ADS-B and Multilateration Integration in the U.S.

The Role of the Integrator

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Vice President
Next Generation Air Transportation Systems

Engineered for life
This is ITT

• High-tech engineering and manufacturing company
• $11 billion in revenues
• 40,000 employees
• Delivering extraordinary solutions to life’s most essential needs:
  • More livable environments
  • Better protection and safety
  • Breakthrough connections

Engineered for life
• **ADS-B Surveillance As A Service Components**
  - Collection of ADS-B reports and distribution to ATC facilities
  - Collection, processing and broadcast of TIS-B and FIS-B data

• **ITT was awarded the contract in 2007 on the basis of a cost effective exceptional technical solution**

• **Base Contract**
  - System Design, Development, Testing at Key Sites, Significant Broadcast Services Deployment

• **Optional Contract Line Items for nationwide deployment and operations and maintenance of the system through 2025**
  - Deployment capital expense funded by ITT
  - Nationwide deployment has begun
ITT is Delivering Four Services to the FAA

**Surveillance Services = Critical (0.99999 Availability)**

- **ADS-B**
  - Surveillance of ADS-B equipped aircraft for Air Traffic Control and Aircraft Situational Awareness
  - Cross-Linking of ADS-B data for Aircraft Situational Awareness

- **ADS-R**
  - Uplink of Surveillance Data of Non-ADSB equipped aircraft for Aircraft Situational Awareness
  - Uplink of Weather and other Flight Information for UAT Equipped Aircraft

**Broadcast Services = Essential (0.999 Availability)**

- **TIS-B**
  - Uplink of Surveillance Data of Non-ADSB equipped aircraft for Aircraft Situational Awareness

- **FIS-B**
  - Uplink of Weather and other Flight Information for UAT Equipped Aircraft
Principal U.S. FAA Requirements Documents

- Functional and performance requirements provided in two documents
  - The Essential Services Specification – TIS-B and FIS-B requirements
  - The Critical Services Specification – ADS-B and ADS-R requirements

- Coverage requirements contained in a Service Volume Description Document
  - Defines three service volume types
    - En route service volume – Air Route Traffic Control Center Coverage up to FL600 (ARTCC geographical area) – 26 (12 in Segment 1)
    - Terminal service volume – TRACON Coverage up to FL250 (60 mile radius around a center point) – 235 (2 in Segment 1)
    - Surface service volume – Airport surface and 7 NM radius of airport reference point to 2,000 feet – 35 (2 in Segment 1)
  - Identifies radar systems serving each area – where radar exists coverage required to be at least as good as radar coverage
The Ground System Architecture – Robust, Safe, and Secure

Radio Station

Radio Station Segment

Radio Station Layout Provides RF Coverage Over a Set of Service Volumes

Network Segment (MPLS VPN)

NOC/P
Oakton, VA

OCN
Herndon, VA

Control Segment

ESA Control Station
Data Center/Ashburn, VA

WSA Control Station
Data Center/Phoenix, AZ

CSA Control Station
Data Center/Dallas, TX

Regional CS
ZAN SDP/AK

WSI FIS-B Data Source
Andover, MA

WSI FIS-B Backup
Atlanta, GA

Legend:

Radio         Network        Control        FAA            Weather
**ADS-B System Components**

**ADS-B Stations**
- Collect
- Approx. 800 Locations
- Dual Link (1090 MHz/UAT)
- Installed at 60 GA Airports
- Installed on Commercial Telecommunication Towers

**Communication Network**
- Transmit
- Commercial Network (AT&T)
- Redundant Connectivity
- Guarantees Low Latency

**Control Stations**
- Process
- 3 Commercial Data Centers
- Geographically diverse
- Redundant Power Supplies
- Security: Network/Physical

**Service Delivery Points**
- Deliver
- Approx. 270 FAA Facilities
- Ensures Minimum ITT footprint at FAA facilities

**Centrally Monitored System from a Network Operations Center**
A Networked Architecture
Surveillance Coverage Modeling

  - “the ITU is the fundamental authority for spectrum allocations and management.”
- ITU-R Recommendation P.528-2, recommends using IF-77 to determine transmission loss.
  - IF-77 curves do not consider terrain
- Our selected model, CRC Predict, considers terrain and closely matches the IF-77 predictions for time variability
U.S. National Coverage Solution –
794 ADS-B Ground Stations
Current U.S. ADS-B Program Deployment

329 Sites Reporting on Network.
331 Sites Constructed
68 Sites in Planning or Construction.
Monitoring of ADS-B System is Centralized

- Monitors Provision of Services (ADS-B, ADS-R, TIS-B, FIS-B)
- Monitors Status of Communication Network
- Monitors Status of All ADS-B Ground Stations & Processors
- 24 / 7 / 365 Operation
- Staffed by 2 Members of the Team
GOMEX Coverage from the US ADS-B System
We Are Adding Wide Area Multilateration (WAM) to the U.S. ADS-B Network

- FAA is working with the State of Colorado and ITT to develop and test a fifth service, MLAT to be initially deployed in Colorado
  - Montrose is Key Site
  - Telluride, Gunnison, and Durango would complete the CO MLAT installations

- Long term, it is expected that the FAA can replace aging terminal area radars with MLAT systems
• The WAM Service will be developed and verified under the same set of Engineering, Development and Verification Processes as the current SBS Services

• The WAM Service will reuse applicable design solutions developed for the current SBS Services

• The solution for WAM Service will be scalable to NAS-wide deployment of WAM Service without further development

• The WAM Service will be robust to failures of the ADS-B Service Application and the other current Applications of SBS Services…and vice versa
  • While Applications are separate, ADS-B and WAM Services are served by a common set of Radios

• The introduction of WAM Service into an SV supporting SBS services will have no impact on existing services
ADS-B Architecture Augmentation for Colorado WAM Service Provision

Add MLAT Radios to Radio Station Segment

Add MLAT Server to Western Service Area Control Station/Data Center

Radio Station Segment

Network Segment (MPLS VPN)

Control Segment

Network Segment (MPLS VPN)

Legend: Radio Network Control FAA Weather

CS-SDP MLAT Communications

MLAT Service Delivery to ZDV
A Data Utility Has Been Created as a Core for Commercial Services

• Fully isolated from the operational network

• Provides:
  • Streaming of data - geographically or otherwise filtered/ real-time or delayed
  • Archiving and retrieval of data for historical analysis
  • Web based tool for data visualization
  • Fleet tracking
  • Facilities for hosting value added applications, e.g. over-flight/airport billing
A Single Source of Real-Time Aircraft Surveillance Data for All Aviation Stakeholders

- High Update Rate
- Highly Reliable
- Accurate
- Secure
- Cost Effective

One Aircraft Target...One Track...One Point of Contact....Nationwide

Surveillance Data Fused from Multiple FAA ATC Systems

- **ASDE-X**
  - Airport surface data
  - 1 second update

- **Terminal Radars**
  - Terminal area data
  - 5 second update

- **En-Route Radars**
  - En-route radar data
  - 12 second update

- **ADS-B Network**
  - ADS-B network data
  - 1 second update

- **Multilateration Systems**
  - MLAT network data
  - 1 second update

- **Flight Plan Data**
  - Flight plan data from FAA Host Computer System
Surface Management Offering - Symphony

[Image of a software interface with a map and icons]

Symphony - Total Operational Awareness. Powered by ITT, (C) 2011.
Conclusion

• The FAA is aggressively pursuing ADS-B implementation in the U.S. National Airspace System

• ITT has successfully designed, developed, and integrated an exceptional ADS-B ground infrastructure solution
  • Flexible, scalable, safe and secure
  • Excellent coverage
  • Capable of operating in the most benign to most stringent 1090 MHz spectrum environment

• We are adding multilateration to this networked infrastructure

• We are pleased to have had the opportunity to present at this forum
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