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
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

WARNING SURFACE TRAFFIC

WARNING LANDING TRAFFIC 35R
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**)
    • 1090 Mhz, 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*

INs and OUTs of ADS-B
Other Systems – ADS-B IN Only

Side view of previous slide

Acft A - 10,000 ft

Acft 2 - 1090

Acft 1 - ATCRBS

Acft 3 - UAT

Acft B - 6,000 ft

Acft 4 - at 6,000 ft

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

INs and OUTs of ADS-B
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

<table>
<thead>
<tr>
<th></th>
<th>Aviation Grade GPS</th>
<th>TABS GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>XPDR TSO-112()</td>
<td>Meets §91.225</td>
<td>TABS Device</td>
</tr>
<tr>
<td>TABS XPDR TSO-199()</td>
<td>TABS Device</td>
<td>TABS Device</td>
</tr>
</tbody>
</table>

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

1. **Will I fly above 18,000 Ft**
   - **YES**: **1090ES required**
     - (Aircraft without electrical systems allowed access with ATC approval)
   - **NO**
2. **Will I fly above 10,000 Ft (excluding 2,500 ft AGL)**
   - **YES**: **1090ES or UAT and XPDR required**
     - (Aircraft without electrical systems allowed access with ATC approval)
   - **NO**
3. **Will I fly in Class B or Class C airspace or within a Mode C veil**
   - **YES**: **1090ES or UAT and XPDR required**
     - (Aircraft without electrical systems allowed access with ATC approval)
   - **NO**
4. **ADS-B system not required**
5. **Will I want an ADS-B IN**
   - **YES**: Options include certified systems or TABS, or ADS-B receive only systems; FLARM, PACS etc
       - (1090ES or UAT OUT required to be a client)
**INs and OUTs of ADS-B**

**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
- 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

- **Must follow the rules outlined on line!**
- **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
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

INs and OUTs of ADS-B
Intermittent NIC, NACp. NACv=0
INs and OUTs of ADS-B
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/equipadbsb

• FAA documents can be found here
  – http://rgl.faa.gov/

• ADS-B Rebate info can be found here
  – https://www.faa.gov/nextgen/equipadbsb/rebate/