# Boeing ADS-B

## Presented to:
## ICAO Regulators Workshop on ADS-B Avionics Equipage Requirements

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# Outline

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# ADS-B Out Mandates - Overview

- **Boeing always strives to build a single international design for delivery to our airline customers worldwide.**
  - Majority of our aircraft deliveries are to non-US based airlines.
- **Different regional mandates' requirements:**
  - Force variability into our product designs
  - Add cost and complexity to their manufacturing and support.
- **To claim that just because a mandate is based on DO-260B it is therefore "standardized" or "harmonized" is misleading:**
  - DO-260B contains many choices on the types and content of the broadcast messages
  - The position source's performance requirements are part of each mandate
    - These requirements are not controlled by DO-260B – they are uniquely developed by/for each region.

# Regional Mandates – Requirements Differences

| Nav Configuration ><br><br>Transmit Configuration | SA ON GNSS Receivers acceptable | SA Aware GNSS Receivers required |
|---|---|---|
| DO-260 / Version 0 | Nav Canada / Hudson Bay (Nov 2010)<br>Hong Kong (2014) | Australia (June 2012 for SA Aware (New Production only) / Dec 2013 for ADS-B Out (New & retrofit) |
| DO-260B / Version 2 | Europe (Jan 2015 new prod / Dec 2017 retrofit)<br>Reg 62H/TSS required | FAA (2020) for new & retrofit aircraft<br>Reg 62H/TSS not required |

# Airframe Manufacturer Integration Challenges

- **Transponder manufacturers have a common TSO basis for the European & FAA ADS-B Out mandates.**
- **The majority of the unique requirements from each mandate are applied at the airframe level; i.e. :**
  - Position data performance requirements (Min NACp / NIC / NACv)
  - Which messages must be transmitted (ie TSS / Reg 62H)

# ADS-B Position Data Sources

- **All GPS position sources that will be in service for European and FAA mandates must be qual tested for velocity accuracy (NACv = 1) compliance.**
- **FAA mandate in 2020 will require SA Aware GPS sensors.**
- **All current Boeing production airplane models have a dual GPS installation which is used for ADS-B Out.**
  - Retrofit and/or STC installations are TBD for GPS configuration.

# Boeing Production & Flight Test Aircraft (Status as of August 2010)

| Model |
| --- |
| 737-600/700/800/900 |
| 747-8[1] |
| 767-200/300/400 |
| 777-200/300 |
| 787-8[1] |

Notes: 1. Currently in Flight Test – will enter into service 4Q2010/1Q2011

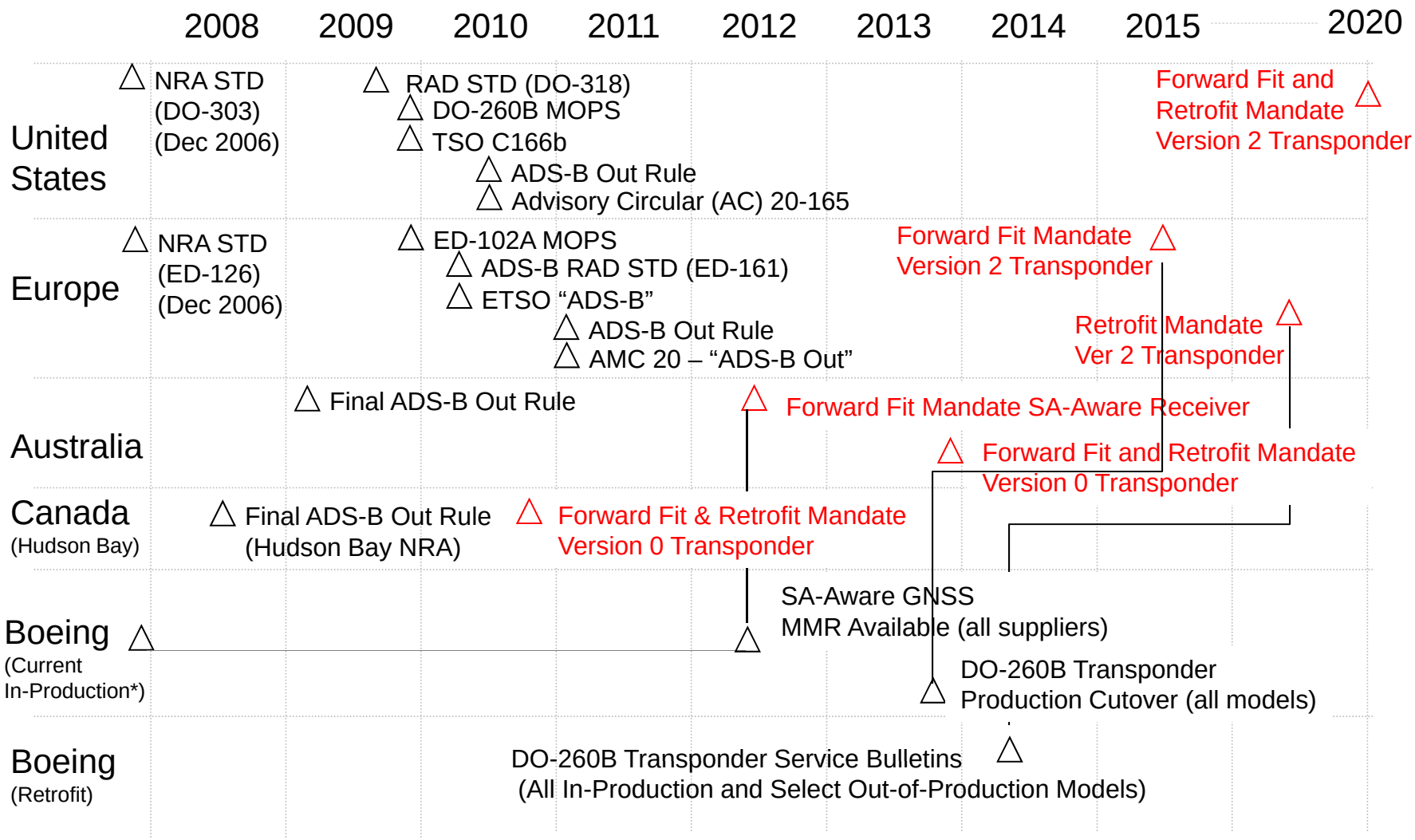
# Out of Production Boeing Aircraft Worldwide Totals

| Model | YE2010 | YE2015 | YE2020 | YE2025 | YE2030 |
|---|---|---|---|---|---|
| **717-200** | 140 | 145 | 120 | 110 | 110 |
| **737-300/400/500** | 1530 | 920 | 610 | 290 | 230 |
| **747-400** | 570 | 530 | 245 | 100 | 60 |
| **757-200/300** | 920 | 935 | 895 | 760 | 390 |
| **MD-10/11** | 170 | 170 | 160 | 150 | 90 |

# “Vintage” Boeing Aircraft Worldwide Totals

| Model | YE2010 | YE2015 | YE2020 | YE2025 | YE2030 |
|---|---|---|---|---|---|
| **707** | 25 | 0 | 0 | 0 | 0 |
| **727-100/200** | 300 | 70 | 10 | 0 | 0 |
| **737-100/200** | 530 | 60 | 10 | 0 | 0 |
| **747-100/200/300** | 200 | 30 | 0 | 0 | 0 |
| **DC-8** | 45 | 10 | 0 | 0 | 0 |
| **DC-9** | 155 | 5 | 0 | 0 | 0 |
| **DC-10** | 80 | 40 | 20 | 10 | 0 |
| **MD-80/90** | 780 | 510 | 210 | 40 | 20 |

# Boeing ADS-B Out Certification Plan
## (Implementation dates are dependent on publication of EASA Rule)




* Future in-production aircraft (787 & 747-8) will both have Version 1 Transponder and SA-Aware MMR at Entry into Service (EIS)

# Future ADS-B Out Certification Activities

- **In-production plans to certify ADS-B Out per EASA & FAA requirements**
  - Current in-production amended type certification (737NG, 767, 777)
    - Buyer Furnished Equipment (BFE) with three suppliers
    - DO-260-like transponder (Version 0 – 1090ES)
  - Future in-production (SFE business model) amended type certification (747-8, 787)
    - Supplier Furnished Equipment (SFE) with single supplier
    - DO-260A Change 2 transponder (Version 1)
- **CASA SA-Aware GNSS forward fit requirement (28 Jun 2012)**
  - Current in-production will have three (3) MMR suppliers all with SA-Aware (TBV)
  - Future in-production (787 INR, 747-8 MMR) already has SA-Aware GNSS as basic
- **Planned DO-260B compliant transponders for FAA & EASA:**

| Supplier/Model | Current In-Production Aircraft (BFE) | | | | Future In-Production Aircraft (SFE) | |
|---|---|---|---|---|---|---|
| | 737NG | | 767 | 777 | 747-8 | 787 |
| ACSS | ATDL - 12008 | | | | - | - |
| Honeywell | TRA 67B | | | | - | - |
| Rockwell | TPR 901<br>822-1338-005 | | | | TPR 901<br>822-1338-005 | ISS - 2100 |

# ADS-B Out Retrofit for Boeing Aircraft

- **In Production Models (737NG/767/777)**
  - Development of retrofit service bulletins for ADS-B Out (DO-260B) for in production models will follow the type certification for each model.
  - Certification of the service bulletin is based on production cert testing.
- **Out of Production Models**
  - There is no existing type cert data to leverage in the development of these service bulletins.
  - A remote certification program on a customer's aircraft is generally required.
  - The out of service costs for the aircraft under test must be accounted for somehow.
  - Boeing Technical Mod/Services will respond to market requests for DO-260B ADS-B Out retrofit service bulletins.

# Boeing ADS-B In Status

- There are no mandates foreseen for ADS-B-In.
- Mature standards and ANSP operational procedures are required for airlines to achieve benefit.
- Operational procedures for ADS-B In applications are in the trial phase.
- Boeing strategy is to ensure equipage architectures with ability for growth.
- We believe this to be the most economic and technically sound approach for our customers.
- Boeing flight deck human machine interface requirements are near completion.
- Research and Feasibility Studies are on-going:
  - 787 program for ADS-B In / CDTI applications starting with the 787-9.
  - Other production models for CDTI applications on Electronic Flight Bag (EFB) and on Forward Displays.
  - Retrofit solutions for non-production models are also being explored.

# TCAS Change 7.1 Status

- **EASA Mandate for new production aircraft in March, 2012 and for retrofit aircraft in March 2014.**
- **Certification agreements with BFE TCAS suppliers in work**
  - LRU developmental testing at Boeing starting in 3Q2010.
- **Planned certification program completion dates will meet EASA deadlines.**
- **TCAS LRU is also the platform for ADS-B In receiver & traffic processor for federated architecture (non-787) airplane models.**