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Automatic Dependent Surveillance – Broadcast

ADS-B

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www.flyadsb.com

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History

• Alaska Capstone, mid-1990s
  – Bethel Part 135 operators equipped
  – Used for radar-like services in a non-radar environment
  – 40 percent accident reduction

• Fed Ex and UPS, late-1990s
  – Operational Evaluations
  – UPS equipped over 100 freighters

• East Coast Deployment, early-2000s
  – ERAU Prescott campus initial interest – safety enhancement
  – Broadcast services and flight monitoring applications
  – ERAU Memorandum of Agreement

• US ADS-B deployment part of International Initiative
  – All new Boeing and Airbus aircraft now ADS-B equipped

• FAA ADS-B Partnerships established to accelerate safety services
Capstone Program

• Objectives: to improve aviation safety and efficiency
• To date, 200 systems installed in commercial aircraft in Bethel area of Southwest Alaska
• 11 ground broadcast transceiver (GBT) sites installed covering over 250,000 square miles
• As of January 2004, commercial aircraft participating in Capstone have accrued on the order of 500,000 operational flight hours using ADS-B
Alaska Capstone Phase I (Bethel)

- **Description**
  - Seeking increased safety: surveillance, terrain and weather information

- **Accomplishments**
  - Integrated ADS-B
  - Equipped over 200 aircraft
  - Commissioned 11 ground broadcast transceivers
  - Radar-like capability from Anchorage Center
  - Automated Weather Observation Systems (AWOS) commissioned and GPS approaches published for 10 airports
  - 40 percent reduction in accident rate for equipped aircraft
ADS-B Service Delivery

- ADS-B technology enables enhanced safety services for general aviation – all on a single digital data link with no subscription fee:
  - Information displayed in the cockpit:
    - Traffic
    - Weather
    - Airspace status
    - Terrain and obstacles
  - Information displayed to FBOs/Flight Operations for Flight/Fleet Monitoring:
    - Traffic
    - Weather
    - Map/training area underlays
• **Automatic**
  - No pilot input required; no interrogation by external system

• **Dependent**
  - Position dependent on own ship’s navigation, typically from Global Positioning System (GPS)

• **Surveillance -**
  - Provides aircraft call sign, position, type, heading, altitude, velocity vector, plus other information

• **Broadcast**
  - Data transmitted to all ground and airborne receivers, nominally once per second
ADS-B Service Delivery

What is ADS-B?

• Automatic Dependent Surveillance – Broadcast (ADS-B)
  – A **surveillance service** in which aircraft automatically provide, via a broadcast-mode data link, data derived from on-board position fixing systems, including aircraft identification, and additional data as appropriate.
  – Functions air-to-air without ground infrastructure
    • Receives all other ADS-B transmissions within range
    • Displays information on cockpit moving map
  – Augments ground-based surveillance
ADS-B Service Delivery

What is TIS-B?

Traffic Information Service – Broadcast

The uplink of FAA Secondary Surveillance Radar (SSR) traffic from an ADS-B ground station to the aircraft for display to the pilot

- Augments airborne situation awareness
  - ADS-B equipped aircraft displayed air-to-air
  - Transponder-equipped aircraft displayed via uplink

- Operates on both ADS-B frequencies
  - 978 MHz: Universal Access Transceiver (UAT)
  - 1090 MHz: Mode S Extended Squitter
ADS-B Service Delivery
What is FIS-B?

Flight Information Services - Broadcast

The uplink of weather information and National Airspace System (NAS) status information (e.g., NOTAMS, restricted airspace notifications) from an ADS-B ground station to the aircraft for display to the pilot

• Initial products:
  – Graphical NEXRAD
  – METAR
  – TAF

• Early enhancements:
  – Graphical TFRs
  – Additional graphical weather products
ADS-B Service Delivery
Traffic Displays

ADS-B Traffic in Blue with Overlaid Waypoints and Navigational Route

Uplinked FAA Radar Traffic with VFR Chart Overlay
ADS-B Service Delivery

Weather Displays

Text METARS and TAFs

Graphical NEXRAD
ADS-B Service Delivery

Airspace and Terrain Displays

Graphical Temporary Flight Restricted Airspace (TFRs)

Controlled Flight Into Terrain Avoidance (CFIT)
ADS-B Service Delivery
Cockpit Display of Terrain & Traffic

Garmin
Apollo MX20
Currently available
ADS-B Service Delivery

ADS-B Compatible Displays

Garmin GNS-430

Garmin GNS-530

Summer 2005
ADS-B Service Delivery

ADS-B Compatible Displays

Late 2005

Garmin G-1000
September 2, 2004
Two days before Hurricane Francis

10-mile range rings from Daytona Beach

100-mile range ring
Certified ADS-B Avionics

Garmin GDL-90
UAT Data Link Transceiver

Only certified UAT Transceiver to date

Certification:
- TSO C145a
- Includes internal TSO-C145a WAAS GPS sensor
GDL-90 Mounted in Cessna-172
MX-20 Installed in Cessna-172
GDL-90 Mounted in Piper Seminole
MX-20 Installed in Piper Seminole
ADS-B Service Delivery

Versatility

Air-to-Air Traffic
Enhanced see-and-avoid

Ground-to-Air Traffic
Uplink FAA radar traffic

Ground-to-Ground
Improved surface navigation and traffic awareness

Ground-to-Air
Uplink graphical weather and airspace status
Safety & Operational Enhancements

• Traffic Information:
  – Enhanced see-and-avoid (situational awareness)
  – Reduced mid-air collisions and near-mid-air collisions (NMACs)
  – Enhanced security – Better tracking of friendly aircraft

• Weather Information:
  – Reduced GA weather accidents
  – Save 50-100 lives annually from weather-induced accidents

• Airspace and Terrain Avoidance:
  – Reduced pilot deviations into restricted airspace
  – Reduced terrain accidents

• Digital Airport Maps
  – Increased situational awareness of:
    • Airport environment, aircraft, and ground vehicles
  – Reduced runway Incursions

• Flight Monitoring:
  – Asset management
  – Conformance monitoring
  – Search-and-rescue
  – Security – Airspace situational displays for security / law enforcement
ADS-B & Radar Feed Status

- Currently 26 GBTs installed in the United States “Lower 48”
- Currently 11 GBTs installed in Alaska
- Call for feedback or to report service problems: 1-877-FLYADSB

Check on current ADS-B service availability and infrastructure status on website: www.flyadsb.com
ADS-B Ground Station Coverage

22 Sites (2004)

39 Sites (2005)

2005 coverage plan: includes potential cost-share partnerships
Ground Station Status

- Initial Site Survey: 41
- Detailed Site Survey: 33
- Installation agreement: 30
- Site Installation: 29
- Service Delivery: 26
- Identified potential Site: 15

Status as of 4/7/05
Last Updated 4/7/05
ADS-B Avionics & Ground Equipment

See: http://www.flyadsb.com/education/education.htm
Melbourne, FL

Radio here

Power Supply

UPS
FAA ADS-B Policy

- Documents referencing ADS-B:
  - ADS-B Link Decision
    2002
  - FAA Architecture 5.0
    2003
  - FAA Flight Plan, 2005-2009
    2004
ADS-B Deployment Strategy

• Export proven Capstone technology to Lower 48:
  – Proven safety benefit (40% reduction in accidents)
• Deploy in “pockets” (key sites) IAW FAA policy
• Provide early safety benefits through cost-sharing partnerships
• Achieve FAA investment decision for Nation-wide deployment:
  – Provides funding in FAA budget for life-cycle support
  – National deployment to begin probably in 2007-2008
  – FAA to install ADS-B at radar-replacement sites
    • Tri-Cities or Chattanooga
  – Partners cost-share for non-radar sites
    • Murfreesboro
ADS-B Service Delivery Partnerships

• Memorandums of Agreement in place:
  – **ERAU**: signed Dec 02 – Sean Jeralds, Richard Theokas
  – **North Carolina**: signed Aug 03 – Bill Williams
  – **Maryland**: signed Nov 03, SATSLab & Ashish Solanki
  – **Virginia**: signed Jul 04 – Keith McCrea, Randy Burdette
  – **North Dakota**: signed Oct 04 – EASE LLC, UND
  – **New York**: signed Mar 05 – Ken Knopp, FAA Vertical Flight Office
  – **Ohio** – signed Apr 05 – Tom Tanger, Ohio Aerospace Institute

• Agreements under discussion:
  – **Florida** – Chuck Arnold
  – **Pennsylvania** – Sharon Daboin, Rick Harner
  – **Tennessee** – Bob Woods
  – **Civil Air Patrol** – COL Al Allenback
  – **Vermont** – Rich Turner
  – **Colorado** – Travis Vallin
  – **Nevada** – Yvon Weaver
Project SafeGuard

- Implementation of ADS-B infrastructure to cover Washington ADIZ
  - Less than 300 feet coverage
  - Augment existing GBTs in the Washington, DC area
- Equipage of >60 aircraft with UAT avionics
  - Garmin GDL-90
  - MX20 MFD (optional)
  - FAA provides avionics
  - User community installs avionics
- Set-up flight monitoring stations at locations around DC
- ADS-B data-feed to:
  - National Capital Region Command Center (NCRCC)
  - Potomac TRACON – 4 Defense Sectors

A one-year demonstration of security applications
SafeGuard Partner List

- Department of Homeland Security
- National Capital Region Command Center
- Potomac TRACON
- Federal Bureau of Investigation
- Department of Defense (1st Helicopter Sq)
- National Park Police
- Maryland State Police
- Maryland State Aviation Authority / Freeway Airport Authority
- Others?

All of the above offices (except Maryland State/W00) are represented in the White House Interagency Airspace Protection Working Group
* Note ( ) designates non standard location identifier

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ADS-B Coverage