ADS-B Overview
Choosing a Traffic System

- **Automatic Dependent Surveillance-Broadcast (ADS-B)**
  - ADS-B is an essential part of the planned NextGen airspace upgrade
  - Designed to create better aircraft visibility at a lower overall cost
  - “ADS-B Out” sends aircraft position via digital datalink along with groundspeed, altitude, and intent (aircraft is turning, climbing, or descending, etc).
  - ADS-B Out mandated for 2020 in Class A, B, C and some E airspace

- **Automatic**
  - Messages are sent out periodically without interrogation (unlike transponder)

- **Dependent**
  - Position and velocity derived from the Global Positioning System (GPS)

- **Surveillance**
  - Primary purpose is for ATC to know where aircraft are

- **Broadcast**
  - Messages are broadcast to everyone not just sent to specific receivers
Choosing a Traffic System

ADS-B Acronyms You Should Know

- **ADS-B** ("A, D, S, B")
  - Automatic Dependent Surveillance - Broadcast
- **ADS-R** ("A, D, S, R")
  - Automatic Dependent Surveillance - Rebroadcast
- **TIS-B** ("Tizz B")
  - Traffic Information Service – Advisory Broadcast (Not Mode-S TIS)
- **FIS-B** ("Fizz B")
  - Fight Information Service – Broadcast (Free Weather)
- **CDTI** ("C, D, T, I")
  - Cockpit Display of Traffic Information (MFD)
- **1090ES** ("Ten-Ninety Eee Ess")
  - Extended Squitter Mode S Transponder (1090MHz ADS-B Datalink)
- **UAT** ("U.A.T.")
  - Universal Access Transceiver (978MHz ADS-B datalink)
Current Ground-Based Surveillance Radar interrogates aircraft Transponders to provide aircraft identification and position information to ATC.

Existing SSR

Ground Radars Transmit on 1030MHz
Current Ground-Based Surveillance Radar interrogates aircraft Transponders to provide aircraft identification and position information to ATC.

Airborne Transponders Receive the 1030MHz interrogations & Reply (Transmit) on 1090MHz.

Ground Radars Transmit on 1030MHz & Receive on 1090MHz.
TCAS & TAS systems allow aircraft to interrogate the transponders of nearby aircraft for on-board Traffic Awareness & Collision Avoidance.

Just like Ground Radar, Airborne TCAS & TAS systems interrogate (Transmit) on 1030MHz & receive Transponder replies on 1090MHz.

Existing SSR
Transmit on 1030MHz & Receive on 1090MHz

Ground Radars

Traffic Information Service (TIS) is a transmission of all traffic from a Terminal Radar Site out to those aircraft with a TIS-capable Mode S Transponder. TIS is being phased out.

The legacy TIS Traffic signal is transmitted on 1030MHz. TIS is already being phased out in many areas in lieu of ADS-B.

Ground Radars Transmit on 1030MHz & Receive on 1090MHz

Existing SSR
With ADS-B, each aircraft automatically transmits its unique aircraft I.D. and position information [Lat/Lon, Altitude, Velocity, etc] to ATC (ADS-B OUT)

Non-ADS-B aircraft are identified using existing Secondary Surveillance Radar. (i.e. Transponder is still required)

Non-Equipped (Mode A/C)

ADS-B Out allows ATC to identify and separate all participating aircraft with greater precision. ADS-B does not require interrogation signal from ground station.
Aircraft with ADS-B IN can receive the ADS-B OUT signals of nearby aircraft.

Non-Equipped (Mode A/C)

Existing SSR

Radio Station

Control Station

FIS Provider

FAA
However, in the U.S., the ADS-B OUT mandate can be met using 1090MHz Extended Squitter at all altitudes, or via 978MHz Universal Access Transceiver (UAT) below 18,000ft.
This is where ADS-B becomes more complicated.
The use of two different ADS-B frequencies (1090MHz or 978MHz) can restrict communication between different aircraft.

This 1090MHz-equipped airplane with ADS-B IN can see other 1090MHz-equipped aircraft but cannot see the 978MHz-equipped aircraft or the non-ADS-B aircraft.
ADS-R solves this communication issue by rebroadcasting the info from each frequency onto the other frequency.

Non-Equipped (Mode A/C)

ADS-R is the re-transmission of 978MHz traffic on the 1090MHz frequency.
ADS-R solves this communication issue by Rebroadcasting the traffic info from each frequency onto the other frequency.

ADS-R also rebroadcasts all the 1090MHz traffic over the 978MHz frequency.
TIS-B solves the problem of displaying non-ADS-B equipped aircraft by broadcasting non-participating traffic to ADS-B equipped aircraft over both frequencies.

Non-Equipped (Mode A/C) traffic data is sent via 1090MHz and 978MHz to TIS-B receivers.

TIS-B is different than the old TIS (which was on 1030MHz.)
TIS-B & ADS-R traffic info are only broadcast to aircraft that also participate with ADS-B OUT.

To be a TIS-B or ADS-R client an aircraft must:
• Be in a region where TIS-B service is offered
• Have produced valid position data within the last 30 seconds to a SBS ground station
• Be ADS-B OUT equipped

Note: If the aircraft has dual receive capability no ADS-R service will be provided to that aircraft.
ADS-R sends information on ‘other-frequency’ ADS-B aircraft within a 15 NM radius and ±5,000 ft of client aircraft (hockey puck).

To be aADS-R client an aircraft must:
- Be in a region where ADS-R service is offered
- Have produced valid position data within the last 30 seconds to a SBS ground station
- Be ADS-B OUT equipped
- Only receiving ADS-B In on one link (978 OR 1090)

Note: If the aircraft has dual receive capability no ADS-R service will be provided to that aircraft.
TIS-B sends information on all non-ADS-B aircraft within a 15 NM radius and ±3,500 ft of client aircraft (hockey puck).

To be a TIS-B client an aircraft must:
- Be in a region where TIS-B service is offered
- Have produced valid position data within the last 30 seconds to a SBS ground station
- Be ADS-B OUT equipped
- ADS-B In on only one link

Note: If the aircraft has dual receive capability no ADS-R service will be provided to that aircraft.
“Piggybacking” - When an aircraft with only ADS-B IN (Y) is within range of a client aircraft (X) and eavesdrops on the information specific to the client aircraft “hockey puck”.

In this example, Aircraft Y has a dual band (1090MHz & 978MHz) receive-only (i.e. Stratus or GDL39) and no ADS-B out.

Aircraft Y can receive TIS-B (non-ADS-B) traffic info only when within Aircraft X’s “hockey puck”.

When outside this hockey puck, aircraft Y will only see air-to-air traffic, which can be fairly limited.
Aircraft equipped with an Active Traffic system (TAS/TCAS) will see all transponder aircraft, regardless of whether they are 1090Mhz, 978MHz, or non-ADS-B.

Active Traffic is still important, even in an ADS-B world.
- Works everywhere
- Independent of equippage
- Not dependent on radar coverage
- Not dependent on GPS integrity
FIS-B provides “Free Weather” to 978MHz UAT-equipped aircraft.

FIS-B is not available via the 1090MHz channel.

FIS-B is a ground based service, which may have line of site limitations not found with current satellite-based systems.

FIS-B Wx products have range and resolution restrictions not found with current satellite-based systems.
Do I have to equip with ADS-B?

Canada
1090 MHz ADS-B Out
Mandated as of Jan 15, 2009, over Hudson Bay region between FL350 and FL400.

United States
978 MHz or
1090 MHz ADS-B Out
Mandate January 1, 2020

Europe
1090 MHz ADS-B Out
Mandated 1090ES ADS-B Out with a Diversity Mode-S transponder for aircraft >12,500lbs or max cruise >250kts TAS by Jan 8, 2015 for new aircraft and Dec 7, 2017 for retrofits.

Australia
1090 MHz ADS-B Out
Mandate above FL290 after December 12, 2013

No Mandate for ADS-B IN
Choosing a Traffic System
ADS-B Summary

- U.S. Mandate for ADS-B ‘OUT’ is 2020 (Affects GA Aircraft)
  - 1090MHZ ES required Above FL180
  - 978MHZ UAT or 1090MHZ ES required below FL180
- All international mandates are for 1090MHz only
- Currently No Mandates for ADS-B ‘IN’
  - 978MHZ Req’d for FREE Weather services
  - Provides longer-range traffic advisory with greater precision
  - Has limitations during mixed-equipage period
  - Has limitations due to altitude and line of sight.
- All Avidyne TAS600-Series systems are fully upgradeable for ADS-B ‘IN’

- Active-surveillance TAS is viable even in ADS-B world.

- Expect additional ADS-B Announcements will be forthcoming.