



| ICAO

Introduction to Automatic Dependent Surveillance - Broadcast

**Ho Wee Sin,
Deputy Director (ANS Support & Master Planning)
Civil Aviation Authority of Singapore**



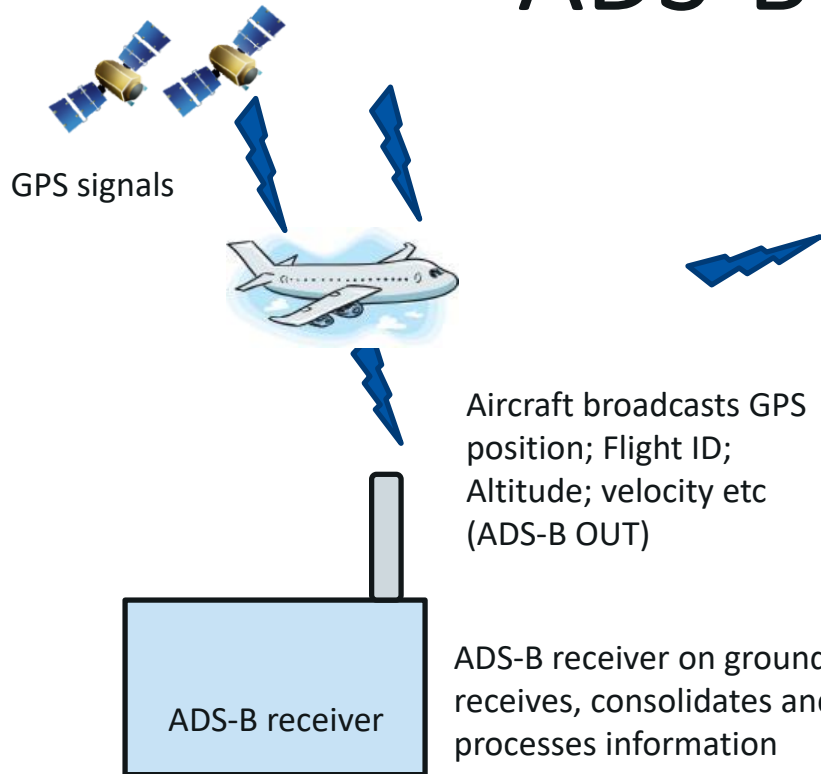


Automatic Dependent Surveillance- Broadcast

- Automatic - Does not require pilot intervention
- Dependent - Require cooperation from the aircraft e.g. need aircraft to report information accurately
- Surveillance - Provide info on position, identity, altitude etc
- Broadcast - Information is broadcasted to receivers in range



ADS-B



ADS-B IN equipped aircraft



Aircraft receives and processes information (ADS-B IN)

Cost difference

Radar



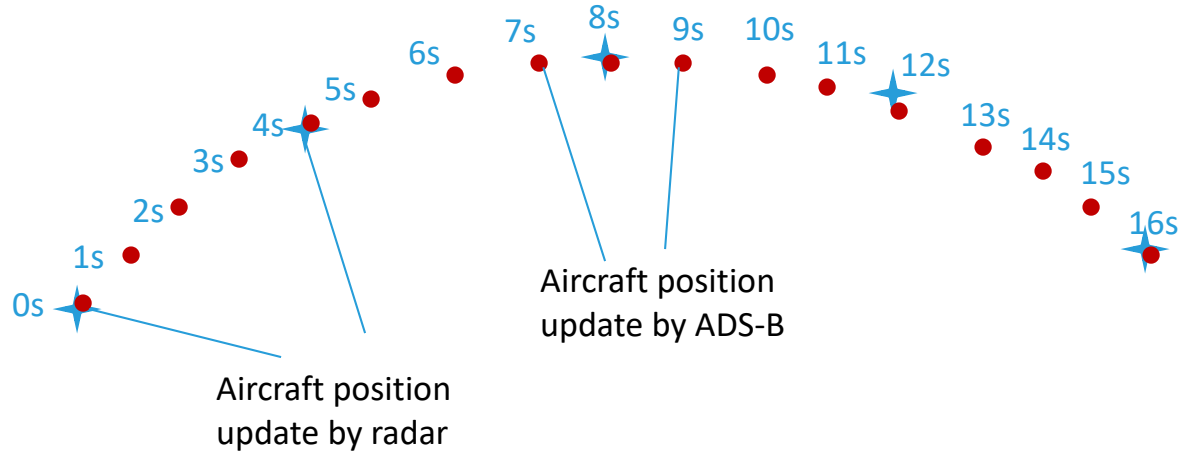
~US\$10,000,000

ADS-B



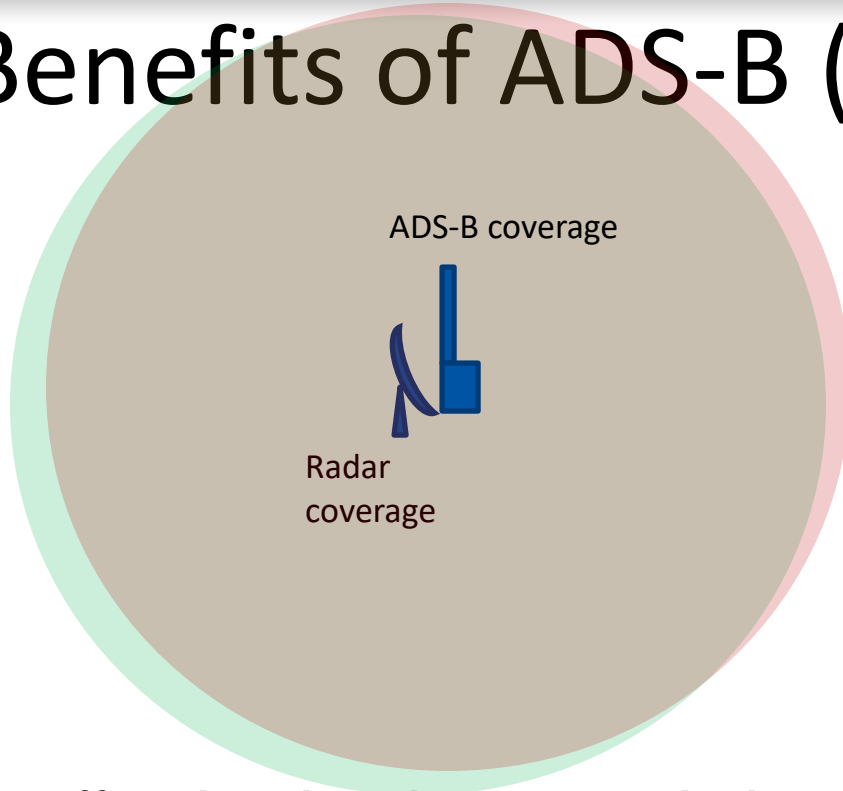
~US\$300,000

Benefits of ADS-B (Radar area)



- Increased track accuracy and higher update rate

Benefits of ADS-B (Radar area)



- Cost effective backup to existing radars

Types of ADS-B technology



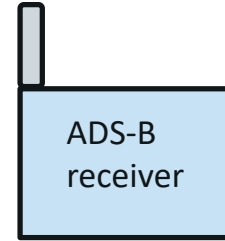
Mode S 1090MHz
Extended Squitter



Universal Access
Transceiver (UAT)



VHF Datalink Mode 4
(VDL Mode 4)



ADS-B IN equipped
aircraft



Mode S 1090MHz Extended Squitter

- Equipped on almost all large passenger aircraft.
 - Uses 1090 MHz
- Protocol definitions
 - RTCA DO-260 or Eurocae ED-102 (Version 0)
 - Original standard for ADS-B equipped aircraft
 - RTCA DO-260A (Version 1)
 - Standard is now superseded by RTCA DO-260B
 - RTCA DO-260B or Eurocae ED-102A (Version 2)
 - On all newly manufactured Boeing and Airbus aircraft
 - Minimum standard for USA airspace from 2020
 - Retrofit solutions developed for older types.



Major differences

	DO-260 (version 0)	DO-260A (version 1)	DO-260B (version 2)
Mode 3/A	Not available	Available as test message	Available
Transponder version	Not available	Available	Available
Accuracy indicator	NACv	NACp, NACv	NACp, NACv
Integrity Indicator	NUCp	NIC, NIC supplement, SIL	NIC, NIC Supplement A/B/C, SIL, SDA
Length/width	Not available	Available	Available
ADS-B in capability indication	Not available	Not available	Available



Upcoming DO-260C/ED102B (Version 3)

- Major additions

- Manned/unmanned operations
- Additional emergency priority and status
- Extended Velocity and Altitude (for supersonic)
- Weather data



Universal Access Transceiver

- Requires a dedicated transceiver in each aircraft
 - Normally used by smaller aircraft
 - Uses the 978MHz
 - Mainly used in USA
- Protocol definitions
 - RTCA DO-282
 - RTCA DO-282A
 - RTCA DO-282B
 - Minimum standard for USA airspace from 2020



VHF Datalink Mode 4

- Operates on 25KHz channels in the 118MHz – 136.975MHz bandwidth
- Protocol definitions
 - Eurocae ED-108
 - Eurocae ED-108A



Common Certification Standards

- European Aviation Safety Agency - AMC 20-24
- Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia
- European Aviation Safety Agency - CS-ACNS-subpart D
- Federal Aviation Administration – Advisory Circular No: 20-165A (or later editions)

APAC States are urged to adopt all the mentioned standards



EASA AMC 20-24

- Provide means of compliance for use of ADS-B in Non-Radar Areas via 1090 MHz Extended Squitter (as stated in ED-126)
- ADS-B transmitter ETSO-2C112b
- GNSS receiver ETSO-C129, ETSO-C145, ETSO-C146 or ETSO-C196 (or later)
- Can be ED-102/DO-260 (or later)



CASA CAO 20.18

- ADS-B transmitter (E)TSO-C166 (or later), or otherwise accepted by CASA.
- GNSS receiver (E)TSO-C145a, (E)TSO-146a, (E)TSO-196a (or later), or otherwise accepted by CASA.
- OR
- Certified to EASA AMC 20-24
- Aircraft manufactured after 8 December 2016 are required to have SA Aware and GNSS Fault Detection and Exclusion (FDE)
- Can be ED-102/DO-260 (or later)



FAA – AC No: 20-165A (or later)

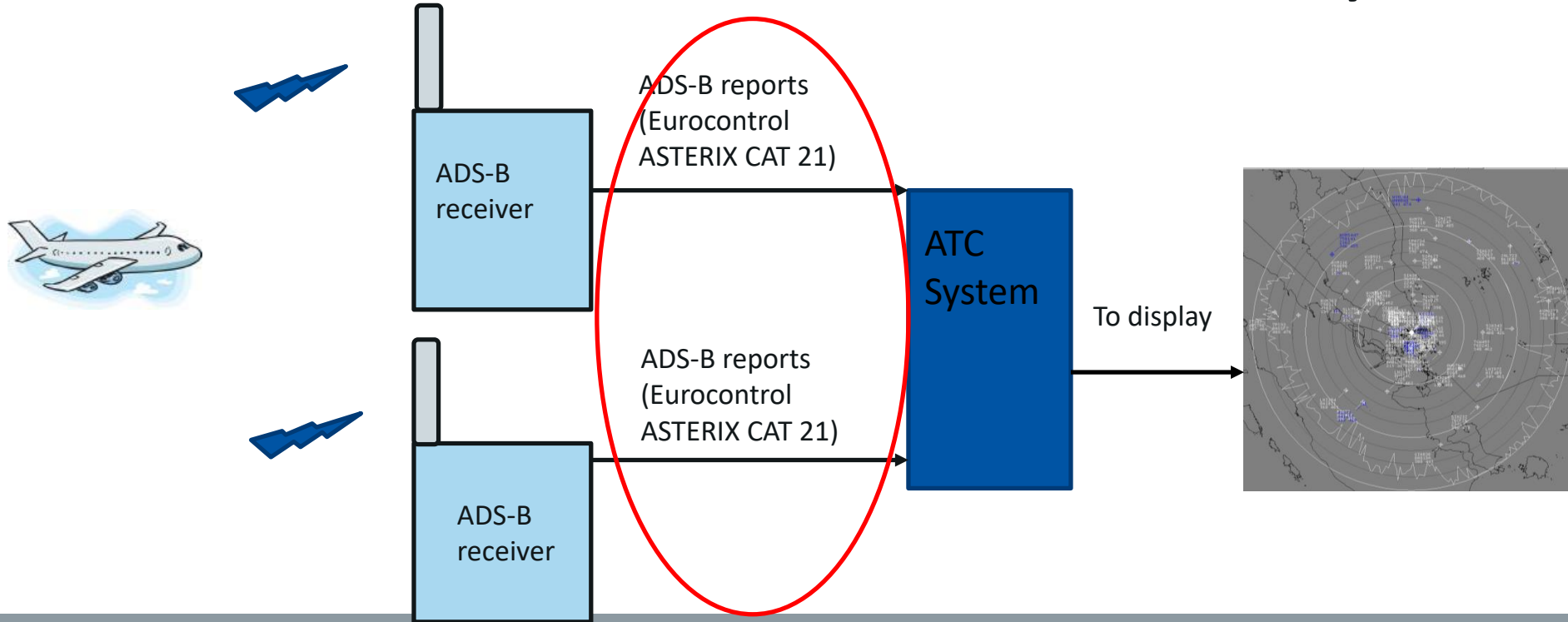
- Uses either UAT or 1090 MHz Extended Squitter
 - (APAC only use the 1090 MHz Extended Squitter)
- ADS-B transmitter TSO-C166B (for 1090ES) or TSO-C154-C (for UAT)
- GNSS receiver TSO-C129, TSO-C145, TSO-C146, or TSO-C196
- Includes performance standards
 - E.g. NIC ≥ 7 ;
 - E.g. NACp ≥ 8
- Has to be ED-102A/DO-260B (for 1090 ES) or DO-282B (for UAT)



EASA - CS-ACNS

- Closely aligned to FAA AC 20-165
- ADS-B transmitter ETSO-C166B or ETSO-C112D
- GNSS ETSO-C129a, ETSO-C145(), ETSO-C196a or ETSO-C146()
- Slightly less stringent performance requirement compared to FAA
 - E.g. NIC ≥ 6 instead of NIC ≥ 7 ;
 - E.g. NACp ≥ 7 instead of NACp ≥ 8
- Uses ED-102A/DO-260B only (1090 ES)

Data format for transmission to ATC system





Eurocontrol ASTERIX CAT 21

- ASTERIX CAT 21
 - Several Editions available
 - Limited backward compatibility
- Editions must be compatible
 - Both system (ADS-B receiver and ATC system) must use the same edition



ASTERIX CAT 21 (part 1)

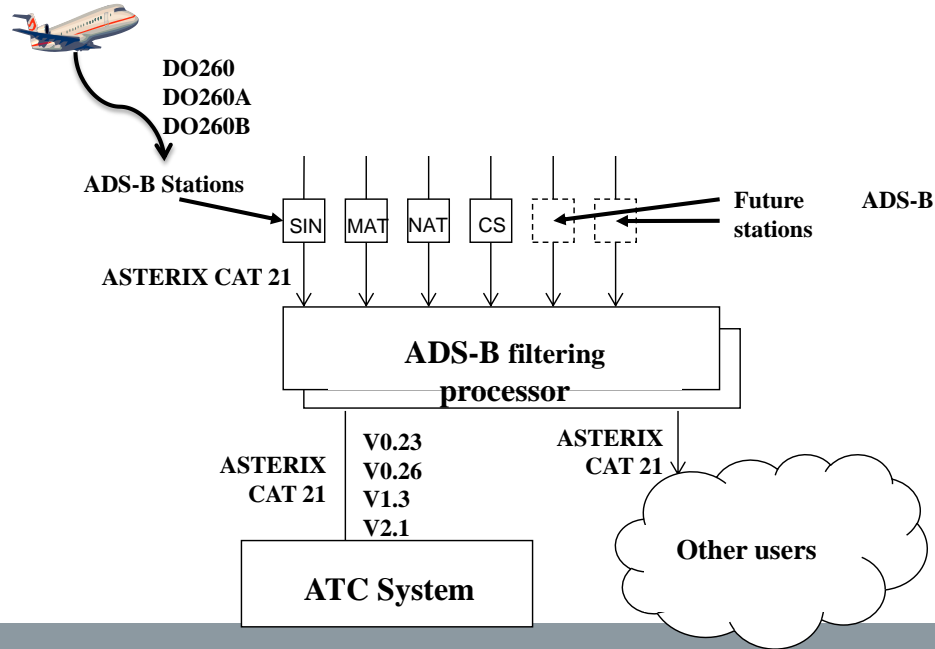
- CAT 21 edition 0.23
 - Basic edition adopted by Asia Pacific
 - Does not have mode A
- CAT 21 edition 0.26
 - This edition is used by many ANSPs as it was stable for a while
 - This edition onwards contain mode A
- CAT 21 edition 1.0 to 1.8
 - Contains DO-260A enhancements (e.g. SIL, length/width)
 - Changes from editions 1.0 to 1.8 are editorial



ASTERIX CAT 21 (part 2)

- CAT 21 edition 2.1
 - Contains DO-260B enhancements (e.g. SIL-sup, SDA)
 - Backwards compatible with edition 1.x
 - Additional information in the optional Reserved Expansion Field (e.g. selected heading, antenna offset)
- CAT 21 editions 2.2
 - Amend the format of 'length/width'
- CAT 21 editions 2.3 to 2.5
 - Includes a flag to indicate black-list/white-list check failure
 - Changes from editions 2.3 to 2.5 are mainly clarifications
 - Edition 2.5 include the option of stating version 3 (i.e. DO-260C)

Managing different inputs and outputs (Singapore's example)





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THANK YOU