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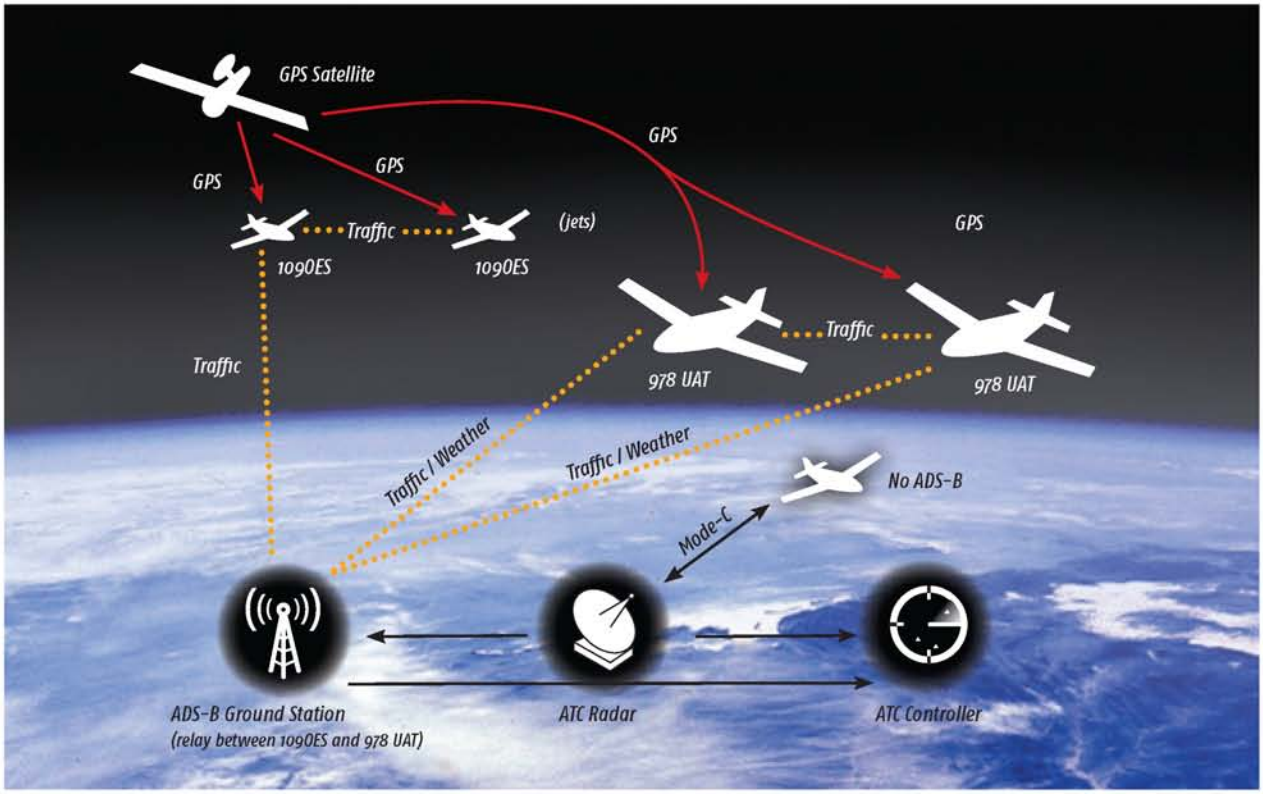
ADS-B

What you need to know

BY 2020, AIRCRAFT OWNERS flying in airspace requiring a Mode-C transponder will need to equip their aircraft with ADS-B Out. Having just bought a plane recently—more on that in a future column—I started checking out alternate approaches for complying with the mandate.

ADS-B stands for automatic dependent surveillance-broadcast. It is automatic because, unlike a transponder, it broadcasts continuously, not just when interrogated by radar or a traffic collision avoidance system (TCAS). It is dependent, since it relies on GPS information. It provides the same surveillance function as radar, but does so by broadcasting its position.

There are two ADS-B capabilities. ADS-B Out, the only one mandated by the new rule, refers to an aircraft broadcasting its position and other information. Unfortunately, equipping aircraft with ADS-B Out will cost thousands but not yield any new benefits. Owners can elect to also equip with ADS-B In, which allows an aircraft to receive traffic information from other ADS-B-equipped



ADS-B Out equipped aircraft determine their position using GPS (red arrows) and broadcast position data (yellow lines) to similarly equipped ADS-B aircraft and to ADS-B ground stations. ADS-B ground stations uplink traffic threats (yellow lines) to aircraft equipped with both ADS-B In and Out and traffic and weather data to aircraft that use 978 UAT for ADS-B.

ILLUSTRATION BY **JOHN A. JOHNSON**

aircraft, surface vehicles, and FAA ground stations. One type of ADS-B In equipment can also receive free in-cockpit weather information—more on that in a moment.

ADS-B won't be required everywhere. It will be required to fly above 10,000 feet mean sea level (except if you're within 2,500 feet of the ground), within 30 miles of some airports (mostly Class B), and when flying under, above, or through Class B and C airspace. There is an exclusion related to flying within 30 miles of Class B airports for any aircraft not originally certificated with an engine-driven electrical system.

A significant kludge in the FAA's ADS-B architecture is that there are two standards for ADS-B, 1090ES and 978 UAT, which operate on different frequencies. The upshot is that aircraft equipped with 1090ES cannot directly detect UAT-equipped aircraft and vice versa. Instead they must rely on about 800 sets of cross-linked, ground-based transceivers that re-broadcast all ADS-B signals on both frequencies. This allows all ADS-B equipped aircraft, regardless of the frequency they use, to see each other—except when they are not within line of sight of a ground-based ADS-B site! This can occur, particularly at low altitudes, so pilots of all ADS-B equipped aircraft still need to look out the window to avoid other aircraft.

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below 18,000 feet can choose either 1090ES or 978 UAT. Most other countries are using the 1090ES standard, so aircraft owners traveling internationally will want to equip with 1090ES. 978 UAT will be attractive to some owners since it can display free weather data in the cockpit.

How did we get two ADS-B standards? 978 UAT is technically a superior system since it has a faster megabit per second data transfer rate that can accommodate up to 500 aircraft simultaneously. However, the airlines weren't particularly interested in free weather and preferred a system compatible with other countries.

There may also have been concerns that if all U.S. aircraft were equipped with 1090ES, this lower bandwidth system could become saturated in large metropolitan areas with many aircraft. Having a separate 978 UAT alternative offloads aircraft from the 1090ES standard by offering a carrot to users in the form of free weather.

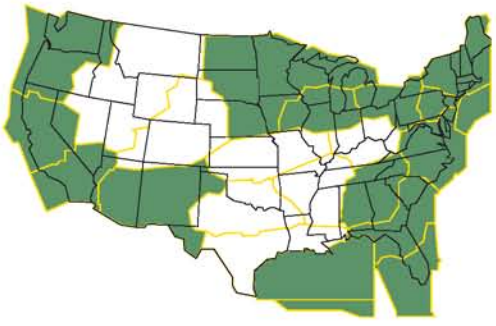
If you're uninterested in ADS-B because it's unavailable in your area, check out the ADS-B coverage map. By the end of September, ADS-B coverage is planned for the entire east and west coasts and a number of northern states. At that time, the FAA also plans to achieve In-Service Decision (ISD), which certifies ADS-B as safe, secure, and ready for nationwide operational deployment.

Finally, if you think the ADS-B mandate means you can get rid of your transponder, think again. Transponders are still needed so that airliner TCAS can locate other aircraft, and they're considered essential to the FAA's backup plan in case ADS-B or GPS fails. They're also needed to transmit ADS-B data for 1090ES.

ALTERNATIVE APPROACHES

ADS-B is not just another box you need to add to your aircraft. Instead, think of it as a system. In some cases, you may already have some or all of the system components needed to comply, which could save you money.

For ADS-B Out capability, you need a position source and a transmitter. A 1090ES



This coverage map shows the fifteen regional zones (in green) where ADS-B service is scheduled to be available in the United States by the end of September 2010.

solution could consist of a wide area augmentation system (WAAS) capable GPS and a Mode-S transponder. At present, no equipment available has the required technical standard order certification from the FAA, so if you have existing equipment in your aircraft it may need at least a software upgrade. For example, Bill Stone of Garmin told me that pilots who already own a GTX 330 Mode-S transponder can upgrade it for ADS-B for $1,200, far less than the cost of buying a new transponder.

Alternatively, you might purchase a 978 UAT transmitter or transceiver. For example, the Garmin GDL 90 UAT includes an internal WAAS-capable receiver and a 978 MHz transceiver. By adding this unit, which lists for $7,995, you'll automatically have ADS-B Out capability. Connect it to a compatible display, such as a Garmin GNS 430 or 530 GPS, and you'll have ADS-B In capability. However, the current version of the GDL 90—like all other ADS-B equipment currently on the market—isn't yet certified, so you are probably better off waiting until certification is received.

ADS-B IN CAPABILITY

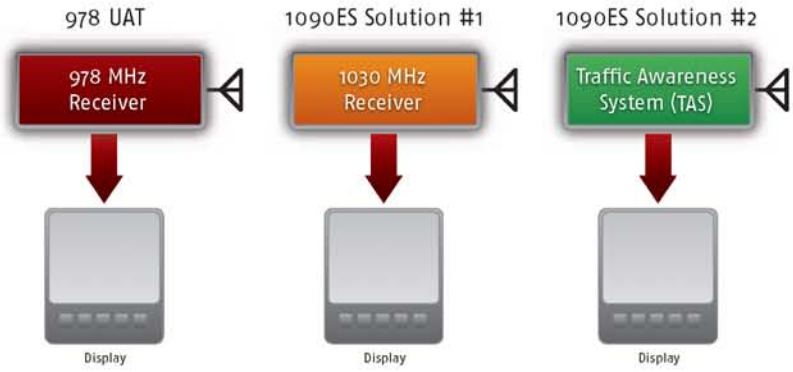
The final standard for ADS-B In has not been released, so manufacturers aren't able to design for it with certainty. Thus any ADS-B receiver solutions you might buy today may have to be upgraded later, or possibly replaced.

An ADS-B In solution consists of an ADS-B receiver and a display for viewing traffic—and in the case of a 978 UAT—weather data. For a 1090ES solution, a Mode-S transponder won't work as an ADS-B receiver. However, if you have a traffic awareness system (TAS), you may be able to upgrade that system. That's because it receives on 1030 MHz, the frequency used for ADS-B In for 1090ES solutions. For example, Garmin's GTS 800 TAS system already includes ADS-B In.

But be careful about purchasing just an ADS-B receiver with the idea that you'll be viewing all traffic data. In the FAA's original deployment of ADS-B in Alaska, the ADS-B ground stations broadcast in unlimited mode, meaning that all traffic data was continuously broadcasted. However, new ADS-B ground stations being deployed by ITT in the lower 48 states broadcast a "custom payload," meaning they only broadcast traffic threats for participating aircraft—those equipped with an ADS-B Out transmitter. Thus if you have only an ADS-B receiver, you will see traffic threats for ADS-B Out equipped aircraft, but you won't see traffic threats for your own aircraft!

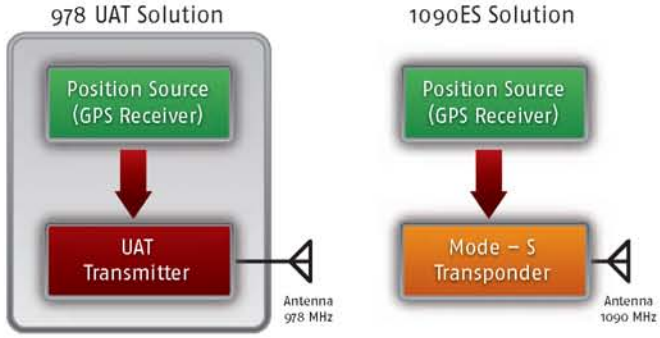
Also, if you buy a 978 UAT receiver, don't expect to see any weather data until after you're in the air, except at a few airports that have an ADS-B ground station located nearby. By contrast, satellite-based service, such as XM weather, works equally well on the ground as in the air.

ADS-B In Alternatives



All ADS-B In *solutions will display traffic from other aircraft and uplinked from ADS-B ground stations. The 978 MHz solutions can also receive near real-time weather information.*

ADS-B Out Alternatives



To meet the ***ADS-B Out*** *requirement by 2020, a position source (e.g. WAAS GPS), and an appropriate transmitter on 978 MHz or 1090 MHz are required. In the latter case, an upgraded Mode-S transponder could be the transmitter. 978 UAT may be one unit with a receiver and transmitter or two separate units.*

OTHER MANUFACTURERS

So far I've only mentioned Garmin solutions, but several other companies were showing their ADS-B solutions at EAA AirVenture Oshkosh 2010. For example, NavWorx sells its ADS600-B 978 UAT transceiver for $2,495. Its ADS600 UAT receiver sells for $1,495.

FreeFlight Systems offers a family of GPS position sources that can be combined with various 978 MHz data links to create ADS-B In and Out solutions. Trig Avionics, a Scottish company, has announced a family of 1090ES ADS-B In receivers, starting at $1,800, which will be available by the end of the year.

HURRY UP AND WAIT

If you are considering buying an ADS-B solution now, you may want to wait a few months. None of the current solutions is certified, so if you buy now you may need an upgrade later. Also, at the present time, the FAA isn't allowing avionics shops to install ADS-B systems using field approvals and a 337 form. Instead, they can only install equipment with a type certificate or supplemental type certificate, which first requires manufacturers to submit a large pile of paper to the FAA for approval. So far, no manufacturer has finished that task.

ADS-B is finally real and here to stay, so plan to get acquainted with the different ways you can upgrade your plane to comply with the 2020 mandate. EAA

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