Attention

Why is everyone being forced to pay thousands to change to this?

Objective

To understand the benefits of ADS-B vs traditional radar.

Schedule

Ground instruction – 10 minutes

Reference Material

https://en.wikipedia.org/wiki/Secondary_surveillance_radar
https://en.wikipedia.org/wiki/Automatic_dependent_surveillance_%E2%80%93_broadcast
https://airfactsjournal.com/2013/01/ads-b-101-what-it-is-and-why-you-should-care/
https://www.faa.gov/nextgen/programs/adsb/faq/#g1

Material

First Let's Discuss the Old Technology

Secondary surveillance radar (SSR) is a radar system used in air traffic control (ATC),that not only detects and measures the position of aircraft, i.e. bearing and distance, but also requests additional information from the aircraft itself such as its identity and altitude. Unlike primary radar systems that measure the bearing and distance of targets using the detected reflections of radio signals, SSR relies on targets equipped with a radar transponder. SSR is based on the military identification friend or foe (IFF) technology originally developed during World War II, therefore the two systems are still compatible.

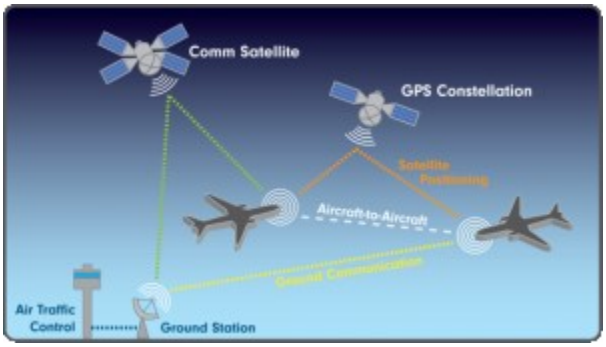
The transponder is a radio receiver and transmitter pair which receives on 1030 MHz and transmits on 1090 MHz. The target aircraft transponder replies to signals from an interrogator (usually, but not necessarily, a ground station co-located with a primary radar) by transmitting a coded reply signal containing the requested information.

Both the civilian SSR and the military IFF have become much more complex than their war-time ancestors, but remain compatible with each other, not least to allow military aircraft to operate in civil airspace. Today's SSR can provide much more detailed information, for example, the aircraft altitude, as well as enabling the direct exchange of data between aircraft for collision avoidance. Most SSR systems rely on Mode C transponders, which report the aircraft pressure altitude. The pressure altitude is independent from the pilot's altimeter setting. Air traffic control systems recalculate reported pressure altitudes to true altitudes based on their own pressure references, if necessary.

The purpose of SSR is to improve the ability to detect and identify aircraft while automatically providing the Flight Level (pressure altitude) of an aircraft. An SSR ground station transmits interrogation pulses on 1030 MHz (continuously in Modes A, C and selectively, in Mode S) as its antenna rotates, or is electronically scanned, in space. An aircraft transponder within line-of-sight range 'listens' for the SSR interrogation signal and transmits a reply on 1090 MHz that provides aircraft information. An aircraft without an operating transponder still may be observed by primary radar, but would be displayed to the controller without the benefit of SSR derived data.

Issues:
- The radars have a range
- The radars do not constantly ‘see’ the plane. If it rotates every 6 seconds then it ‘sees’ a particular plane every 6 seconds
- Pilot must set a unique code in the transponder when on IFR plans as this system does not give tail number
- Very limited info
- The mode C reply provides height increments of 100 feet, which was initially adequate for monitoring aircraft separated by at least 1000 feet. A slight change of a few feet could cross a threshold and be indicated as the next increment up and a change of 100 feet. Mode S is increments of 25 feet.

<u>What is ADS-B?</u>



Automatic dependent surveillance — broadcast (ADS–B) is a surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. The information can be received by air traffic control ground stations as a

replacement for secondary surveillance radar, as no interrogation signal is needed from the ground. It can also be received by other aircraft to provide situational awareness and allow self-separation.

ADS–B is "automatic" in that it requires no pilot or external input. It is "dependent" in that it depends on data from the aircraft's navigation system. Aircraft self-report their GPS position in a networked environment, so pilots can see the entire air traffic picture around them. There is also the added benefit of datalink weather available through ADS-B.

How Does it Work?

ADS-B enhances safety by making an aircraft visible, real time, to air traffic control (ATC) and to other appropriately equipped ADS-B aircraft with position and velocity data transmitted every second. ADS-B data can be recorded and downloaded for post-flight analysis. ADS-B also provides the data infrastructure for inexpensive flight tracking, planning, and dispatch.

"ADS-B Out" periodically broadcasts information about each aircraft, such as identification, current position, altitude, and velocity, through an onboard transmitter. ADS-B Out provides air traffic controllers with real-time position information that is, in most cases, more accurate than the information available with current radar-based systems. With more accurate information, ATC will be able to position and separate aircraft with improved precision and timing.

"ADS-B In" is the reception by aircraft of FIS-B and TIS-B data and other ADS-B data such as direct communication from nearby aircraft. The ground station broadcast data is typically only made available in the presence of an ADS-B Out broadcasting aircraft, limiting the usefulness of purely ADS-B In devices.

The system relies on two avionics components—a high-integrity GPS navigation source and a datalink (ADS-B unit). There are several types of certified ADS-B data links, but the most common ones operate at 1090 MHz, essentially a modified Mode S transponder, or at 978 MHz. The FAA would like to see aircraft that operate exclusively below 18,000 feet (5,500 m) use the 978 MHz link, as this will alleviate congestion of the 1090 MHz frequency.

ADS-B Enables Improved Safety

- Radar-like IFR separation in non-radar airspace
- Increased VFR flight following coverage
- ATC final approach and runway occupancy, reducing runway incursions on the ground
- Will be easier to find aircraft that have crashed or had an off airport landing
- Helps pilots to see and avoid other aircraft
- VFR-like separation in all weather conditions
- Real-time cockpit weather display

Free Detailed Weather

Since weather and traffic come into play so much during any discussion of ADS-B, let’s define some terms: FIS-B and TIS-B. These are the two products that we can receive via ADS-B In.

Flight Information Services-Broadcast (FIS-B) is just a fancy name for datalink weather. Only available with a 978 MHz receiver, the end product is very similar to what we're used to seeing with XM Weather. NEXRAD radar, METARs, TAFs, TFRs, AIRMETs and other information is continuously updated in flight, and all this can be displayed on either a panel-mount MFD or a portable device like an iPad. There is no monthly subscription fee with FIS-B (your tax dollars paid for it), which is a nice feature. But unlike XM Weather, ADS-B weather uses the network of ground stations, not satellites. That means coverage, while pretty good now and getting a lot better, is not as universal as XM.

With a tablet you can look us ATIS/AWOS at any airport without the need for the radio. This is a big benefit when you are not in radio range. You can look up where storms are. This was previously not possible in most small planes.

From the FAA

Why is the FAA transitioning away from radar and towards ADS-B technology?

ADS-B is an environmentally friendly technology that enhances safety and efficiency, and directly benefits pilots, controllers, airports, airlines, and the public. It forms the foundation for NextGen by moving from ground radar and navigational aids to precise tracking using satellite signals.

With ADS-B, pilots for the first time see what controllers see: displays showing other aircraft in the sky. Cockpit displays also pinpoint hazardous weather and terrain, and give pilots important flight information, such as temporary flight restrictions.

ADS-B reduces the risk of runway incursions with cockpit and controller displays that show the location of aircraft and equipped ground vehicles on airport surfaces – even at night or during heavy rainfall. ADS-B applications being developed now will give pilots indications or alerts of potential collisions.

ADS-B also provides greater coverage since ground stations are so much easier to place than radar. Remote areas without radar coverage, like the Gulf of Mexico and parts of Alaska, now have surveillance with ADS-B.

Relying on satellites instead of ground navigational aids also means aircraft will be able to fly more directly from Point A to B, saving time and money, and reducing fuel burn and emissions.

What are FAA ADS-B In broadcast services?

ADS-B In pilot cockpit advisory services consist of Flight Information Service-Broadcast (FIS-B) and Traffic Information Service-Broadcast (TIS-B). These are free services transmitted automatically to aircraft equipped to receive ADS-B In.

FIS-B provides a broad range of textual/graphical weather products and other flight information to the general aviation community. FIS-B is only available on the 978MHz Universal Access Transceiver (UAT) equipment. FIS-B includes the following:

Aviation Routine Weather Reports (METARs)
Non-Routine Aviation Weather Reports (SPECIs)
Terminal Area Forecasts (TAFs) and their amendments
NEXRAD (regional and CONUS) precipitation maps
Notice to Airmen (NOTAM) Distant and Flight Data Center
Airmen's Meteorological Conditions (AIRMET)
Significant Meteorological Conditions (SIGMET) and Convective SIGMET
Status of Special Use Airspace (SUA)
Temporary Flight Restrictions (TFRs)
Winds and Temperatures Aloft
Pilot Reports (PIREPS)

TIS-B is an advisory-only service available to both 1090ES and UAT equipment users. TIS-B increases pilots' situational awareness by providing traffic information on all transponder-based aircraft within the vicinity of the ADS-B In equipped aircraft receiving the data.

G1000 with ADB-B vs ADS-B In

I flew in North Georgia a number of times in a G1000 plane that was not equipped with ADS-B yet with a Stratus 2S suction cupped to the window. There were about 3 times as many planes reported to Foreflight with the Stratus than the G1000 got from ground radar. The weather was also much more detailed.

You can monitor planes in the area

You can set up a monitoring station with a Raspberry Pi with a small antenna or a tall mounted one. There are no houses with a radar.

https://flightaware.com/adsb/
http://stratux.me/
https://www.amazon.com/1090MHz-ADS-B-Antenna-66cm-26in/dp/B00WZL6WPO
http://www.dpdproductions.com/page_vhf_air.html#adsbout

With this size you can see aircraft in the immediate area

With this size you can see aircraft for up to 200 miles