



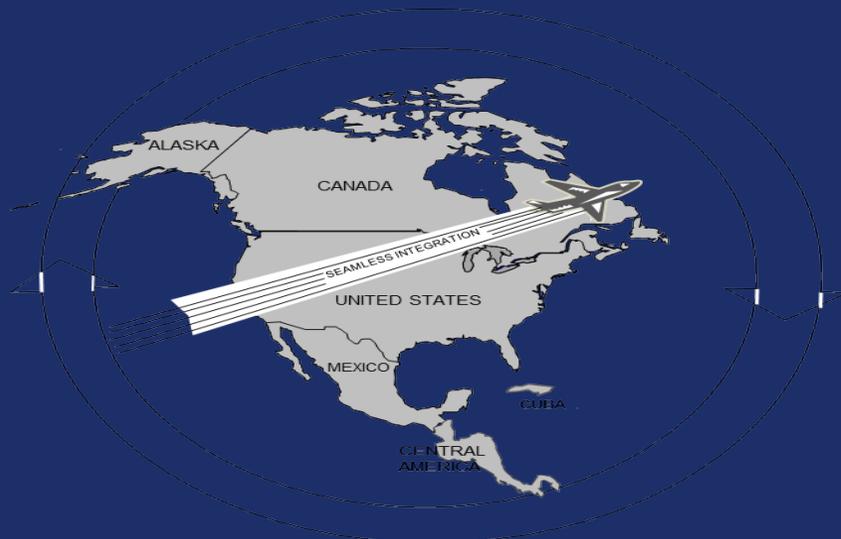
ICAO

# INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY



# Overview of changes introduced in ADS-B Version 3



Federal Aviation  
Administration

Presented to: NAM/CAR/SAM Workshop on the Development of the  
regulation for the implementation of ADS-B

By: Alex Rodriguez

Date: July 2023



# Outline

---

## Overview of changes introduced in ADS-B Version 3



# Overview of ADS-B Version 3 Changes

- **High-level summary of changes**
  - ADS-B MOPS re-opened with the primary objective to support Interval Management application requirements; Terms of Reference additionally included support for Airborne Collision Avoidance System X (ACAS X), Weather, UAS and Commercial Space vehicles
  - Activity commenced in January 2016; MOPS approved by RTCA and EUROCAE in December 2020
  - Due to a backward compatibility issue, the working group re-convened and published a DO-260C Change 1 on January 2022.
- **This overview is focused on the new functionality introduced in the ADS-B Version 3 MOPS**

# Interval Management (IM)

- **Add broadcast of additional weather parameters (wind and temperature; see next slide)**
- **Receiver Improvements to support IM**
  - Advanced range receiver to support longer range performance
  - Track initiation enhancements to improve track acquisition
    - reduced time to initiate tracks for surface traffic by simplifying position decode
    - reduced time to initiate tracks for airborne traffic by use of velocity information
  - Track file maintenance enhancements to prioritize IM traffic as needed
    - reserves 3 track IDs to prevent removal due to automatic range filtering
- Uniform distribution of (even/odd) squitter formats

# Aircraft-derived weather data

- Supports applications such as IM, wake vortex avoidance and surfing, hazardous weather detection and avoidance, and weather forecasting
- Requirements derived from RTCA DO-364 (Aeronautical Information/Meteorological Data Link Services), which built on previous work from RTCA, World Meteorological Organization, and ICAO Annex 3
  - 2 new optional periodic Messages (Aircraft State & Weather State)
    - Aircraft State, if provided, includes: aircraft configuration, ICAO Aircraft Type, gross weight, wingspan
    - Weather State, if provided, can include either:
      - icing status; wind quality, wind speed and direction, air temperature, airspeed OR
      - icing status (optional), roll angle, heading, air temperature, airspeed
      - ***Avionics intending to meet European EHS requirements must provide one of these Weather State messages***
  - Additional weather data added to an existing 1090ES Aircraft Status Message
    - Eddy Dissipation Rate (EDR) and Water Vapor
- Version 3 also supports broadcast of pilot-observed flight weather [Pilot Reports (PIREPs)] with 3 new on-condition messages
  - Flight Weather; Temp, Wind & Turbulence; Hazardous Weather

# UAS

- For all aircraft types, ADS B version 3 provides an indication whether the aircraft is conducting manned or unmanned operations
- Version 3 includes capability to broadcast a UAS/RPAS lost link condition
- This emergency condition will be reported and made available via ADS-B and Mode S replies and may be used to initiate appropriate contingency procedures when activated
  - Input of Mode A = 7400
- When in the lost link condition, if implemented, the UAS/RPAS can broadcast its contingency plan identifying the course of action the UAS/RPAS is following

# Commercial Space / Hypersonic Vehicles

- Version 2 and earlier ADS-B cannot reliably support:
  - horizontal velocities above 1000 knots
  - altitudes above 130,000 feet
  - vertical velocities above 32,500 feet per minute
- Version 3 accommodates higher velocities and altitudes
  - Horizontal and vertical velocities consistent with a Space Shuttle launch profile can be reported
  - Altitudes up to 1M feet

# ACAS Support

- Transponder changes to ensure that RA coordination messages are given priority over other data provided to the own ship ACAS
- Transponder changes to improve the availability of coordination data received over the RF link and provided to the own ship ACAS
- RA reporting by the transponder incorporates additional data from collision avoidance systems which provide both vertical and horizontal resolution capability, such as ACAS Xu for unmanned aircraft
- Addition of ADS-B subfields to
  - enable Detect & Avoid (DAA) systems to receive ACAS coordination data
  - support future ACAS coordination capabilities

# 1090 MHz frequency conservation – 1 of 2

- Removal of replies to Mode A/C/S All-Call (i.e., Long P4)
- Additionally, transponder reply-rate limiting is improved to minimize loss of surveillance and ACAS functionality in high-density airspace
- New functions to report a transponder experiencing reply-rate limiting and ADS-B Transmit Power indication
- Interrogation/Reply Monitor (IRM) data has been incorporated as an optional reporting feature
  - Will improve 1030/1090 MHz spectrum monitoring and assist in the protection of aeronautical surveillance and collision avoidance system performance
  - IRM data includes measurement of transponder interrogation and reply rate activity from equipped aircraft

# 1090 MHz frequency conservation – 2 of 2

- Phase Overlay technique, which provides additional data within existing messages, is specified
  - Although Phase Overlay is optional in this MOPS version, it is introduced so that industry can begin producing and testing equipment that can readily incorporate the capability
  - ADS-B Phase Overlay Support
    - Airborne and Surface messages which include full state and status in single extended squitter
    - IRM messages which provide additional detail on min/max rates
  - Mode S Phase Overlay Support
    - Additional Mode S register data included in Mode S replies to interrogations

## Surface Reporting Improvements

- ADS-B version 3 supports the ability to report availability of FAA's Same-Link-Rebroadcast service.
- To enable more accurate position determination on the airport surface by Multilateration systems, ADS-B version 3 includes transponder antenna offset information

# Autonomous Distress Tracking (ADT)

- ICAO has released requirements that aircraft delivered after January 1, 2021, automatically transmit aircraft position at least once per minute when the aircraft is in distress.
- ADS-B has always provided aircraft position; version 3 provides a means to initiate broadcast of 'aircraft in distress', when initiated manually or automatically, to satisfy ICAO requirements

# Fixes and Miscellaneous Improvements

- Corrected handling of aircraft identification data which can result in a potential difference between aircraft identification data received via ADS-B and ground interrogators (with these MOPS, consistent data will be presented to controllers)
- Revised Emitter Category encodings
  - clarified that intended use is solely as aid to visual acquisition
- New ADS-B information to support avionics debugging
  - Active transponder side indication
- Minimum Transponder functionality requirements redefined to eliminate unused data link functions
  - becomes new ICAO minimum Mode S transponder standard for international civil air traffic





---

Thank You!