Federal Aviation Administration

The INs and OUTs of ADS-B

Presented by: John Fisher

Date: Nov 12, 2016

Outline

- **Glider ANPRM Process**
- **Surveillance Overview**
  - ATCRBS, Mode S, and ADS-B
- **ADS-B OUT and IN**
- **1090ES and 978 UAT**
- **Other Systems**
- **ADS-B Equipage**
- **Performance Report**
- **More Information, Questions**

Surveillance Overview

- **These slides are for reference only**
- **Have a question?**
  - Always refer to the appropriate document (not this slide deck), before proceeding

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Glider ANPRM Process

- **Advance Notice Of Proposed Rule Making**
- **An NTSB accident investigation recommended removal of the glider exception from §91.215**
- **Senator Reid and Representative Amodei, from Nevada requested the FAA invoke the emergency rulemaking process to remove the glider exception from §91.215**
- **ANPRM initiated in response to the above**

Glider ANPRM Process

- **ANPRM allows FAA to gather information in advance of a NPRM**
- **ANPRM was posted in the Federal Register 16 June, 2015 requesting information from the public**
- **The comment period is closed, comments have been reviewed, input has been provided to the Rulemaking Management Council**

Glider ANPRM Process

- **Rulemaking Management Council may:**
  - Move forward with a rulemaking effort to remove the exception for gliders via notice in the Federal Register **(post an NPRM notice)**
  - Withdrawal the rulemaking action via notice in the Federal Register **(post a notice closing the activity)**
- **Next Step – Post notice by the end Dec ‘16**
- **Ex parte - Prevents me from discussing or taking questions concerning the ANPRM**

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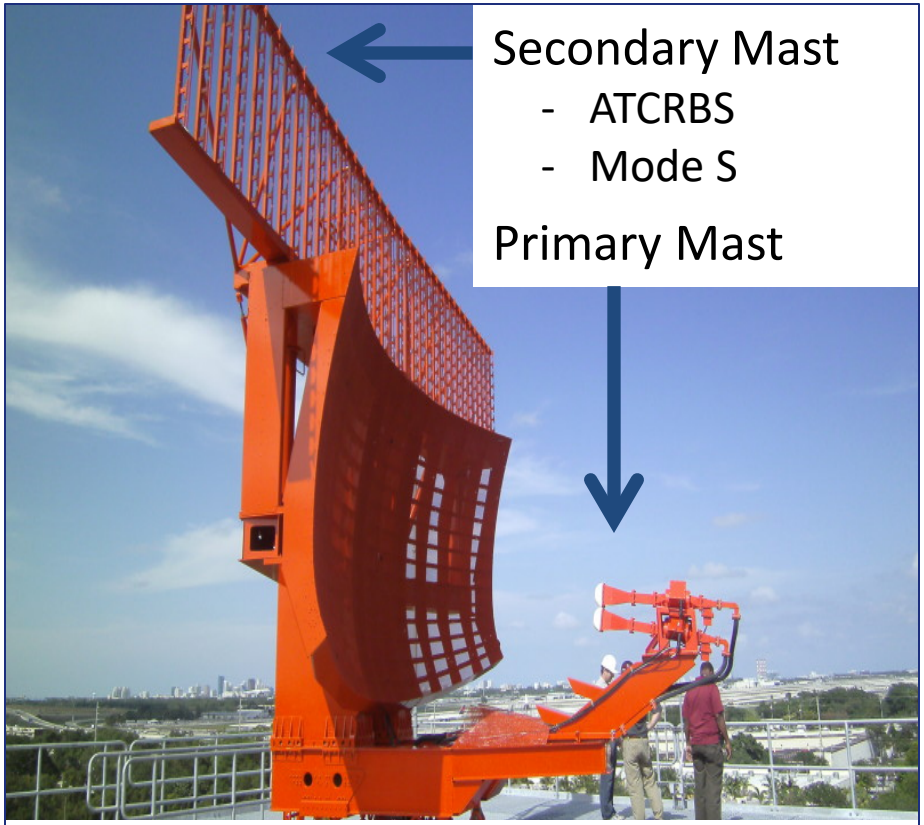
Surveillance Overview (ATCRBS)

- **Air Traffic Control Radar Beacon System**
  - **Ground radio requests Mode 3/A and altitude**
    - Requests info from all aircraft in beam dwell



ASR-9

Surveillance Overview (Mode S)

- **Mode Select (Mode S)**
  - Generational leap forward in technology
  - Less garble and RF than ATCRBS
  - Challenge response based
  - Each aircraft has a unique name, (a 24 bit address)
  - Allows communication with individual aircraft
  - Enables transmission of more information
  - Supports TCAS

Surveillance Overview (ADS-B)

- **Automatic Dependent Surveillance – Broadcast**
  - Again, generational leap forward, less RF, more information, less spinning metal on the ground
  - ADS-B is broadcast based, no challenge response
  - ADS-B position is based on GPS system
  - ADS-B is client based (for the most part)

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ADS-B OUT and IN

- **ADS-B OUT system**
  - ADS-B system broadcasts information about the aircraft “OUT”
- **ADS-B IN system**
  - Receives and processes “OUT” messages
  - ADS-B IN is optional

ADS-B OUTside the Cockpit

- **ADS-B OUT provides**
  - Increased safety
  - Controllers have more insight into the airspace
  - Ability to pack more aircraft into the airspace
  - Saves time and fuel
  - Accurate position info

ADS-B INside the Cockpit

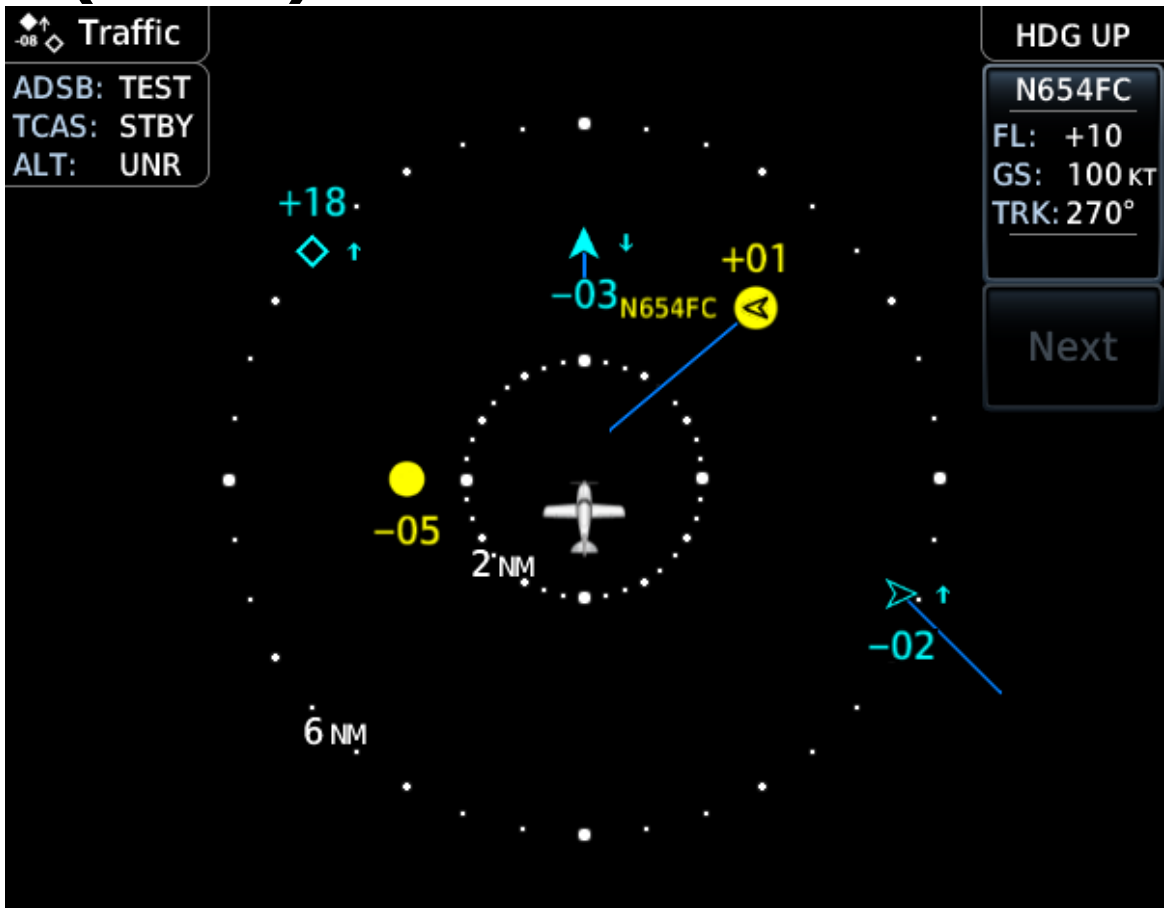
- **Eight ADS-B IN Applications to date**
- **ADS-B IN applications are performance based**
  - Basic Surface (SURF)
  - Basic Airborne (AIRB)
  - ADS-B Traffic Advisory System (ATAS)
  - And six others; EVAcq, VSA, ITP, CAVS, FIM
- **ADS-B will transform the NAS**

ADS-B INside the Cockpit

- **SURF - As seen from both aircraft**

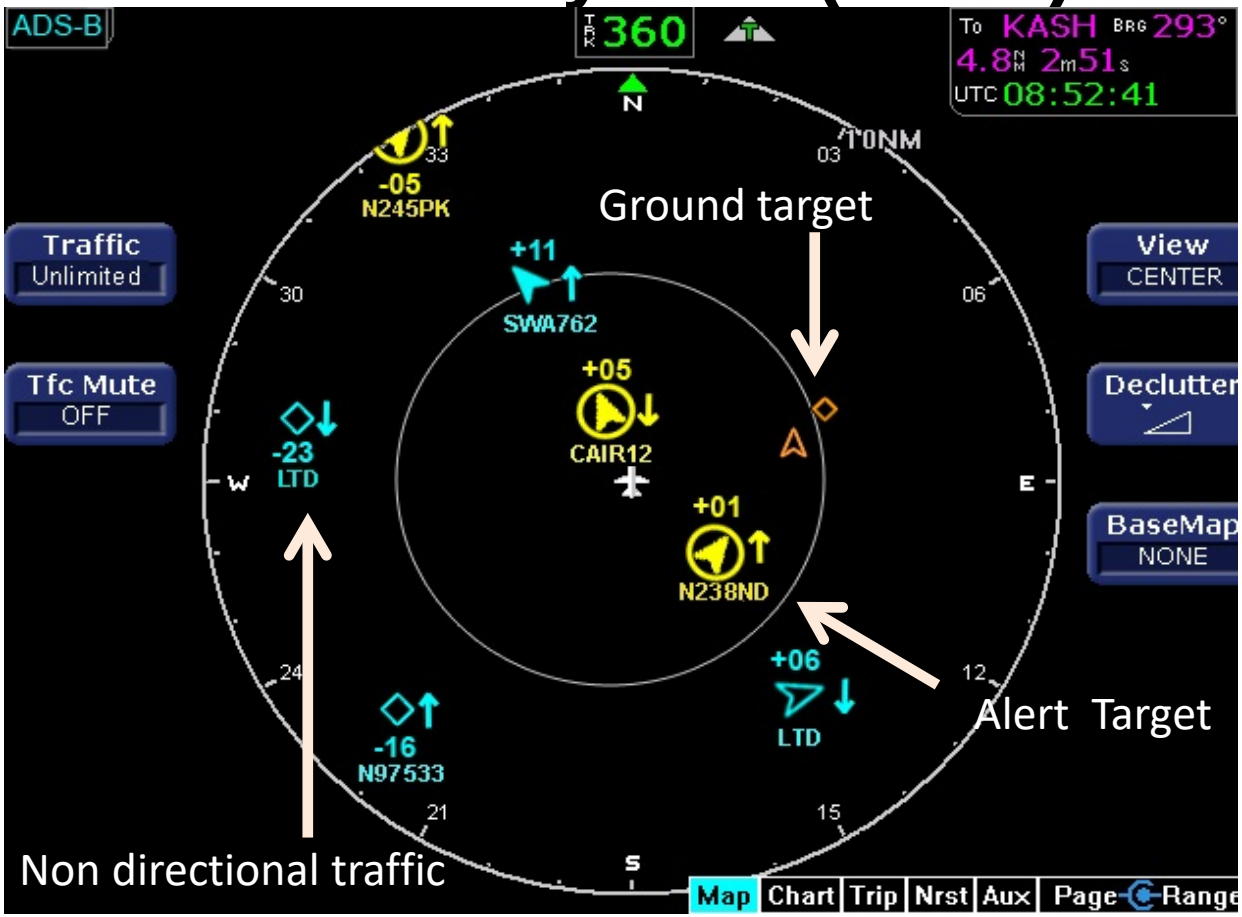
ADS-B INside the Cockpit

- **Basic Airborne (AIRB)**
  - Provides graphic representation of proximate ADS-B, ADS-R and TIS-B traffic



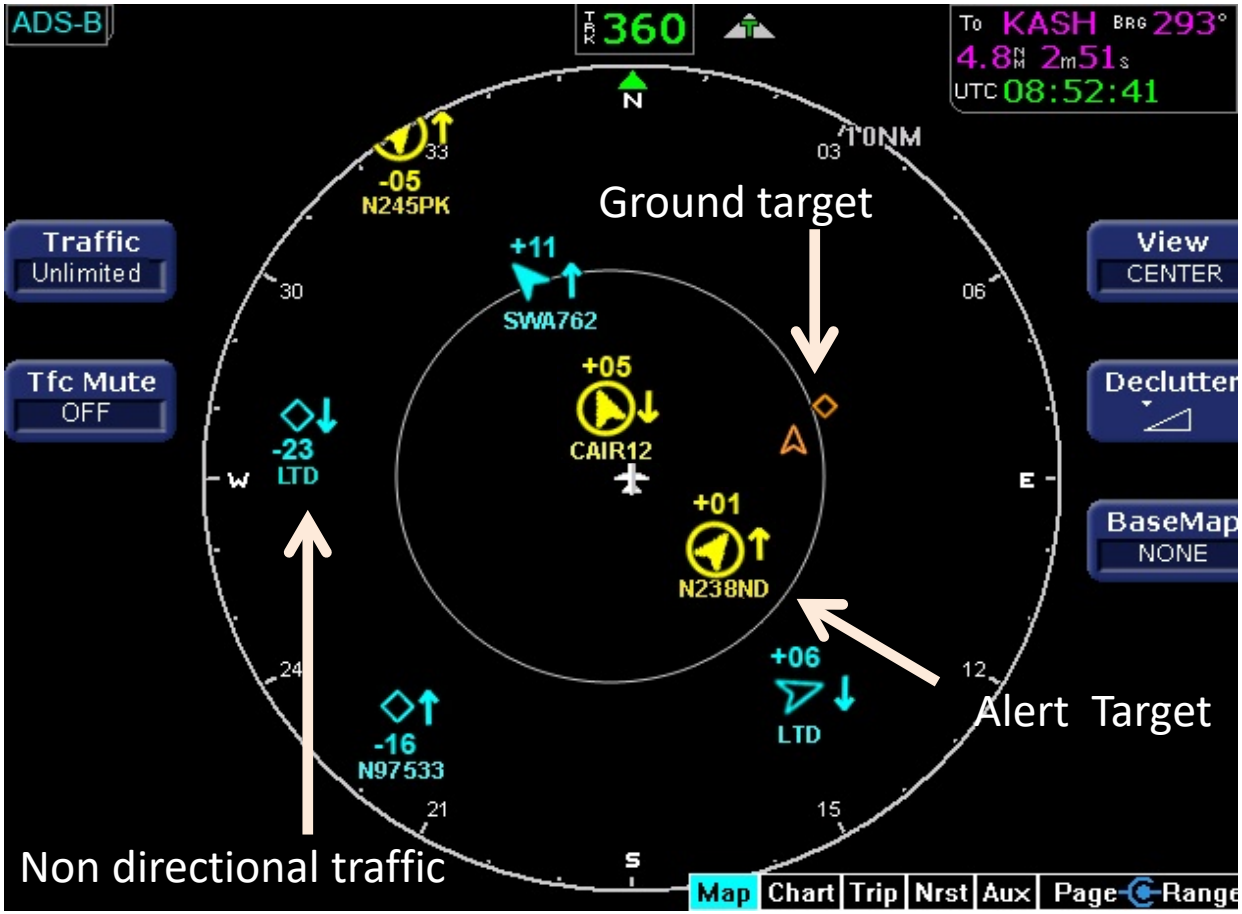
ADS-B INside the Cockpit

- **ADS-B Traffic Awareness System (ATAS)**
  - Provides aural and visual cues of conflict traffic in support of see and avoid responsibilities

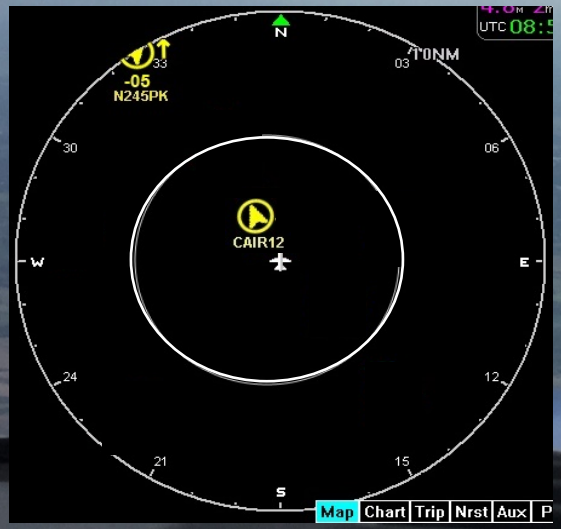


ADS-B INside the Cockpit

- **ATAS**
  - Intended to reduce the mid-air and near mid air collisions involving GA aircraft
  - Cheaper than TCAS



ADS-B IN – in the real world



Approximate view 30 Aug, 2015

ADS-B IN – in the real world

- **10 miles from that great annual fly-in**

… December ‘15 in Maryland

ADS-B INside the Cockpit

- **ADS-B IN Takeaway**
  - Provides pilots with real time information about the airspace around them enhancing awareness
  - Reduces midair collision risks by providing information pilots can use to self separate
  - ADS-B IN will transform the NAS
  - ***"ADS-B IN is not backward compatible. Once you fly with ADS-B IN, you will never want to fly without it"***

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1090ES and 978 UAT

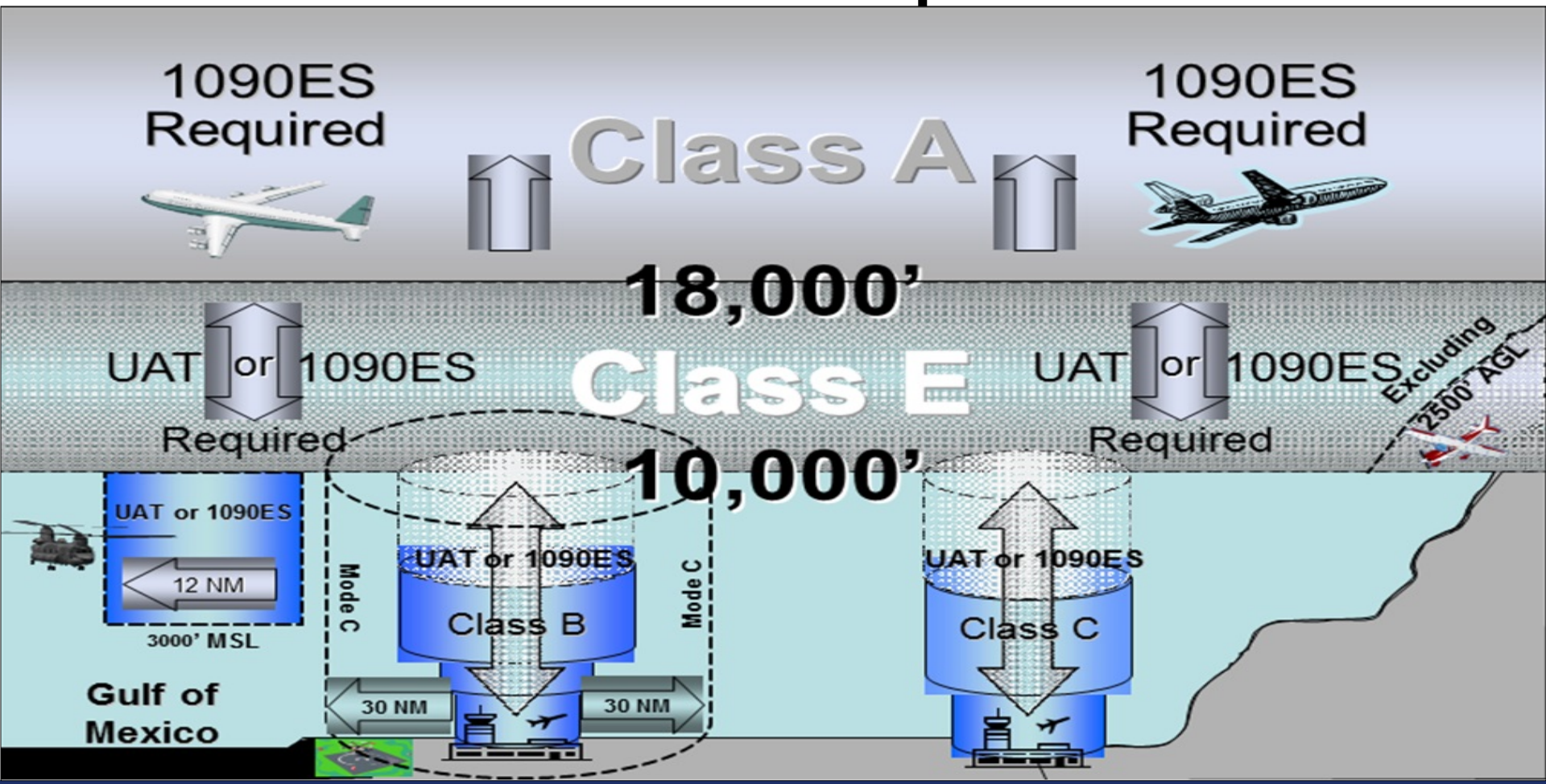
- **There are two versions of ADS-B**
  - 1090 Extended Squitter (**worldwide**)
    - 1090Mhz, same freq as TCAS
  - Universal Access Transponder (**US ONLY**)
    - 978 Mhz
  - Three different Performance Standards
    - Version 0 (V0) (RTCA DO-260)
    - Version 1 (V1) (RTCA DO-260A)
    - Version 2 (V2) (RTCA DO-260B)

1090ES and 978 UAT

- **Characteristics of 1090ES**
  - Required above 18,000 ft* (*= gliders etc excepted)
  - Same format and frequency as ATCRBS, Mode S and TCAS I and II systems
- **Characteristics of UAT**
  - Capable of receiving FIS-B products
    - Weather
    - NOTAMS
  - Still need a transponder
  - Anonymity mode

1090ES and 978 UAT

- **ADS-B 1090 and 978 Airspace**



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Other Systems – ADS-R

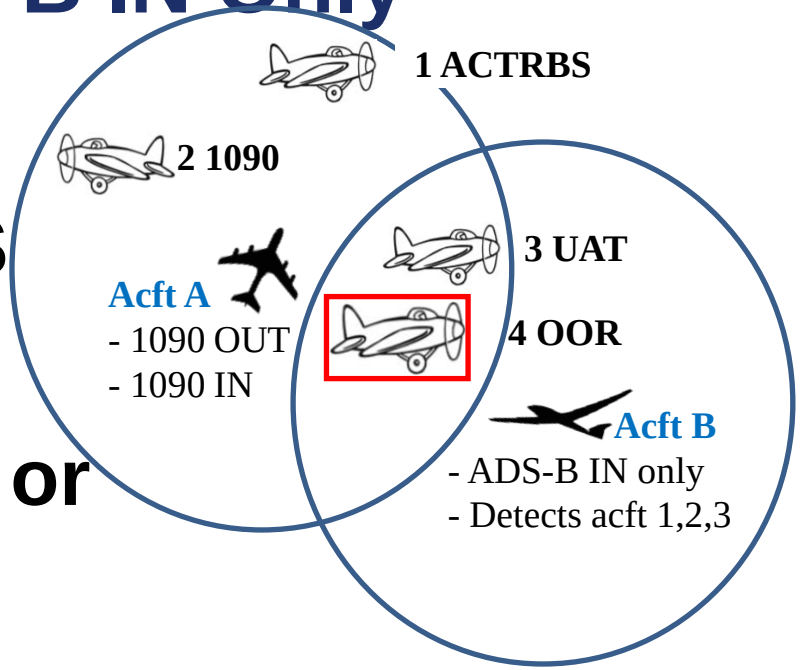
- **Automatic Dependent System – Rebroadcast (ADS-R)**
- **ADS-R takes 1090ES messages received by the ground and rebroadcasts them to UAT clients (on 978 Mhz)**
- **ADS-R takes UAT messages received by the ground and rebroadcasts them to 1090ES clients (on 1090 Mhz)**

Other Systems – TIS-B

- **Traffic Information Service – Broadcast**
  - Provides information on non-ADS-B aircraft
  - Provided to 1090ES and UAT ADS-B IN clients
  - TIS-B information provided to ADS-B clients broadcasting NIC>4, NACp>4, NACv>0, SDA>0, and SIL>0
  - These criteria are aligned with TSO-C199

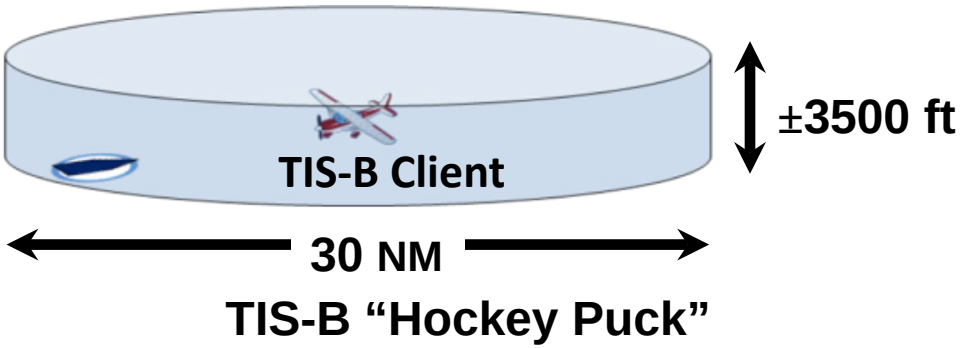
Other Systems – ADS-B IN Only

1. Detected via TIS-B
2. Detected via 1090ES
3. Detected via ADS-R
4. Out of Range (OOR) or not in Hockey Puck



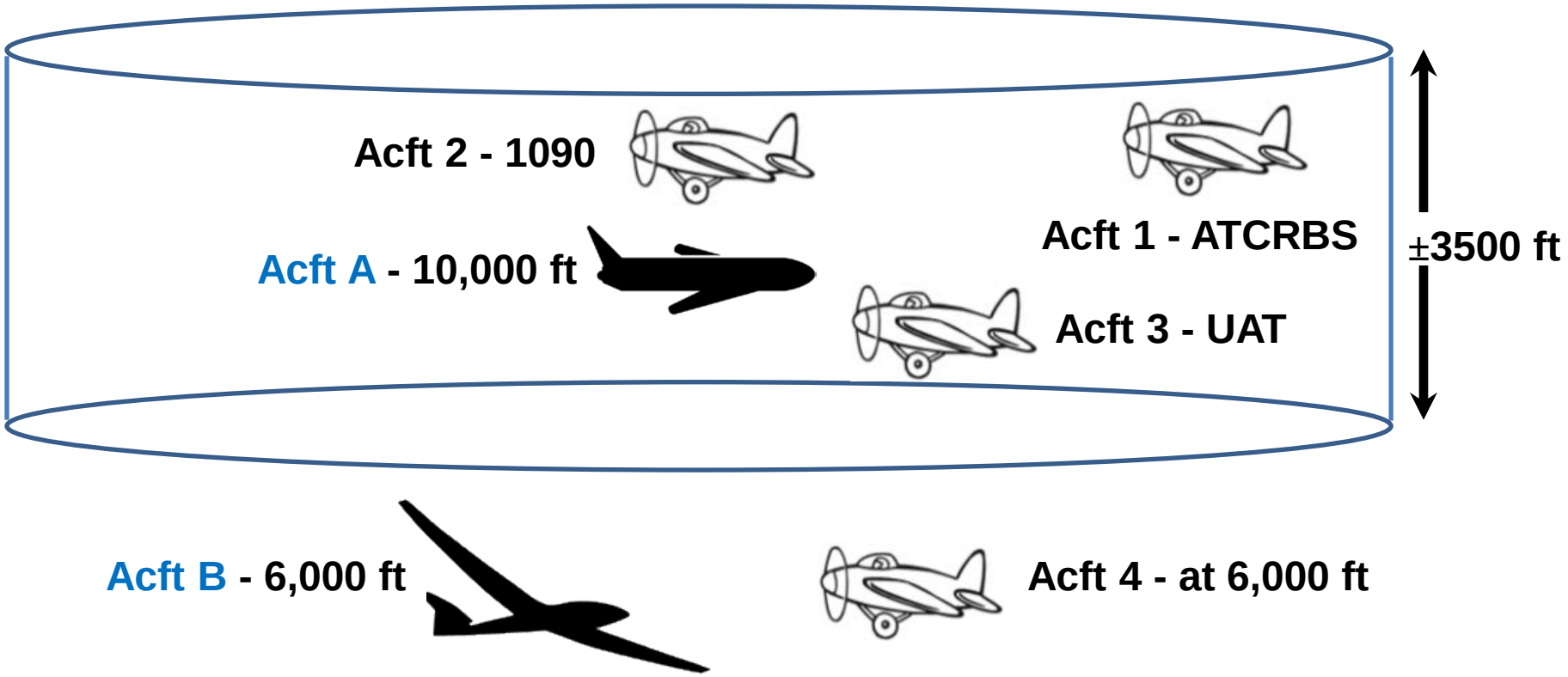
5. Does not account for difference in altitude

6. Note: TIS-B does not show primary targets



Other Systems – ADS-B IN Only

Side view of previous slide

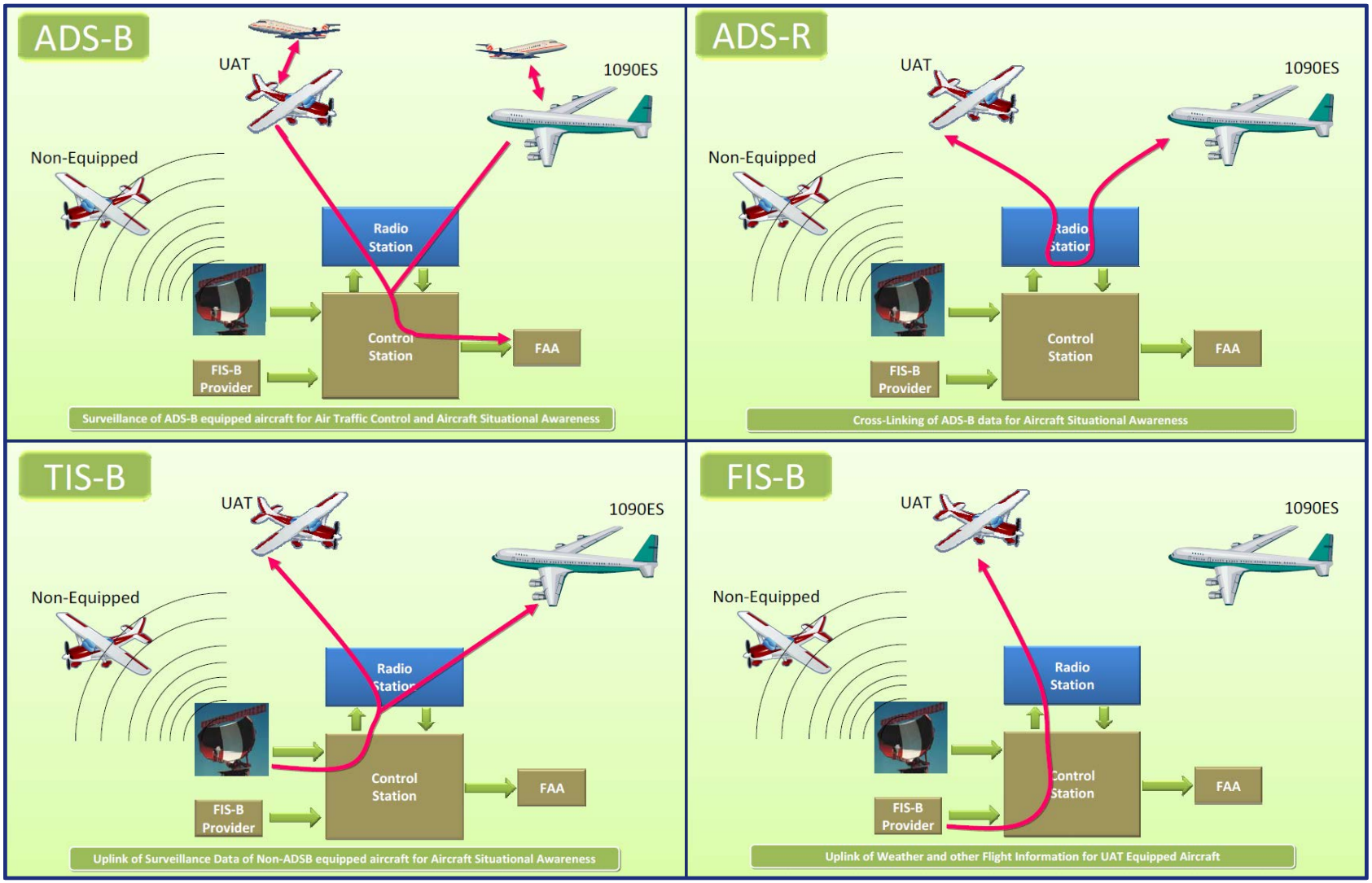


TIS-B does not show primary targets, it only provides ATCRBS and Mode S targets

Other Systems – FIS-B

- **Flight Information Service – Broadcast**
- **Only provided on UAT**
- **A broadcast message, (not client based)**
- **Provides:**
  - Weather products
  - NOTAMS

Other Systems – Graphic



Other Systems – TABS (TSO-C199)

- **Traffic Awareness Beacon System**
  - Based on Transponder / ADS-B MOPS
  - Detectable by TCAS I and II and TAS systems
  - Platform for loggers and other systems
  - Developed to increase safety by providing a standard for a low cost surveillance solution for aircraft excepted in 14 CFR 91.215 and 91.225 (i.e. balloons, aircraft without electrical systems etc)
  - Considered an ADS-B client

Other Systems – TABS (TSO-C199)

- **Traffic Awareness Beacon System**
  - Reduced power requirements
  - Allows for use of commercial grade GNSS that pass defined screening tests, (outlined in TSO-C199)
  - Will not meet separation standards

	Aviation Grade GPS	TABS GPS
XPDR TSO-112()	Meets §91.225	TABS Device
TABS XPDR TSO-199()	TABS Device	TABS Device

Transponder - GNSS Pairing table

Other Systems – PowerFLARM and PCAS

- **Power Flight Alarm (PowerFLARM)**
  - Invisible to TCAS and ATC
  - Not FAA certified
- **Portable Collision Avoidance System (PCAS)**
  - Invisible to TCAS and ATC
  - Not FAA certified

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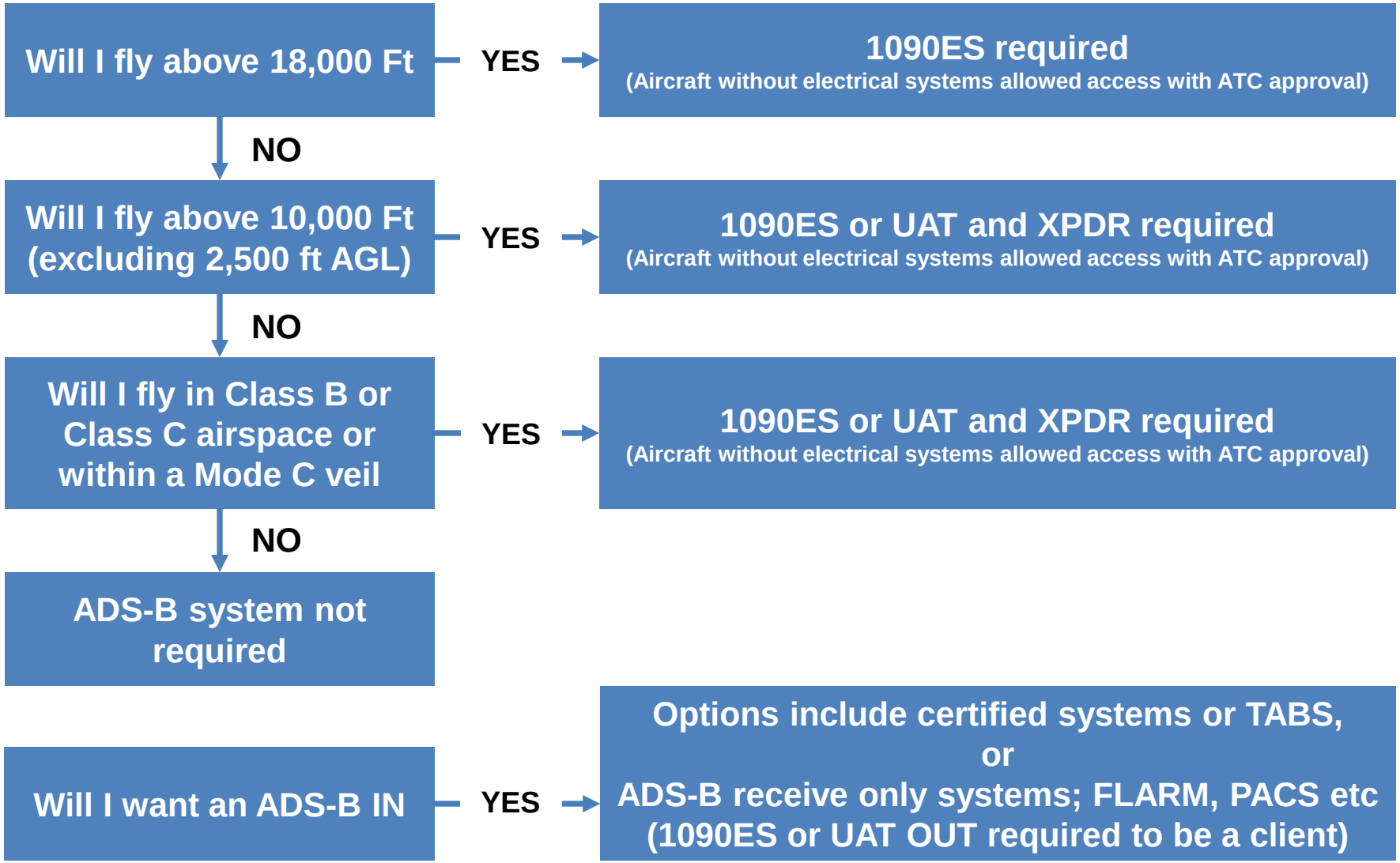
ADS-B Equipage

- **14 CFR 91.215 describes who must equip with a transponder and in what airspace**
- **14 CFR 91.225 describes who must equip with an ADS-B device and in what airspace**
- **Gliders, balloons, aircraft without electrical systems excepted**

ADS-B OUT Equipage – Determination



ADS-B OUT Equipage – Installation

Is the aircraft a
Part 21 (LSA)
Part 23/27 (GA)
Part 25/29 (Transport)
Part 121 (Scheduled Comm)
Part 135 (Unscheduled Comm)

YES →

Per ADS-B policy memorandum, March 2, 2016 The ADS-B equipment may be installed without further FAA approval if the equipment pairing (e.g. ADS-B and Position Source) have been previously approved via a TC/STC/Amend TC.

NO ↓

Is this a Part 91 (Experimental)

YES →

Per ADS-B policy memorandum , January 2016, and AC 90-114A Chg 1 The ADS-B equipment may be installed and operated if the equipment has been declared by the manufacturer to meet the performance requirements of TSO-C166b or TSO-C154c per 14 CFR 91.227. The equipment must also be paired with a position source that would satisfy the performance requirements of 91.227 per the ADS-B manufacturer's instructions. A statement of compliance must also be obtained from the manufacturer at time of installation.

NO ↓

Contact Local FSDO

ADS-B Equipage - Rebate

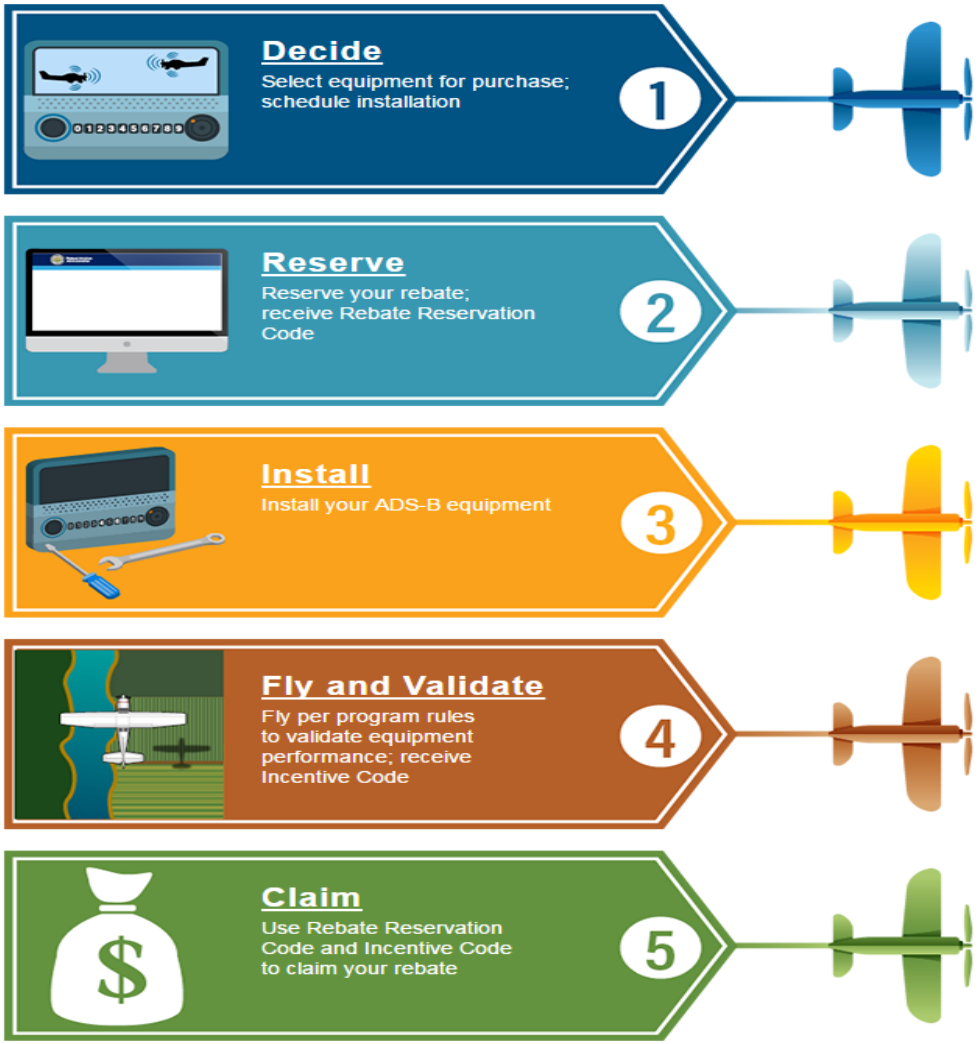
- **ADS-B Rebate Program info**
  - **http://www.faa.gov/nextgen/equipadsb/rebate/**
- **FAA is offering a $500 rebate per system**
- **The program will run until Sep 18, 2017 or until all 20,000 rebates are gone**

ADS-B Equipage - Rebate

- **<u>Must follow the rules outlined on line!</u>**
- **Eligible aircraft**
  - **U.S.-registered,**
  - **Fixed-wing,**
  - **Single-engine piston**
  - **Piloted**
  - **Registered before 2016**

ADS-B Equipage - Rebate

- **Research / Decide** on eligible equipment
- **Reserve rebate** on line
- **Install** within 90 days
- **Fly and validate** within 60 days
- **Claim rebate**



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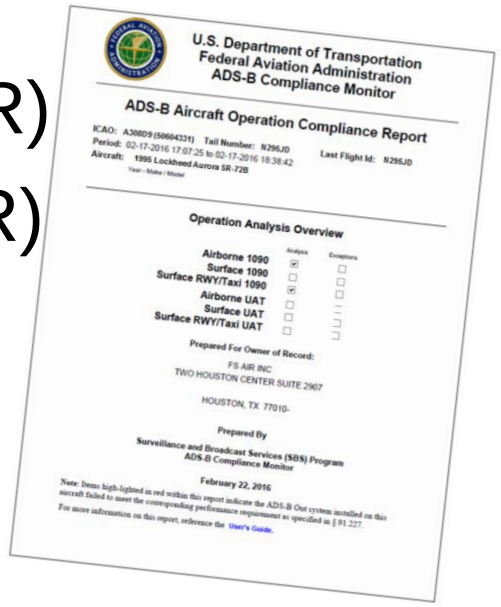
Performance Report

- **Owners and installers can verify ADS-B installations**
- **3 methods of verifying an ADS-B installation**
  - Public Performance Report (PAPR)
  - Aircraft Performance Report (ACR)
  - First of Kind Report
    - i.e. new ADS-B device
    - i.e. new ADS-B GPS pairing
    - Contact John Fisher for more info



U.S. Department of Transportation
Federal Aviation Administration
ADS-B Compliance Monitor

ADS-B Aircraft Operation Compliance Report

ICAO: A30BD9 (50604331) Tail Number: N295JD Last Flight Id: N295JD
Period: 02-17-2016 17:07:25 to 02-17-2016 18:38:42
Aircraft: 1995 Lockheed Aurora SR-72B
Year - Make / Model

Operation Analysis Overview

	Analysis	Exceptions
Airborne 1090	☑	☐
Surface 1090	☐	☐
Surface RWY/Taxi 1090	☑	☐
Airborne UAT	☐	☐
Surface UAT	☐	☐
Surface RWY/Taxi UAT	☐	☐

Prepared For Owner of Record:

FS AIR INC
TWO HOUSTON CENTER SUITE 2907

HOUSTON, TX 77010-

Prepared By

Surveillance and Broadcast Services (SBS) Program
ADS-B Compliance Monitor

February 22, 2016

Note: Items highlighted in red within this report indicate the ADS-B Out system installed on this aircraft failed to meet the corresponding performance requirement as specified in § 91.227.

For more information on this report, reference the User's Guide.

Performance Report

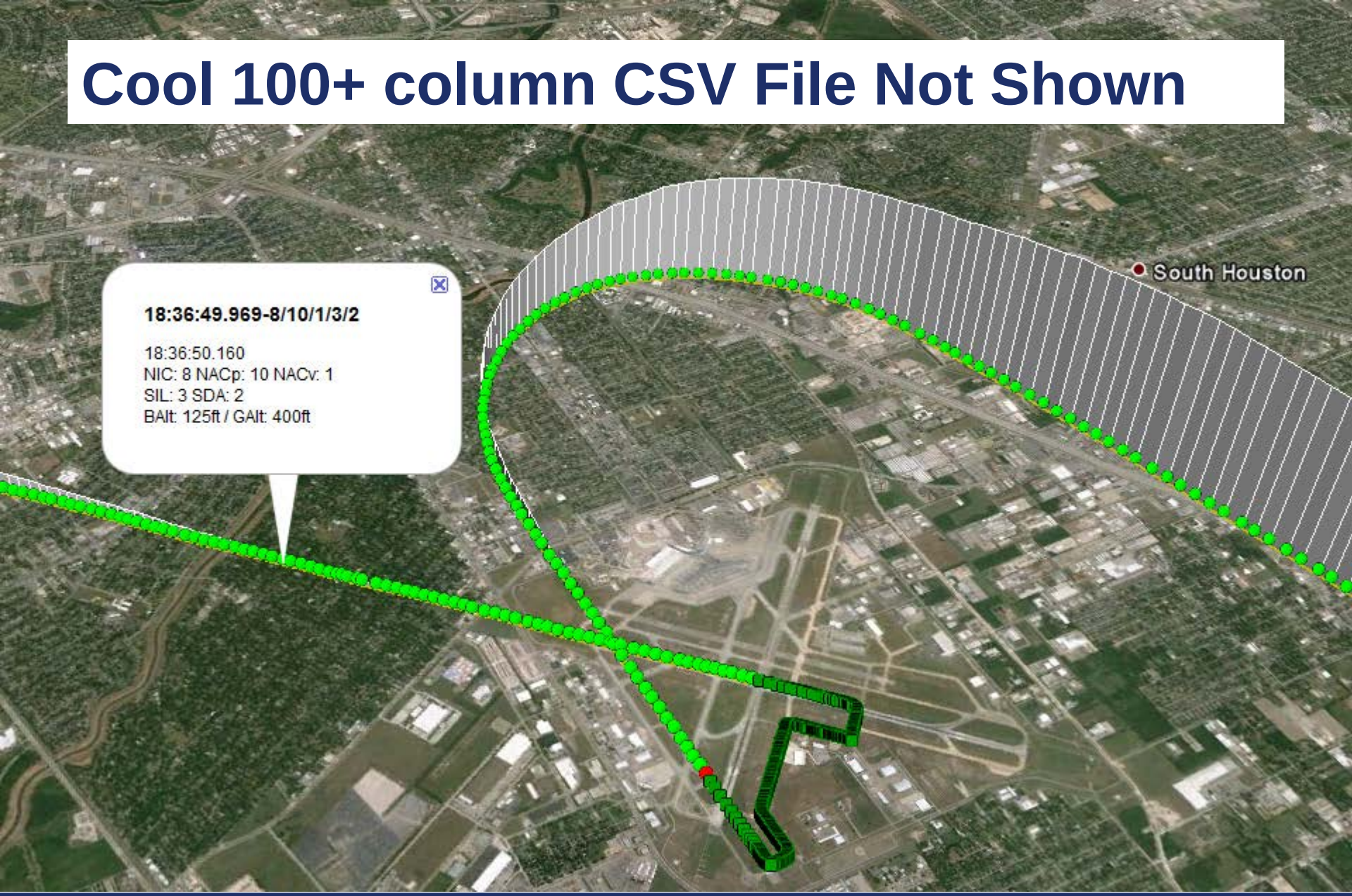
- **Allow installers and owners to verify their ADS-B system is functioning correctly**
- **Reports are based on Performance Monitor**
- **You DO NOT need to perform a special flight**
- **Reports are free**
- **You can download a report here:**

https://adsbperformance.faa.gov/PAPRRequest.aspx

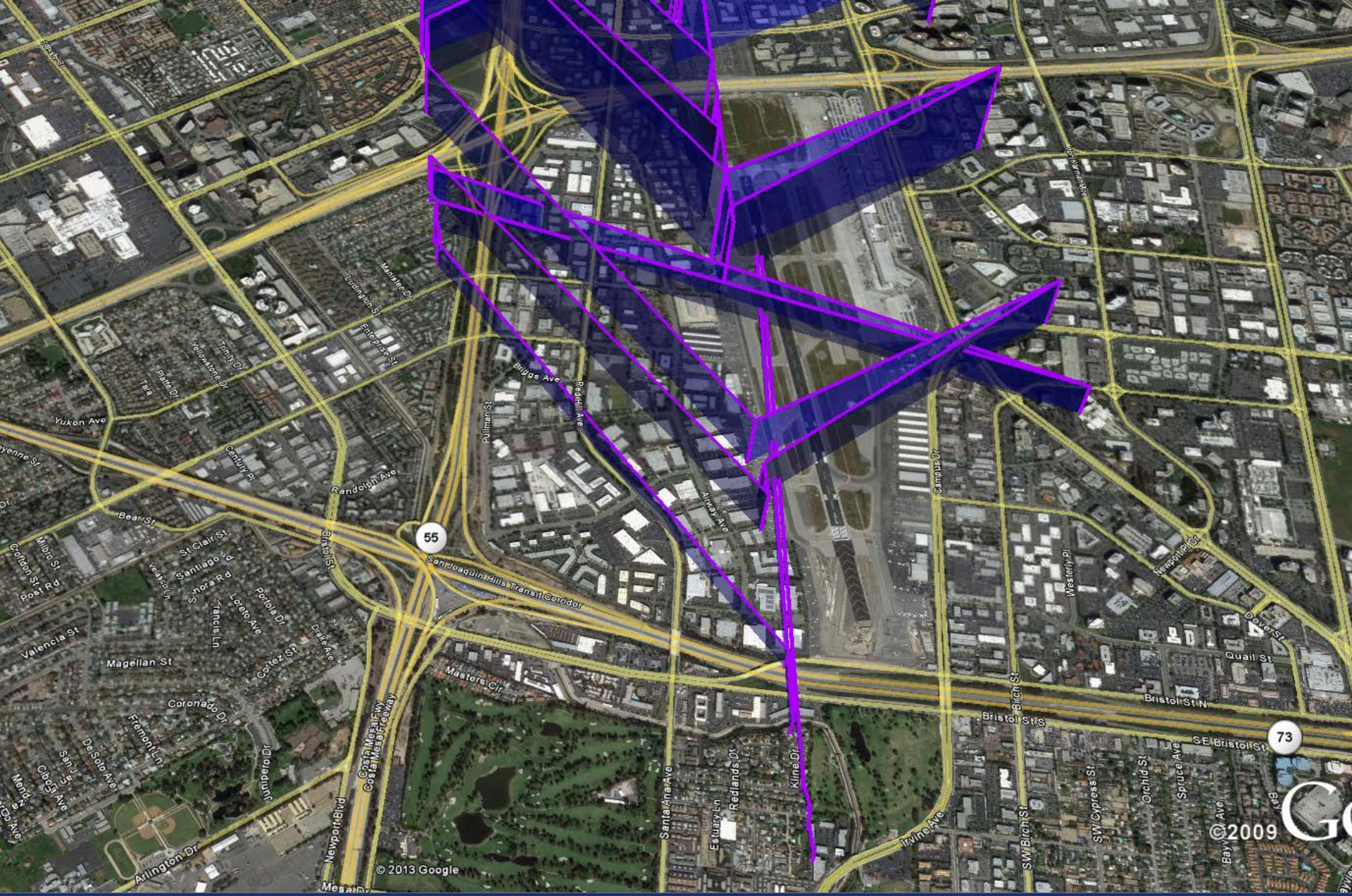
Performance Report

- **Provides verification your ADS-B system is working correctly**
- **Already equipped?**
  - See me after this presentation and I'll run a report for you real time

Cool 100+ column CSV File Not Shown




Intermittent NIC, NACp. NACv=0



INs and OUTs of ADS-B

Federal Aviation Administration

Performance Report

- **Take away**
  - The Performance Monitor is running 24/7/365
  - Provides a good way to ensure ADS-B system is working correctly
  - Performance reports are free
  - No special flight is needed
  - Data is starting to be used by controllers

More Information

- **More info about ADS-B can be found at:**
  - http://www.faa.gov/nextgen/equipadsb
- **FAA documents can be found here**
  - http://rgl.faa.gov/
- **ADS-B Rebate info can be found here**
  - https://www.faa.gov/nextgen/equipadsb/rebate/

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