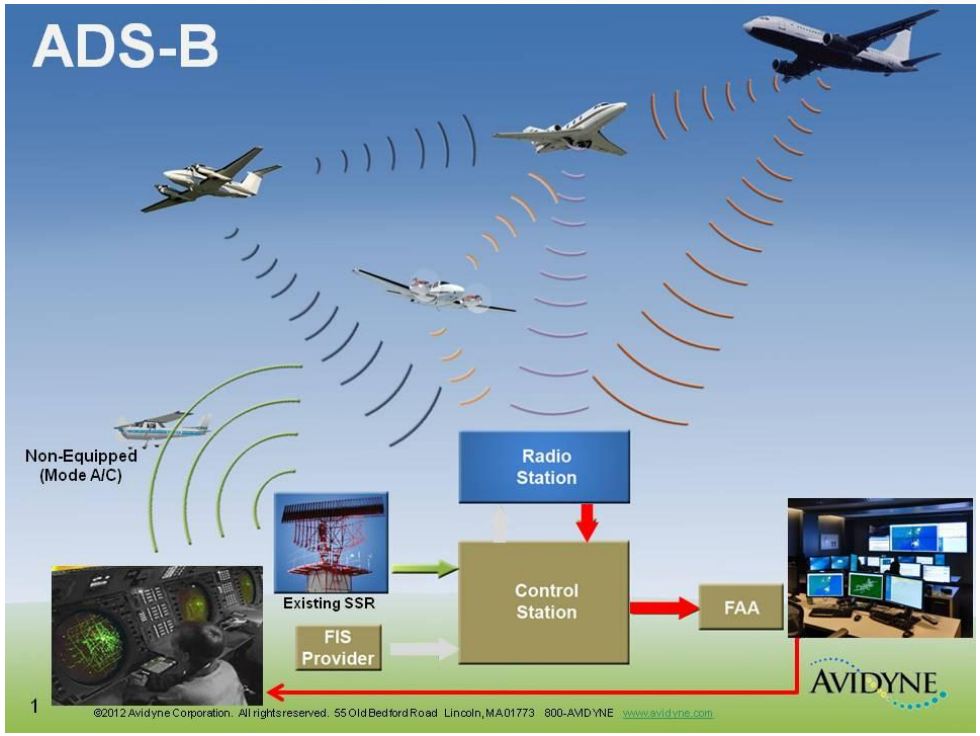
What is ADS-B?

Automatic Dependent Surveillance-Broadcast (ADS-B)

- **A**utomatic
  - Messages are sent out periodically without interrogation (unlike transponder)
- **D**ependent
  - Position and velocity derived from the Global Positioning System (GPS)
- **S**urveillance-
  - Primary purpose is for ATC to know where aircraft are
- **B**roadcast
  - Messages are broadcast to everyone not just sent to specific receivers



Why is ADS-B Technology being deployed?

What's in it for the FAA?

- Air Traffic Control transforming from ground-based to satellite-based system
- Cornerstone of FAA's Next Generation Air Transportation System (NextGen) to increase accuracy
- ADS-B increases safety and efficiency of National Airspace System
- ADS-B designed to create better aircraft visibility at lower overall cost to the FAA

What's in it for you?

- Increased safety
- Enhanced ATC services – Faster update rates and position updates between radar sweeps
  - Allow more efficient controller vectors
  - Earlier "radar contact" due to lower level ADS-B coverage
- Improved last-position data for Search & Rescue (SAR)
- Free Weather

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What are all these Acronymns associated with ADS-B?

ADS-B Acronyms:

- ADS-B (“A, D, S, B ”) (In & Out)
  - 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)

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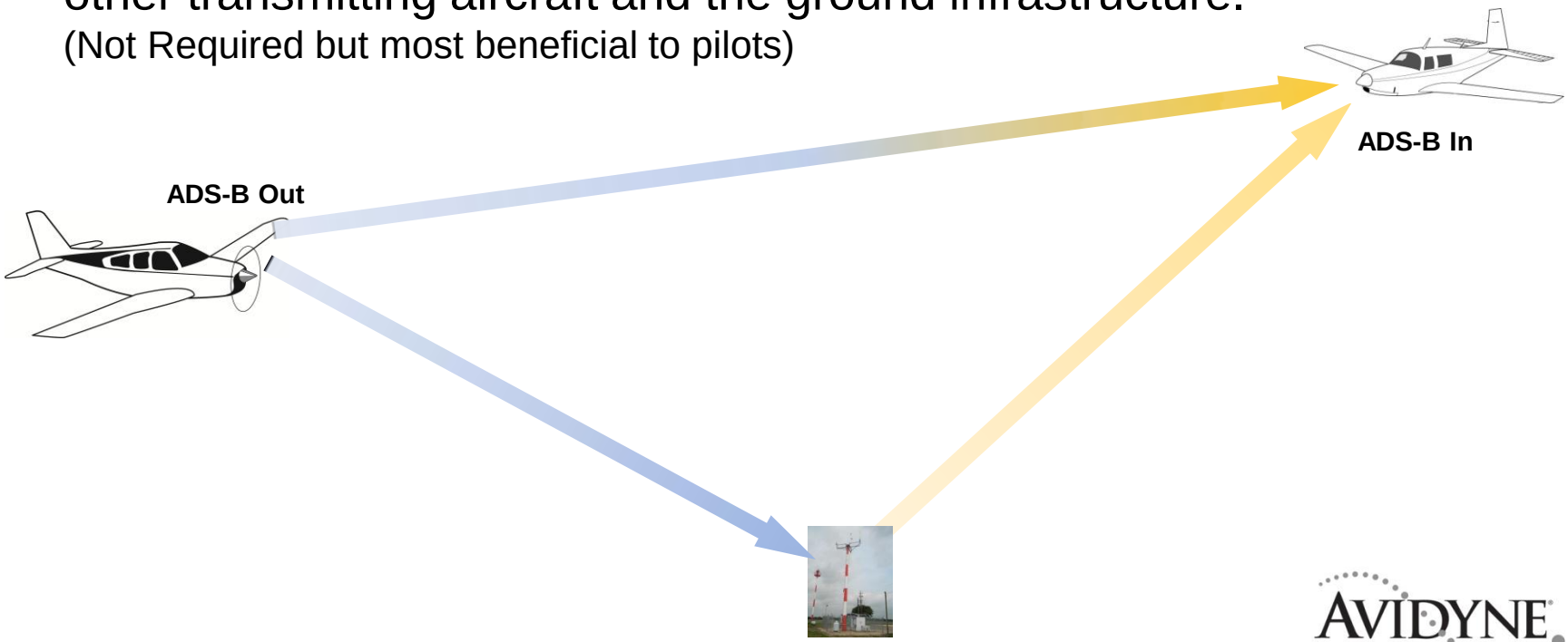
What is the difference between ADS-B IN & ADS-B OUT?

- ADS-B OUT – The ability to transmit information from the aircraft to ground stations and to other equipped aircraft.
  (Required to meet mandate)

- ADS-B IN – The ability of the aircraft to receive information from other transmitting aircraft and the ground infrastructure.
  (Not Required but most beneficial to pilots)



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What is the difference between ADS-B IN & ADS-B OUT?

Dual Links – 1090MHz & 978MHz (UAT):

- Three main reasons for dual links:
  1. Frequency congestion on 1090 MHz (assumed 3x fleet growth from 2000 to 2025, problems with even 2x fleet growth)
  2. UAT avionics believe to be cheaper for GA (If 1090ES coupled with transponder, maybe, but UAT requires separate control head)
  3. UAT provided free weather to GA (before widespread XM/Sirius datalink weather)
- 1090ES
  - 1090 MHz Extended Squitter (same frequency as transponder replies)
  - Mode-S transponder that sends out additional ADS-B information periodically in addition to replying to SSR and TCAS interrogations
  - International standard
- 978/UAT – Universal Access Transceiver (UAT)
  - 978 MHz – less crowded frequency since not used by SSR and TCAS
  - Synchronized CDMA – Code Division Multiple Access so requires precise (GPS) timing device
  - Additional bandwidth for additional datalink data (e.g. FIS-B)
  - Can share antenna with Mode-C transponder through coupler
  - Not used in any other countries except US

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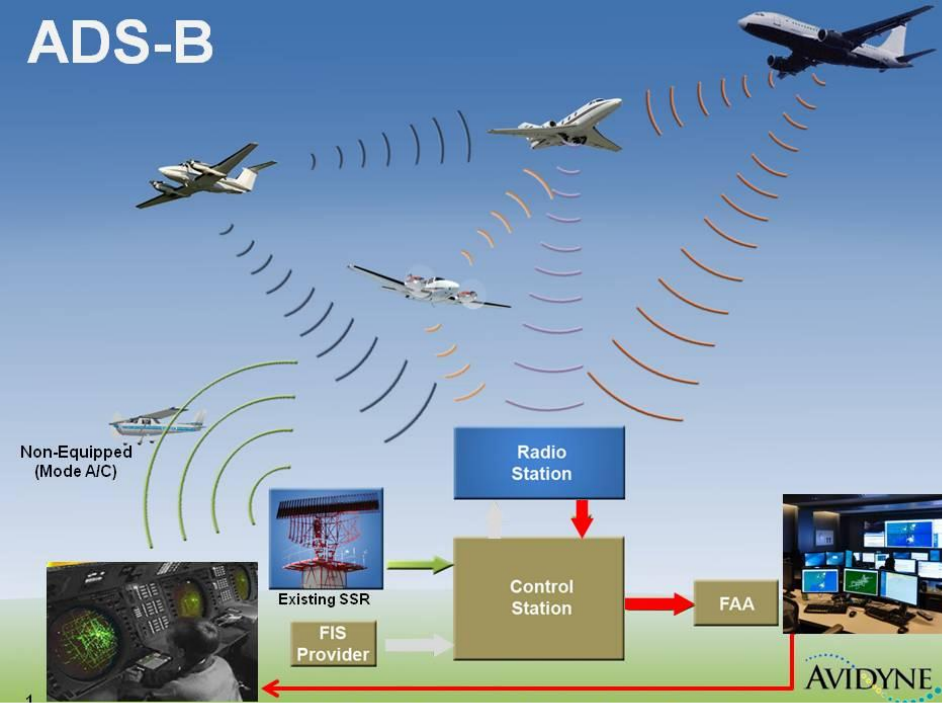
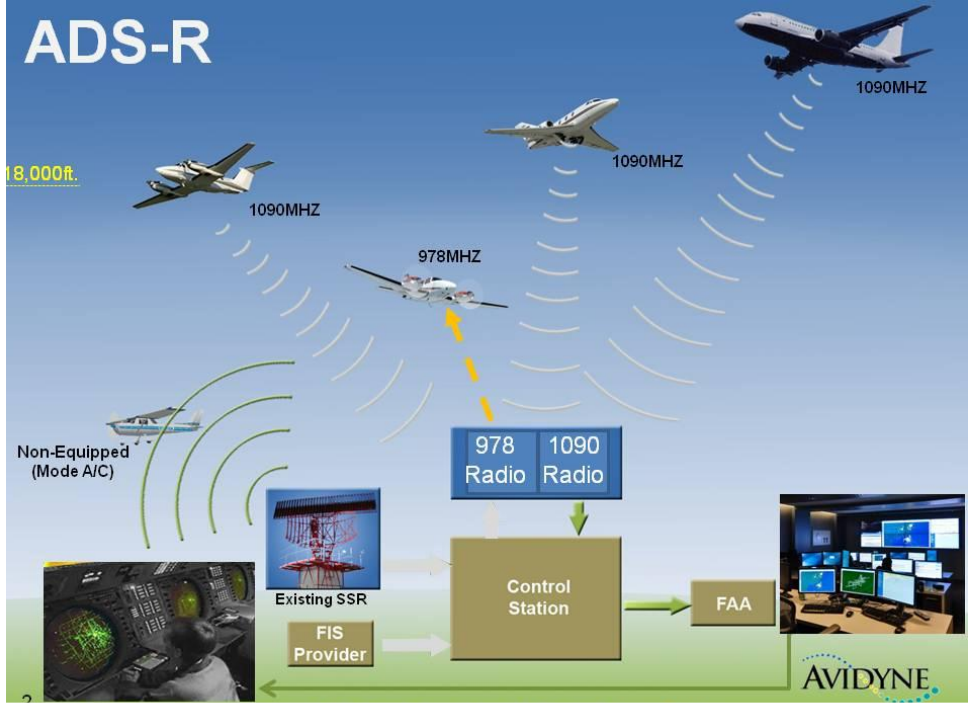

ADS-B
Non-Equipped
(Mode A/C)
Radio
Station
Existing SSR
Control
Station
FAA
FIS
Provider
AVIDYNE
1


ADS-R
1090MHZ
1090MHZ
1090MHZ
18,000ft.
978MHZ
Non-Equipped
(Mode A/C)
978
Radio
1090
Radio
Existing SSR
Control
Station
FAA
FIS
Provider
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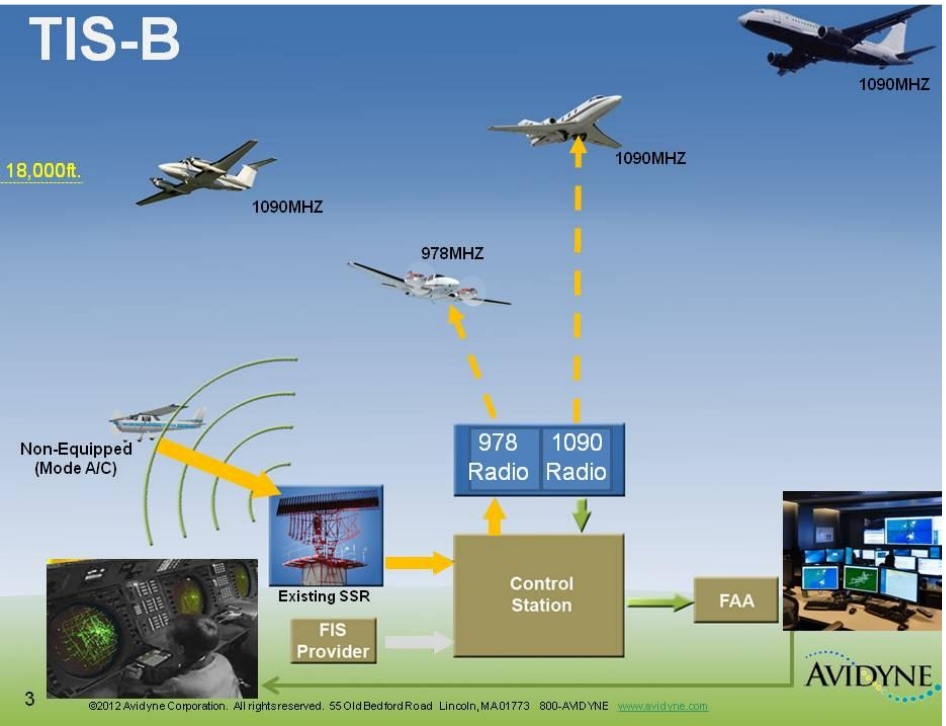
2


TIS-B
1090MHZ
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1090MHZ
978MHZ
Non-Equipped
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978
Radio
1090
Radio
Existing SSR
Control
Station
FAA
FIS
Provider
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3
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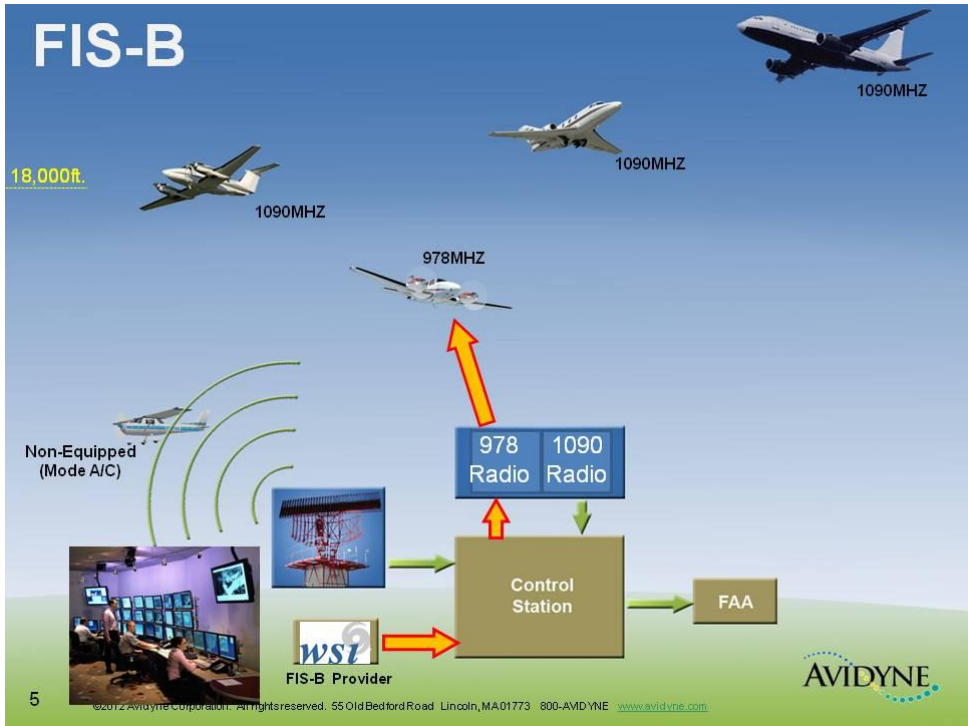
FIS-B
1090MHZ
1090MHZ
18,000ft.
1090MHZ
978MHZ
Non-Equipped
(Mode A/C)
978
Radio
1090
Radio
Control
Station
FAA
WSI
FIS-B Provider
AVIDYNE
5
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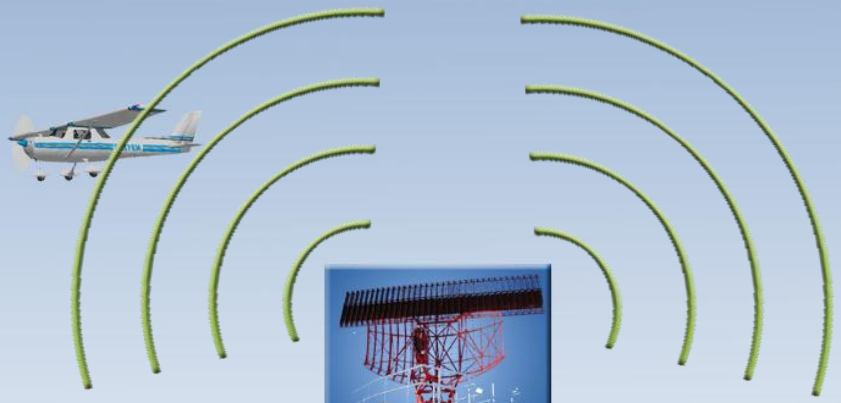
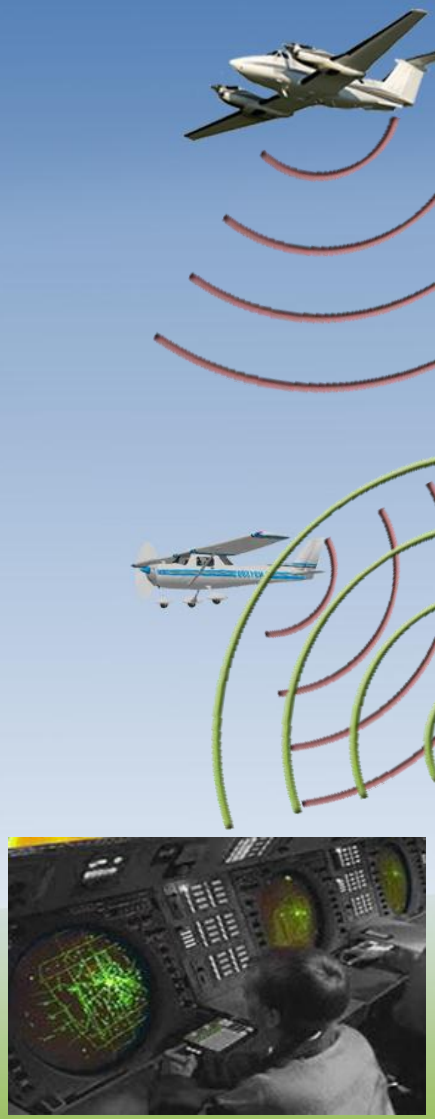
Current Ground-Based Surveillance Radar interrogates aircraft Transponders to provide aircraft identification and position information to ATC.



Existing SSR

Ground Radars Transmit on 1030MHz

Current Ground-Based Surveillance Radar interrogates aircraft Transponders to provide aircraft identification and position information to ATC



Existing SSR

Ground Radars Transmit on 1030MHz & Receive on 1090MHz

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

Ground Radars Transmit on 1030MHz & Receive on 1090MHz

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.

Existing SSR

Ground Radars Transmit on 1030MHz & Receive on 1090MHz

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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)

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.

Non-Equipped (Mode A/C)

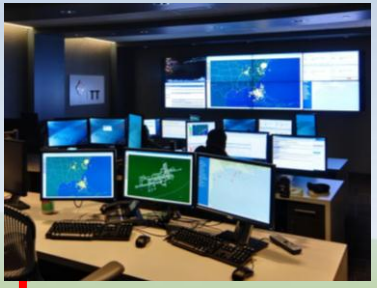
Radio Station

Existing SSR

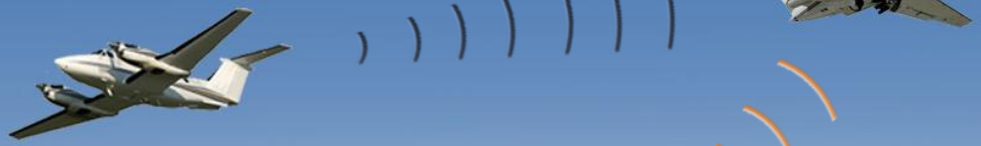
FIS Provider

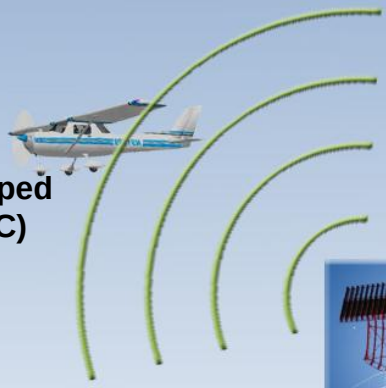
Control Station

FAA



Aircraft with ADS-B IN will be able to receive the ADS-B OUT signals of nearby aircraft





Non-Equipped
(Mode A/C)

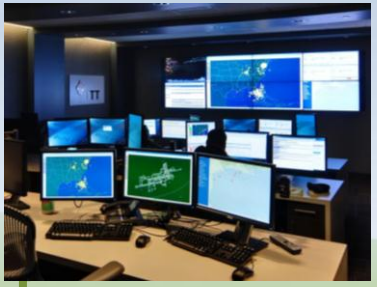
Existing SSR

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.

1090MHZ ES

1090MHZ ES

18,000ft.

1090MHZ ES

978MHZ UAT

Non-Equipped
(Mode A/C)

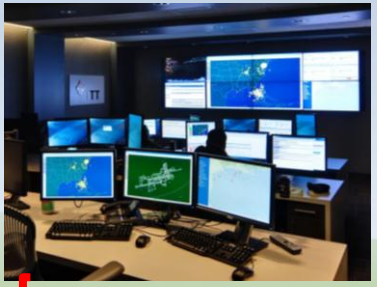
978 Radio | 1090 Radio

Existing SSR

FIS Provider

Control Station

FAA



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This is where ADS-B becomes more complicated. The use of two different frequencies (1090MHz or 978MHz) restricts communication between aircraft on one frequency to the other.

1090MHZ

1090MHZ

18,000ft.

1090MHZ

978MHZ

The 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.

Non-Equipped (Mode A/C)

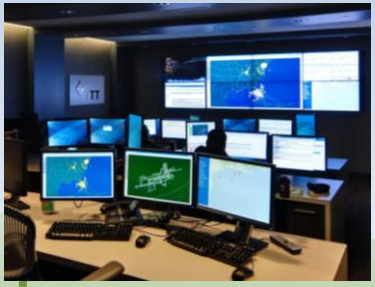
978 Radio | 1090 Radio

Existing SSR

FIS Provider

Control Station

FAA



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ADS-R solves this communication issue by Rebroadcasting the info from each frequency onto the other frequency.

1090MHZ

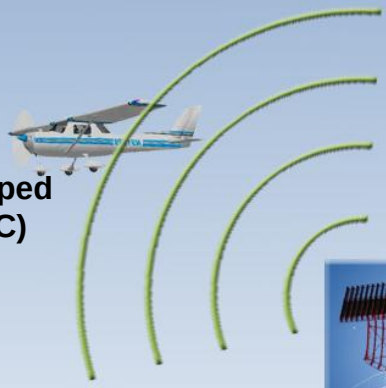
1090MHZ

18,000ft.

1090MHZ

978MHZ

ADS-R is the transmission of 978MHZ traffic on the 1090MHz frequency.



Non-Equipped (Mode A/C)

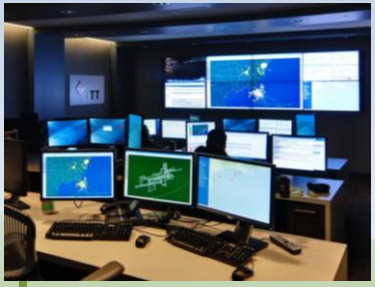
978 Radio | 1090 Radio

Existing SSR

FIS Provider

Control Station

FAA



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ADS-R solves this communication issue by Rebroadcasting the traffic info from each frequency onto the other frequency.

1090MHZ

1090MHZ

18,000ft.

1090MHZ

978MHZ

ADS-R also rebroadcasts all the 1090MHz traffic over the 978MHz frequency.

Non-Equipped (Mode A/C)

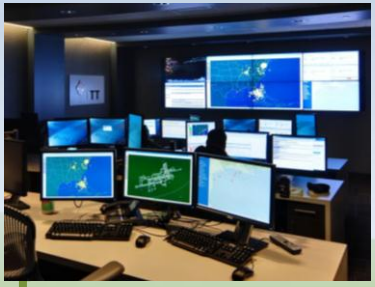
978 Radio | 1090 Radio

Existing SSR

FIS Provider

Control Station

FAA



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TIS-B solves the problem of displaying aircraft with no ADS-B (neither 1090 or 978) by broadcasting non-ADS-B traffic to ADS-B equipped aircraft over both frequencies.

1090MHZ

1090MHZ

18,000ft.

1090MHZ

978MHZ

Non-Equipped
(Mode A/C)

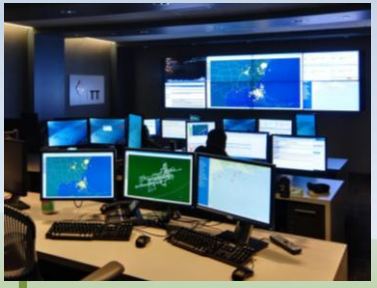
978 Radio | 1090 Radio

Existing SSR

FIS Provider

Control Station

FAA



Non-ADS-B traffic data sent via 1090MHz and 978MHz to TIS-B receivers.

(TIS-B is different than the old TIS which is 1030MHz.)

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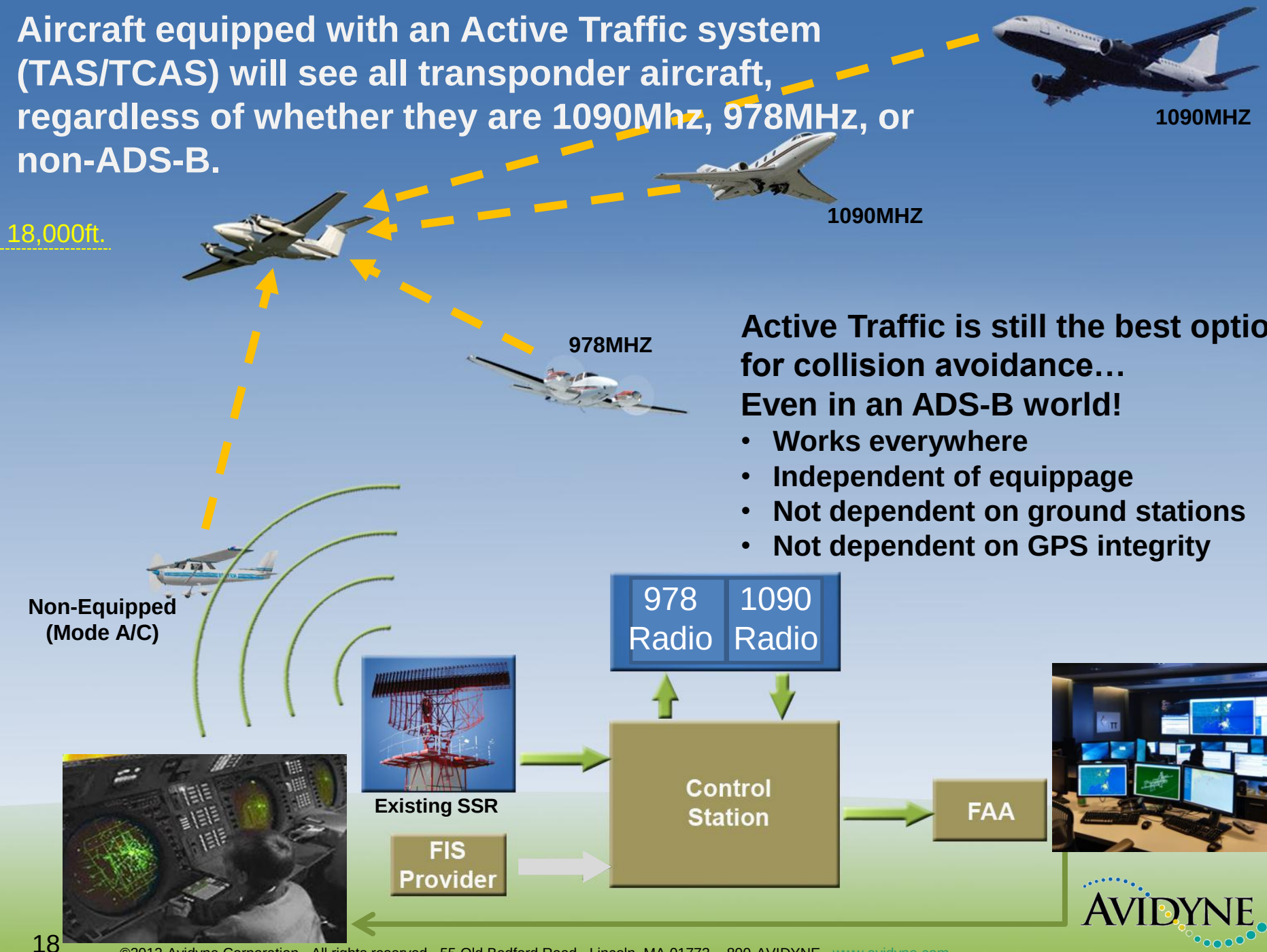
Aircraft equipped with an Active Traffic system (TAS/TCAS) will see all transponder aircraft, regardless of whether they are 1090Mhz, 978MHz, or non-ADS-B.



Active Traffic is still the best option for collision avoidance… Even in an ADS-B world!

- Works everywhere
- Independent of equippage
- Not dependent on ground stations
- Not dependent on GPS integrity

FIS-B provides “Free Weather” to 978MHz UAT-equipped aircraft.

1090MHZ

1090MHZ

18,000ft.

1090MHZ

978MHZ

Non-Equipped
(Mode A/C)

978 Radio | 1090 Radio

Control Station

FAA

wsi

FIS-B Provider

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

FIS-B is a ground based service, which may have line of site limitations.

FIS-B Wx products have range and resolution restrictions not found with current satellite-based systems.

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