Surveillance and Broadcast Services

FAA Surveillance Alternatives and Standards

To: ICAO/FAA Workshop on ADS-B and Multilateration Implementation
By: Jim Linney, Program Manager - International
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# NextGen: Improving Efficiency and Capacity

## Today’s National Airspace System

- Ground-based Navigation and Surveillance
- Air Traffic Control Communications By Voice
- Disconnected Information Systems
- Air Traffic “Control”
- Fragmented Weather Forecasting
- Airport Operations Limited By Visibility Conditions
- Forensic Safety Systems
- Focus on major airports

## NextGen

- Satellite-based Navigation and Surveillance
- Routine Information Sent Digitally
- Information More Readily Accessible
- Air Traffic “Management”
- Forecasts Embedded into Decisions
- Operations Continue Into Lower Visibility Conditions
- Prognostic Safety Systems
- Focus on metropolitan areas

*Delivering safety, capacity, efficiency & environmental stewardship*
Complexity and Viewpoint Affects Perception of NextGen

We must take a broader view
Surveillance Overview

- Surveillance capabilities will be supported in all NAS operating domains for NextGen (beyond 2020)
  - Oceanic, En Route, Terminal, Surface

- Multiple technologies will be used to provide surveillance capabilities
  - Primary radar
  - Beacon systems
  - Multilateration
  - Automatic Dependent Surveillance - Broadcast (ADS-B)
    - Both air-air and air-ground applications
Primary Radar - Current Status

- **En Route Primary**
  - Not required for providing en route air traffic separation services
    - However, if available, will be used to supplement beacon surveillance in en route

- **Terminal (ASR-8, ASR-9, ASR-11)**
  - Supports terminal separation services
    - Provides a “safety net” in cases where aircraft transponder is not responding to beacon interrogations
    - Also used as “gap fillers” for en route in many cases
  - Provides additional source of weather surveillance at most sites
  - ASR-9 undergoing Service Life Extension Program (SLEP); mobile ASR capability being procured

- **Surface (ASDE-3 (w/AMASS), ASDE-X (SMR), LCGS)**
  - Used at certain locations to provide surface situational awareness for ATC
    - Alerting also provided with most systems
  - LCGS in evaluation stage
Primary Radar - Future Plans

• **En Route**
  – If available, will continue to use primary radar to supplement ADS-B and beacon surveillance in the future, but it is not required

• **Terminal**
  – Current roadmaps assume all terminal primary radar capabilities will remain in the NAS beyond 2020
    • Based on combined “safety net” and weather requirements, and an assumption of defense/security requirements
    • NextGen Surveillance and Weather Capability to be implemented starting 2023
  – Absent requirements from other agencies, terminal primary radar capabilities may be required by FAA only at certain locations in the future (see key issues)
    • “Safety net” may only be required in high and medium density terminal areas
    • Weather surveillance (from ATC primary radar) may only be required at certain locations
    • FAA (safety) study will be needed to validate future primary radar needs

• **Surface**
  – May no longer be required to support surface surveillance (see key issues)
    • Study to be conducted to determine future requirements

• **All Domains**
  – All radar/automation interfaces to be transitioned to IP/ASTERIX by 2018
Beacon Systems - Current Status

• **En Route (Mode S, ATCBI-6)**
  – Primary means (and in many cases sole means) of surveillance in en route
    • Also used as backup surveillance for many terminal locations
    • Common Digitizer (CD-2) used at Mode S sites to provide interface to ATC automation if system reverts to “IBI” mode
  – Mode S undergoing SLEP

• **Terminal (ATCBI-5, Mode S, ASR-11)**
  – With collocated primary radar, supports safe terminal area operations
    • Required by FAA Order 7110.65 for many operations
    • Also used as “gap fillers” for en route in many cases
  – Mode S undergoing SLEP

• **Parallel Approaches (PRM)**
  – Required for certain (closely spaced) parallel approaches
  – PRM undergoing replacement (with Multilateration)
Beacon Systems - Future Plans

• **En Route**
  – All existing en route beacons to be retained as backup surveillance (to ADS-B) after 2020
    • NextGen Backup Surveillance Capability to be implemented (terminal and en route) starting 2023
  – CD-2 to be removed
    • Need to verify that “IBI” mode is no longer required for ATC (see key issues)

• **Terminal**
  – Terminal beacons at the busiest 43 airports to be retained as backup to ADS-B after 2020
    • Includes 35 “OEP” airports + additional 8 airports (per 2009 FAA study)
    • Remaining terminal beacons to be decommissioned after 2020

• **Parallel Approaches**
  – Support for parallel approaches to be transitioned to ADS-B
    • Multilateration to be used as backup surveillance at certain locations

• **All Domains**
  – All beacon/automation interfaces to be transitioned to IP/ASTERIX by 2018
  – Potential congestion on 1090 MHz beyond 2020 needs to be mitigated (see key issues)
Multilateration

• **Current Status**
  – En Route (e.g., WAM)
    • Wide Area Multilateration implemented in Colorado and Southeast Alaska
    • Additional work planned in Colorado, future additional sites TBD
    • Supports 5NM separation
  – Surface (e.g., ASDE-X)
    • Surface Multilateration is or will soon be implemented at all ASDE-3 and ASDE-X locations

• **Future Plans**
  – En Route
    • WAM can be implemented in other locations if it can be supported by a positive business case; no specific plans at this time
    • May serve as a possible alternative for the NextGen Backup Surveillance Capability acquisition (en route and/or terminal areas)
  – Surface
    • Surface Multilateration will continue to be used beyond 2020 as backup surveillance (to ADS-B) at selected locations
      • Some locations will no longer require collocated surface primary radar
    • Potential congestion on 1090 MHz beyond 2020 needs to be mitigated
ADS-B - Current Status

- **ADS-B “Out”**
  - Airspace rule published in 2010
    - UAT, 1090 links
    - Avionics standards updated, equipage starting
  - Approved for use by ATC (for properly equipped aircraft)

- **ADS-B “In”**
  - Traffic / Flight Information Services - Broadcast (TIS-B / FIS-B) approved for airborne advisory/situational awareness applications late 2008
  - Additional airborne ADS-B applications in development

- **All Modes**
  - Ground infrastructure being implemented, full rollout expected by 2013
    - Supports “Critical Services” (e.g., separation services) and “Essential Services” (e.g., TIS-B, FIS-B)
ADS-B - Future Plans

• ADS-B “Out”
  – Will become primary means (and in many cases sole means) of surveillance for ATC beyond 2020
    • Airspace rule compliance required by 2020
  – All en route and a limited set of terminal beacon systems will be retained to provide backup surveillance
    • In the event of an interruption of ADS-B services

• ADS-B “In”
  – More advanced airborne ADS-B applications will be developed and approved for use (e.g., interval management, 3NM separation in en route, etc.)
  – Airspace for ADS-B “In” capabilities being developed and prioritized with industry

• All Modes
  – Potential congestion on 1090 MHz beyond 2020 needs to be mitigated
Surveillance Roadmap (2 of 3)
Surveillance Roadmap (3 of 3)

- Evaluate Multi-Function Phased Array Radar (MPAR) Technology
  - ARD 107
  - IID 77

- Develop Requirements for Inter-agency Air Domain Surveillance
  - ARD 407
  - ARD 409

- Evaluate Removal of Surface Radars
  - ARD 370
  - ARD 399

- Evaluate LCGS
  - ARD 258

- Develop Surveillance Requirements for Integrating Arrival/Departure
  - FID 107
  - IID 406

- Inventory Time and Frequency Requirements and Assess GPS Outage Impact
  - 344
  - 345

- Identify GNSS Alternate Strategy
  - 511

- Assess 1090 Spectrum Mitigation Alternatives
  - FID 401

- Determine requirements for ADS-B in Rulemaking
  - FID 403
Key Issues

• Requirements for interagency Air Domain Awareness need to be defined
  – Needed for approval of NextGen Surveillance System business case for **ALL** users (FAA, DoD, DHS, etc.)
    • Preliminary requirements needed by mid-2013, final by 2015

• **Requirements for surface primary radars need to be revisited**
  – Roadmap assumes that these systems can be retired in the future

• **Potential congestion on 1090 MHz beyond 2020 needs to be mitigated**
  – Impacts beacon systems, Multilatration, ADS-B and TCAS
  – Alternatives analysis to be completed by 2012

• **Requirements for potential “ADS-B In” need to be identified**
  – Capabilities will be required to support certain NextGen improvements
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# Surveillance Roadmap: Decision Points (1 of 2)

<table>
<thead>
<tr>
<th>DP #</th>
<th>Target Date CY</th>
<th>High Priority</th>
<th>Domain</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>2013 Q1</td>
<td>N</td>
<td>Domain</td>
<td>Final Investment Decision for migration of PRM to PRM-R (based on multilateration)</td>
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<td>52</td>
<td>2010 Q2</td>
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<td>Final Decision for Avionics Mandate/Rulemaking for ADS-B (out)/MODE-S/UAT (Completed)</td>
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<td>76</td>
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<td>Final Investment Decision for removal or SLEP/replace ASDE surface primary radars (evolving requirements for safety and security may impact decision)</td>
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<td>Decision for replacement of terminal primary radars (ASR-11 PSR) and removal of terminal beacons</td>
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<td>Decision for replacement of en route beacons (ATCBI-6)</td>
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<td>Investment Analysis Readiness Decision for legacy radar (ASR-9) SLEP, through 2025</td>
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<td>Final Investment Decision to implement SIM in terminal and en route legacy radar systems</td>
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<td>Final Investment Decision for technology refresh of beacons (ATCBI-6)</td>
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<td>Automation</td>
<td>TAMR Phase 3 Final Investment Decision</td>
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<td>Combined Initial Investment Decision and Final Investment Decision for LCGS</td>
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<td>Final Investment Decision for ADS-B to assume LCGS function, or approve a Technology Refresh for LCGS</td>
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<td>Navigation cut-over to dual frequency operations</td>
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<td>In-Service Decision for SBS Critical Services (ADS-B) NAS wide implementation, including backup strategy</td>
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<td>Final Investment Decision for ASR-11 Technology Refresh Segment 2 (through 2025)</td>
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<td>Decision on ADS-B Rule Compliance</td>
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<td>Establish Requirements for a Backup Timing Source</td>
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<td>Initial Investment Decision for migration of PRM to PRM-R (based on multilateration)</td>
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<td>401</td>
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<td>In-Service Decision for Low Cost Ground Surveillance system</td>
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<td>In-Service Decision for Runway Status Light system</td>
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<td>Concept and Requirements Definition Readiness (CRDR) Decision for SIM in Terminal and En Route Legacy Radar Systems (Complete)</td>
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<td>Decision on GNSS Alternate Strategy</td>
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<td>Concept and Requirements Definition Readiness (CRDR) Decision for a Mobile/Transportable Airport Surveillance Radar (MASR) (Complete)</td>
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