



# **POTENTIAL ROLE OF ADS-B FOR DATA COMMUNICATIONS**

Presentation to the RTCA ADS-B MASPS Ad Hoc Group

## **DO-242-WP-5-01**

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# Purpose

- Attempt to capture needs of the operators
- For technical discussion purposes only.
- This discussion does not reflect official FAA policy.



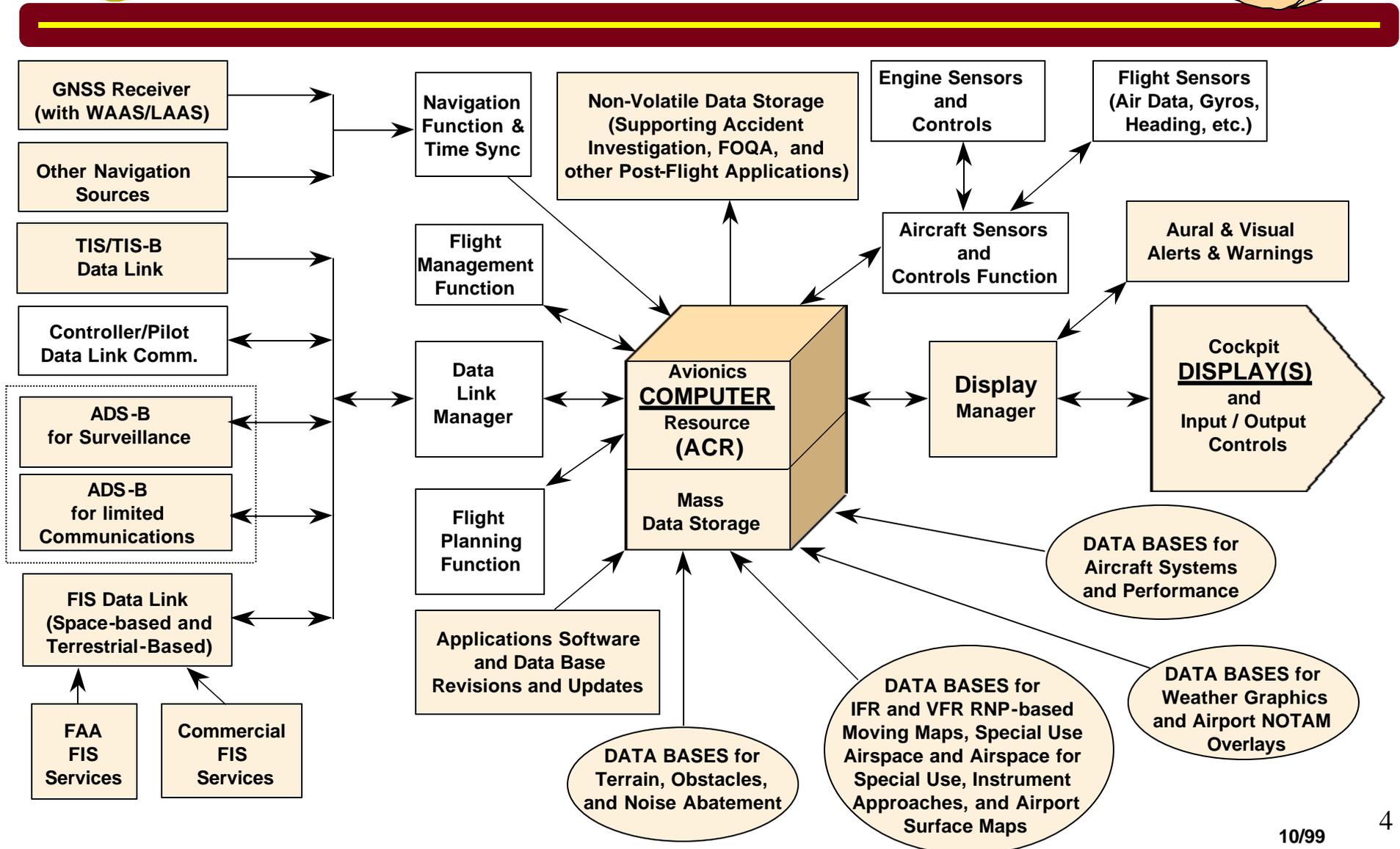
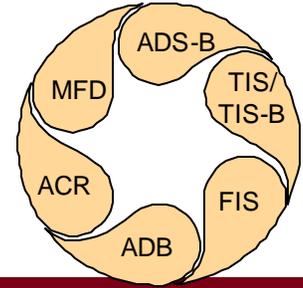
# Core Issues for Discussion

- Should ADS-B be used ONLY for traffic surveillance, or...
- Should ADS-B, as either a single-purpose or multi-purpose data link, be used to facilitate broadcast & data exchange?
- Examples:
  - Downlink of selected parameters
  - Crosslink of selected parameters
  - Uplink of selected parameters



# Advanced Avionics Architecture

## (The Building Blocks of Free Flight)





# Related NAS Architectural Issues

- If additional operational data link broadcast requirements can be validated, might there be a need for multiple, discrete, ADS-B data links?
  - One link on multiple frequencies
  - Multiple links on multiple frequencies



# Considerations

- Size, weight, and electrical power requirements for most GA aircraft suggest a single “black box” architecture.
- “Black box” affordability for the user, especially for GA.
- Increased installation and continued airworthiness costs for aircraft with multiple black boxes, including ELT’s.
- Discussion rightfully excludes applications or services that would make use of CPDLC and addressed data link.



# Primary References

- Appendix E of RTCA DO-242.
- Draft “Compendium of ADS-B and Other CNS Applications and Services.”
- Draft Electronic Flight Bag Advisory Circular
- SC-193 User Requirements for Aerodrome Mapping Data



# Sample Applications

- Aids to Enhanced Situational Awareness & Radar-like Services
- AUTOMETTS / E-PIREPs Data Exchange
- Wake Vortex Modeling
- Marking Obstacles
- Runway Incursion Alerting
- Crash, Fire, and Rescue (CFR) and ELT Needs
- Tactical SUA and TFR Monitoring



# Common Elements

- The above applications (generally) make use of ADS-B enabled aircraft ID, aircraft position reports, plus additional message elements
- Some of these communications-related message elements are as follows...



# Enhanced Situational awareness / Radar-like Services

- Aircraft make and model  
IP#4, Ken Staub



# AUTOMETS / E-PIREPS

- Periodically broadcast the seven AUTOMETS meteorological parameters per RTCA SC-195 AUTOMET document (DO-252). They include:
  - Wind reports
  - Static air temperature (SAT)
  - Turbulence
  - Humidity
  - Roll angle flag
  - Water vapor mixing ratio
  - Icing accumulation
- Increase frequency of wind reports while on final approach.



## Uses of AUTOMET / E-PIREP Data

- En route air-to-air exchange of winds, temperature and turbulence (W-T-T) reports would allow aircraft to be forewarned. Reports would cross ATC boundaries.
- En route and terminal area air-to-ground reports (all seven elements) would feed NWS RUC and SNIP models.
- Gridded wind field data would be used by aircraft FMS's, and as graphical depictions on an MFD, to assist en route and in 4D FMS transitions and approaches
- For use with CTAS, FAST, etc.





# Wake Vortex Modeling

- Aircraft make and model (wingspan)
- Wind velocity vector
- Actual weight:
  - Impacts wing loading (knowing only the aircraft's OEW and MLW would mean a "bigger box" on the aircraft's MFD)
- Air density:
  - Pressure Altitude (via TIS-B / FIS-B altimeter setting ?)
  - Static Air Temperature
- Wind and air density can be used from own ship with lesser accuracy



# Marking Obstacles

- Supports SC-193 Terrain and Obstacle User Requirements Document
- Addressed in IP #6
  - Details the specific messages needed to support ADS-B equipage “Class B3” broadcast systems



# Runway Incursion Alerting

- Supports various surface movement applications
- Sample exchange data:
  - Aircraft make and model
  - Aircraft heading during taxi and at Vstop
  - Brake on / off
  - Percentage power (Note: Also supports airport noise abatement monitoring, and safety warnings during cross-bleed engine starts)
  - Air / ground state (i.e., on the airport surface or in hover above the airport)
  - Student pilot
  - Others



# Crash, Fire, and Rescue (CFR) and ELT Functionality

- Nature of emergency
  - DO-242 defines six emergency / priority status codes
- Souls on board
- Fuel on board (quantity)
- Type fuel on board



# Tactical Special Use Airspace (SUA) Monitoring

- For use by DOD and by Dept. of Interior / Bureau of Land Management (DoI / BLM)
- Would provide:
  - Line-of-sight transmissions indicating whether a particular SUA or TFR airspace was “hot or cold”
  - Effective altitudes, i.e., bases and tops
  - Times of release or reclamation
- Would augment the current NOTAM process



# Technical and Architectural Issues

- Bandwidth constraints for each of the three candidate ADS-B data links may limit the size of data broadcast messages
- It may be possible to accommodate some of these needs via a lower data rate transmission
- Is separation of the surveillance (versus the broadcast communications) function needed?
- Others



## Desired Outcomes

- Use this emerging data exchange requirement as a “metric” in further evaluating the three candidate RF links.
- DO-242 A MASPS Ad Hoc Group should develop a table of message elements and update rates, and include as requirement in “Draft” MASPS
  - Livack, Working Paper 242A-WP-5-02, Draft Issue Paper #2.



# Follow On Presentation Agenda

- Four New Submitted “Draft” Issue Papers (Livack)
- Issue Paper # 4, Classes of Aircraft (Staub)
- Issue Paper # 14, Certified Navigation Center (Staub)
- Issue Paper # 19, Runway Incursion Alerting (Staub)