's Citation and Hawker Beechcraft service center network has already installed more than 1,000 ADS-B upgrades and has solutions for Citations, King Airs and Hawkers. Business aviation avionics shops have also prepared for the mandate and either developed their own STCs or worked with engineering firms such as Dan Buzz and Associates to develop ADS-B OUT packages for a huge number of aircraft types. The number of entities that have worked on ADS-B is staggering, and they have done their best to prepare for the vast influx of work that is on the horizon. Even better, the FAA has smoothed the path for approved model list (AML) STCs for Part 25 business jets, vastly speeding the approval process.

ACSS is among the companies to offer equipment to meet the ADS-B mandate.

Equipment Options

Avionics manufacturers—ACSS, Appareo, Aspen, Avidyne, BendixKing, FreeFlight, Garmin, Honeywell, Rockwell Collins, Trig and Universal—have expended extraordinary resources to help the industry meet the ADS-B OUT mandate. For a current list of aircraft models and all of the available ADS-B solutions, see www.faa.gov/nextgen/equipadsb/adsb_ready/.

In the business aircraft arena, Aviation Communication & Surveillance Systems (ACSS), the L-3/Thales joint venture, recently unveiled a transponder and self-contained GPS receiver that meet the latest regulatory requirements, for about 40 percent less cost than some existing offerings. The NXG-900 GPS eliminates the need to upgrade an old FMS or other installed avionics with a new GPS sensor, which can be expensive. The ACSS GPS is there only to provide the required position accuracy needed for ADS-B OUT, however, and it can't be used for any aircraft navigational or Tcas functions. The NXG-900 GPS also has an ADS-B IN receiver, so buyers can receive free FIS-B weather information (in the U.S. only) wirelessly on mobile devices via Bluetooth.

Last year, ACSS announced the NXT-700 transponder, which is plug-and-play compatible with the Honeywell MST-67A found in a number of business jets, including older ones without another reasonably priced ADS-B solution available. No wiring or rack changes are needed to replace the MST-67A with the NXT-700. ACSS has received an AML-STC covering a number of business jets, and from 4,000 to 5,000 older business aircraft that need a new transponder qualify to use the NXT-700, according to ACSS president Terry Flaishans.

ACSS also makes two transponders that serve the business jet and air transport markets, the NXT-600 and NXT-800, respectively, as well as the L-3 Avionics NGT series ADS-B OUT transponder for smaller aircraft. Installers have found a home for single and dual NGT-9000 installations in some light jets. "We're in a good position with our transponders," said Flaishans. "There are no issues to meet the needed quantities, from a supplier standpoint."

At Honeywell Aerospace, solutions for ADS-B and in many cases Fans upgrades are available for business aircraft as far back as 1980s models. "We have interesting offerings in terms of mandates and features," said Todd Mathis, manager of technical sales. "We want to get the word out to operators: we have the equipment and we are ready for this. We need the operators to come in, and we're concerned about the myths that the ADS-B OUT mandate will be delayed. We have competitive offerings no matter what class or era of aircraft you have, offerings that maintain the existing configuration and support well into the future aircraft systems support and future upgrades."

The best place to look for available upgrades from Honeywell is the company's latest mandates chart, available by searching online for "mandates-at-a-glance."

At Rockwell Collins, said Rob Myhlhousen, principal marketing manager for

ADS-B, "We're planning for the demand for the current fiscal year, and making sure products are available and service centers are ready and equipped for customers who may need upgrades." Myhlhousen's team is monitoring the marketplace, he explained, to detect a rapid uptake in interest for ADS-B upgrades so "we're able to meet the demand."

On the Fans side, those upgrades, said Rockwell Collins Fans principal marketing manager Chuck Wade, "are available for all but one or two aircraft. We're ready, and we've been waiting." Bombardier jets and Dassault Falcons are the primary market for Rockwell Collins Fans upgrades, and the company is trying to encourage operators to consider doing ADS-B and Fans upgrades at the same time, to reduce overall downtime. "It's real savings," he said. "Whether it's a Challenger 300, Falcon 50EX or 2000, everything is there and ready."

Rockwell Collins's website shows all the available upgrades for aircraft with its avionics, including third-party options: www.rockwellcollins.com/ads-b.

"Our big push is that [the equipment] is certified and ready now," said Myhlhousen. "Our transponders are certified, GPS sensors, everything you need from a hardware perspective. We've had a great response from our dealers and the OEMs [certifying service bulletins and STCs], and in many cases customers have multiple options when it comes to upgrades. In business aviation, the market responded greatly in terms of getting certifications ready, and these are available as soon as the customers decide they're ready."

"We've planned for [the demand for upgrades]," said Universal's Miller. "We're one of the few avionics manufacturers that has our own production facility, here in Tucson, and our lead times are normally short. We don't think our equipment is going to have a lead-time issue when things get busy."

Basic or Integrated?

One decision that business aircraft owners and operators will have to make when planning for NextGen upgrades is whether to buy the least expensive "federated" package that will keep the aircraft legal or to seek an upgrade that is integrated with the existing avionics suite and not only retains the current autopilot/FMS functionality but also enhances that with features such as LPV approaches and is prepared for future NextGen developments. That latter choice is more expensive, but the benefits might outweigh the added costs, according to avionics manufacturers.

"There are two mandates where that becomes important," said Honeywell's Mathis, "ADS-B and Fans. The case for integration is compelling. You have a range of elements with a certified configuration and system integrity that you have with an integrated solution. Our offerings are really price competitive with many of the add-on solutions."

The other issue with this choice is aircraft value and the ease of selling when that time comes. "You might save a little going with a [non-integrated] add-on, but on the whole you won't be ahead." The idea is to be ready for future upgrades, especially considering business aircraft have long service lives, he explained. Integrated systems are easier to maintain, he added.

"Future maintainability is key," agreed Hurst. "Federated systems make that more difficult to do."

"We're trying to educate operators to think beyond ADS-B and look at performance-based navigation and other areas where it needs SBAS GPS," said Myhlhousen of Rockwell Collins. "You could put in a third-party solution with an SBAS GPS, but that doesn't integrate with the FMS. With the Rockwell Collins GPS sensor, you're one step closer to RNP and LPV capability. If it's a third-party solution, you're not positioning the aircraft for additional airspace modernization benefits. And it preserves the value of the aircraft, and affects the ability to support it."

There are some cases where a federated upgrade makes sense, particularly older jets. "Since our FMS is a federated type in most installations, older aircraft can upgrade with our package reasonably," said Miller of Universal Avionics. But this could also be considered as a building-block approach, with compliance first, then the ability to add new functionality later, and this is something that Universal offers. An operator, for example, could upgrade an older Universal FMS with a new nav computer for ADS-B OUT and later add LPV capability to take advantage of the 3,500 LPV approaches now available.

Better Get Scheduled

There is a growing sense of urgency among the avionics and aircraft manufacturers, service centers and regulators, that the ADS-B deadline is rapidly approaching, and aircraft owners and operators need to make immediate plans to upgrade or face grounding on Jan. 1, 2020.

"We're hearing there are upgrades taking place," said Myhlhousen, "but not significant numbers, [although] signs are pointing in the right direction. We're hearing from dealers that there is a lot more activity around quoting. We hope that's a good sign for 2017."

Honeywell's Hurst worries about the capacity of the avionics shops as the deadline approaches. "At some point if you continue to wait, you will not get a slot," he cautioned.

"For Honeywell," added Mathis, "we look at this in terms of three segments where there is market interest and we have offerings. On our newer production aircraft with Epic or 2000-era systems, ADS-B OUT has been wildly successful, with extremely high adoption in the larger jets. For the mid-90s jets, those customers are upgrading to ADS-B OUT. But the issue is [the difficult] decision-making on lower hull values for 80s-era jets."

Mathis stated the issue clearly for procrastinators: "We must get the word out to operators and owners that their aircraft need to be upgraded ASAP and the time to get that done is now. Prices are going to slowly increase rather than decrease."

"Our network is concerned with that issue," said Hurst. "We provisioned heavily for inventory to support this, but we need people to come in."

"If demand is so high and supply meets only a certain amount, then the price is going to go higher," agreed ACSS's Flaishans. "The business jet market is picking up; it's a little slow, but we're seeing a pickup. Dealers are getting more efficient at installing these upgrades. The message should be, 'Start equipping because time is going to run out.'"

Another consideration, explained Universal's Miller, is that some avionics manufacturers are offering incentives for early adopters, but those are going to disappear as demand rises sharply. Avionics shops are likely to raise their rates, too, when demand picks up. "Dealers are concerned," he said. "[Owners] that pop in and want to have this done right away are going to be in for a shock." ❑