HE FAA IS WORKING to ensure that all aircraft outfitted with automatic dependent surveillance-broadcast (ADS-B) “out” — a basic level of equipage that transmits position data — have properly programmed and working equipment.

ADS-B is the surveillance part of the FAA’s NextGen effort to modernize the U.S. air traffic system.

ADS-B “out” will be required to fly in most controlled airspace by January 1, 2020, but many owners of experimental and light-sport aircraft (LSA) are going the extra step of equipping with optional ADS-B “in” equipment to take advantage of the traffic and weather information services that provide added situational awareness and peace of mind.

Nearly half of the ADS-B “in” equipment in experimental aircraft and LSA uses the 978 MHz frequency via a universal access transceiver (UAT). Another solution is to equip with a Mode S transponder with ADS-B capability operating on 1090 MHz with extended squitter (1090ES).

The FAA broadcasts two types of useful safety information from the ground to ADS-B “in”-equipped cockpits via UAT. Traffic information services-broadcast (TIS-B) shows nearby air traffic (ADS-B “in” can also receive position reports directly from nearby aircraft with ADS-B “out”). ADS-B “in”-equipped aircraft with UAT also have access to flight information services-broadcast (FIS-B) graphical weather as well as text-based advisories, including notices to airmen. A Mode S transponder can receive TIS-B but not FIS-B due to bandwidth limits on the 1090 MHz frequency.

For TIS-B to function most effectively, ADS-B “in”-equipped aircraft need ADS-B “out” to provide the ground system with position information, which enables reception of nearby traffic information.

Enhanced safety is the main reason owners and pilots opt to install ADS-B “in” equipment in experimental aircraft and LSA when complying with the 2020 ADS-B “out” mandate. Better information and situational awareness lead to better decisions, which can help pilots avoid other aircraft and changing weather conditions nearby, potentially saving lives.

It is important to pair ADS-B “out” transmitters with approved GPS positioning sources. Experimental aircraft and LSA owners should seek ADS-B and GPS pairings approved by the FAA or deemed compliant by avionics or aircraft manufacturers. A manufacturer of an avionics system that includes ADS-B and GPS in the same box must obtain an approval of that system from the FAA.

Aircraft with a standard airworthiness certificate, such as a Cessna 172, must have ADS-B “out” paired with a position source that is approved by the FAA.

Experimental aircraft owners have numerous options when it comes to equipping with ADS-B. The easiest way is picking an avionics package with a compliance statement from the manufacturer for that ADS-B “out” transmitter and GPS.

James Marks, who leads the FAA’s ADS-B Focus Team, warns owners and pilots that portable ADS-B units — those that transmit ADS-B data and some that also receive it — can present problems. Such units do not have a fixed GPS antenna, which can mean inconsistent and poor performance.

“The rule states that ADS-B ‘out’ equipment must be installed in the aircraft,” Marks said. “The rule is very clear on this.” ADS-B receivers, on the other hand, do not interact with the ground system, so they don’t create any problems with information exchange. The FAA doesn’t certify or approve portable receivers, however, and is not sure how dependable the information is for pilots. Users of these units have to trust the manufacturers exclusively that the displayed information is reliable.

AFTER INSTALLATION

Once you have completed your installation or it has been accomplished at a repair shop, what should you do next? Go flying in ADS-B coverage, then go online.

After your first flight in ADS-B coverage, you can easily check online to see if your new equipment works properly and complies with FAA rules by requesting a public ADS-B performance report (PAPR).

ADS-B offers pilots and air traffic controllers better safety and situational awareness, but it’s imperative to check if your equipment is working properly after it’s installed and any time it’s serviced.
FINDING AND FIXING ISSUES

When installing ADS-B equipment, it's critical that you or your repair shop technicians correctly adjust several settings and codes.

"The most important thing is to ensure that the installation complies with the rule when it is completed. But that is often not the case with a large number of aircraft installations being completed now," Marks said. "Many aircraft equipped with ADS-B are operating with some type of unresolved problem."

Marks' small team notifies aircraft owners about the most serious ADS-B "out" avionics issues and works to resolve them. His team reports that it's not uncommon to hear that the owners were not aware their ADS-B avionics had problems.

Most installation issues so far have occurred in the biggest equipage group: single-engine, fixed-wing general aviation aircraft used primarily for recreation or training.

About 5,000 of 27,000 completed ADS-B "out" installations have performance problems or transmit incorrect data, the FAA found. Of those, 4,100 are single-engine general aviation aircraft including experimental and LSA.

About half of all ADS-B "out"-equipped experimental and LSA have issues with performance or avionics configuration. Many light aircraft owners have a great deal of technical savvy, but errors can and do occur with do-it-yourself ADS-B installations. Aircraft operators must ensure that their ADS-B equipment is functioning properly.

The most serious errors the FAA sees are:

- The transmitted FAA-assigned International Civil Aviation Organization (ICAO) 24-bit code is wrong. Some ADS-B units are manufactured with a default code. If it isn't changed to the assigned code at installation or is entered incorrectly, the aircraft will not be properly recognized by the FAA's ADS-B ground system and will also prevent processing of a PAPR request.

- On aircraft equipped with dual-out (1090ES and UAT), two different ICAO codes might be loaded into each unit. Few experimental aircraft or LSA will be equipped with dual-out.

- The transmitted flight identification code is incorrect. In most cases, the flight identification code should match the aircraft's registration number (N-number) and should always match the flight identification code filed on a flight plan.

If the transmitted ICAO code doesn't correlate to your aircraft's assigned N-number, your ADS-B installation is not compliant with the FAA rule. Ground test equipment will only verify that an ICAO code is loaded into the avionics, not that it is valid for your specific airframe.

For general aviation aircraft transmitting ADS-B "out" on both 1090 MHz and 978 MHz, having different codes in the Mode S transponder on 1090 MHz and in the UAT on 978 MHz may appear on a controller's display as two aircraft in close proximity. If the offending aircraft is also equipped with ADS-B "in," the pilot may see a second aircraft displayed very close by, prompting him or her to try to avoid an aircraft that isn't there. A pilot mistakenly thinking he or she needs to act fast to avoid a collision with a nonexistent aircraft can create a safety hazard.
The FAA ADS-B Focus Team’s highest communications priority is to quickly contact any aircraft operator with incorrect ICAO codes (either a single erroneous code or two codes that don’t match) or the wrong flight identification number. The agency handles about 200 of these high-priority cases a month.

Because ADS-B performance problems can emerge after initial installation, it is a good idea for aircraft owners to check performance with the PAPR service periodically, especially after maintenance or a software update to an ADS-B system component.

**IMPROVING PAPR AS ADS-B EQUIPAGE RISES**

The original idea for the PAPR came from discussions at the 2014 EAA/FAA Winter Summit, and the PAPR e-mail service was set up in May 2014. The FAA continues to improve the process for requesting and receiving PAPR reports based on feedback from aircraft owners, pilots, and manufacturers.

**ADS-B Out will be required in the following airspace:**
- **Class A, B, and C airspace**
- **Class E airspace** areas at or above 10,000 ft MSL over the 48 states and DC, excluding airspace at and below 2,500 ft AGL
- Airspace within 30 nautical miles (nm) at certain busy airports from the surface up to 10,000 feet MSL; airports listed in Appendix D to part 91
- Above the ceiling and within the lateral boundaries of a Class B or Class C airspace area up to 10,000 feet MSL
- **Class E airspace** over the Gulf of Mexico at and above 3,000 feet MSL within 12 nm of the coastline of the United States

An earlier process let users request ADS-B avionics performance by e-mail, but responses could take up to a day.

Now a user can visit the FAA’s portal an hour after a flight, enter data in a few fields, and submit a request in a matter of minutes. A six-page report comes back in about 30 minutes. A PAPR provides an overall assessment of avionics performance and sufficient detail to determine if your equipment complies with ADS-B regulations. It also flags any issues about the integrity and accuracy of your aircraft position reports.

The FAA estimates that 100,000 to 160,000 general aviation aircraft may need to be ADS-B “out” equipped by the 2020 deadline. About 1,300 new ADS-B installations occur each month.

Equipping early and validating that your ADS-B avionics are working properly will prevent any potential headaches that could arise as the deadline approaches. Aircraft owners who do not equip by the 2020 deadline may find that their aircraft will not be permitted to fly in certain airspace where ADS-B is required until they complete an installation and the equipment is working properly. As the mandate deadline approaches, repair shops expect to get even busier.

Some general aviation airports are located in Class B or C airspace because of their proximity to larger airports. Aircraft based at these airports will need ADS-B “out” equipment installed and working properly by the deadline on January 1, 2020. Otherwise, pilots will need authorization from controllers every time they fly until the required equipment is installed and working correctly. You can view the ADS-B rule for the airspace where you fly by downloading the Equip ADS-B Google Earth map at www.EAA.org/extras.

To ensure that you can keep flying when you want after the 2020 mandate, it’s better to have ADS-B installed and validated early. FAA Administrator Michael P. Huerta has reiterated on many occasions that the 2020 deadline for ADS-B equipage will not be extended.

**HOW ADS-B BENEFITS PILOTS**

Many aircraft owners contemplating an ADS-B “out” equipment installation to comply with the 2020 mandate may wonder what’s in it for them.

“The positioning data provided by ADS-B is more precise and timely than radar, and there is no doubt that this increases safety,” Marks said.

For example, the accuracy of radar is affected by the distance and atmospheric conditions between the aircraft and the radar site. At the outer limits of radar’s range, the accuracy of radar positioning can be skewed by more than 1,000 feet. Radar positioning depends on the sweep rate for each site, which can be between 4 to 6 seconds in terminal areas and 12 to 15 seconds for en route areas. This isn’t the case with ADS-B because the avionics onboard the aircraft determine its precise location using GPS, and report its position to a network of ground radio stations that feed air traffic control facilities across the country.

ADS-B also provides coverage in some areas where there is no radar capability, such as mountain valleys and over the Gulf of Mexico beyond the reach of shore-based radar. When controllers can track aircraft with ADS-B, they can provide the same services as when an aircraft is in radar contact.

In addition, if you decide to equip with optional ADS-B “in” equipment you can receive traffic information and, for those who select UAT, weather information as well.

David Hughes is an FAA writer/editor in NextGen Outreach and Reporting. Get answers about ADS-B airspace, equipment, installations, and benefits at http://faa.gov/go/equipadsb.