ADS-B Avionics

APANPIRG ADS-B TASK FORCE SEMINAR
Nadi, Fiji

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Technology Development
Airservices Australia
Avionics – Available today

• Honeywell
  – Air Transport  TRA-67A
  – Business / GA  MST-67A & KT-73

• Rockwell Collins
  – Air Transport  TPR-901
  – Business / GA  TDR-94/94D - 108

• ACSS
  – Air Transport  XS-950  * Must have “ModA”
  – Business / GA  RCZ-852

• UPS-AT
  – Air Transport  AT7000
Let's talk about the famous "wire"

Transponder
Software

GPS data bus

Adapted from a FedEx presentation

Don’t need cockpit displays for ADS-B out
What do I need to have ADS-B?

• A GPS source – which provides the integrity data
  – Big Aircraft = ARINC label 130 : HPL

• A barometric altimeter

• A device which transmits ADS-B
  – A modern mode S transponder

  Or

  – An ADS-B transmitter box with antenna

• A wire between them that carries Position & Integrity
Big Aircraft

1. Air Data
   - BARO Altitude

2. GPS ANTENNA
   - GPS engine
   - GNSS MMR Receiver

3. Mode S ATC transponder
   - Enhanced/Elementary Surveillance SB
   - Include ADS-B ES Capability

4. TCAS Antenna
   - TCAS Unit
   - 1090 Receiver
   - ADD TCAS SOFTWARE FOR ADS-B
   - CDTI TRAFFIC
   - HPL
   - Flight ID

5. Existing SSR Antenna
   - IRS Position, velocity & Flight ID
   - FMS / IRS
   - Control panel
   - TCAS TRAFFIC DISPLAY

6. ADS-B Now OK: USES HPL

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GPS requirements

- GPS MUST output HPL
- A GPS with Fault detection & Exclusion is strongly preferred
- A TSO145a GPS engine is preferred
- A GPS which does **not** assume “SA” in **on** is preferred
Regional Aircraft

• SAAB, Embrarer, Bomardier slow to embrace ADS-B
  – Choices: Wait for integrated solutions or do it yourself
  – Transponder products exists
  – GNSS: More care needed

• Or an “ADD ON” solution:
Non-TCAS Equipped Aircraft

As used in Bundaberg Australia

DF 17 Squit + Mode A/C/S

ANTENNA
ANTENNA

KLN 94

KT 73

EXISTING
NEW

Aircraft State
RS-232

Altitude
Gillham
A-429
RS-232

ALTIMETER

MODE S TRANSPONDER

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SIMPLIFIED ADS-B TRANSMITTER

GPS ENGINE & ADS-B TRANSMITTER

No PRODUCT YET

PERHAPS IN RESPONSE
TO AUSTRALIAN RFP ONE WILL EXIST

Altitude Gillham A-429 RS-232

ALTIMETER

DISPLAY

TCAS

DIVERSITY TRANSPONDER

L-BAND SUPPRESSION BUS

ANTENNA

EXISTING

NEW

Mode A/C/S

DF 18 Squit Only

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Smaller Aircraft Equipment are being developed

- Development of ADS-B capability in transponders
- Low cost, size and weight

- eg Microair: Bundaberg Queensland
- eg Avionics AustralAsia: Brisbane Queensland
- eg Filser & Becker & Eurotelematik: Germany
- eg Honeywell & Garmin: USA

Airservices Australia
Request for Proposal
Closes soon
IFR  ADS-B Option 1

- **Existing SSR transponder**
- **Small Box**
  - **1090 Transmitter**
  - **TSO146 GPS NAV**
- **Traffic Antenna**
- **GPS Antenna**
- **1090 Receiver**
- **Moving Map Display**

**Legend**:
- **ANTENNA**
- **1090 Transmitter**
- **GPS NAV**
- **SMALL BOX**
- **Existing SSR Antenna**
- **ADS-B Transmission**
- **New Antenna**
- **Position & Integrity**
- **Traffic**

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IFR ADS-B Option 2

- ADS-B Capable SSR transponder
- 1090 Transmitter
- Existing SSR Antenna
- Traffic Antenna
- Position & Integrity
- TSO146 GPS NAV
- Moving Map Display
- 1090 Receiver
- GPS Antenna

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VFR ADS-B options

Existing SSR transponder

1090 Transmitter

GPS engine

1090 Receiver

Traffic Antennas

Moving Map Display

ADS-B Transmission

New Antenna

Existing SSR Antenna

GPS ANTEENNA

SMALL BOX (in tail etc)

Traffic Antennas

GPS ANTEENNA

Antennas

ANTENNA
Indicative Low-end ADS-B Avionics for GA

MANDATORY

- Low weight, low cost, low power, low installation costs
- CASA approval
- Compliant with any or all of the following (or equivalent):
  - ATSO C1004: ATC transponder (DF18)
  - ATSO C1005: ADS-B only (DF18)
  - TSO C112: Mode S transponder
- Operable up to FL150 (125W output)
- Base model to include TSOed GNSS receiver with:
  - Ability to take advantage of Selective Availability (SA) off
  - Fault Detection & Exclusion (FDE)
  - Provision of HPL for ADS-B
- Must operate on aircraft with existing transponders
- Bottom antenna only required
- STC Approved Model List (AML) to cover a wide selection of aircraft with MTOW < 5,700 kg
- Available mid to end-2007

DESIRABLE

- Integrated altitude encoder (with an optional (lower cost?) configuration able to receive data from an external altitude encoder)
- Integrated TSOed GNSS navigator (with an optional (lower cost?) configuration able to receive GNSS data from an external source)
- Baro-aiding
- Squat switch (on ground reporting)
- Emergency input discrete
- Emergency input SPI
- Future growth to incorporate ADS-B receivers (for CDTI etc)
Prices for Avionics

• Close low for new aircraft off the production line
  – Eg: Airbus, Boeing
  – BUT Bombardier, SAAB & Embrarer don’t support it yet

• Expensive for old aircraft without GPS (eg B767)

• Cost of Service Bulletin from Boeing/Airbus depends on relationship. Low cost to Very high cost
Standards for Mode S

- ICAO → Signals in Space
  - Annex 10 SARPS Amend 77

- AVIONICS & TEST STANDARDS
  - RTCA
    → ADS-B MASPS DO242
    → ADS-B MOPS 1090 DO260 & DO260A
    → Mode S MOPS DO-181c include ADS-B

- FORM/FIT STANDARDS
  - AEEC
    → ARINC 718A

- FAA (Regulator)
  → TSO C112
  → TSO C116

- EUROCAE
  → ED73B Mode S MOPS
  → ED102 ADS-B for 1090Mhz

- AVIONICS & TEST STANDARDS
  - EUROCAE
    → ED102 ADS-B for 1090Mhz

- FORM/FIT STANDARDS
  - EUROCAE
    → ED86

- JAA (Regulator)
  → JTSO 2C112

- CASA (Regulator)
  → ATSO C1004 ModeAC + ADS-B
  → ATSO C1005 ADS-B only
What about the DO260 vs DO260A debate?

• Points to note:
  • FAA’s TSO C166 allows DO260 AND DO260A
    ➔ Expects DO260 to be inadequate for some applications
    ➔ Regional class TDR94D -108 is the only DO260A box available

• At least 2 years till large aircraft DO260A boxes available
• Final draft Interop document defines minimum requirements for ATC use of ADS-B
What’s missing?

• Internationally accepted Airworthiness requirements/ certification
  – FAA, CASA & EASA expected to work on them soon
  – Following work of RFG or following work of an ATC provider or foreign regulator

• Airliner “certification”
  – What is needed?
Discussion

More details on Airservices Website

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**ADS-B Class B (ADS-B Out) Avionics Architecture**

- **TCAS**
- **Transponder/TCAS Control Panel & Cables**
- **Mode S Transponder**
- **GNSS/GPS**
- **Control Panel**
- **Air Data Computer**

Baseline in Passenger configuration. May need to be upgraded to Change 7 to be compatible with upgraded Transponder.

Replace if required for Flight ID.

- **Existing Units**
- **New Additions**

- **Call Sign**
- **Position, Velocity, ...**
- **INTEGRITY**
- **Altitude**

Upgrade To Include ADS-B Functionality

Adapted from a FedEx presentation

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