



International Civil Aviation Organization

**FIFTEENH MEETING OF THE ADS-B STUDY AND IMPLEMENTATION  
TASK FORCE (ADS-B SITF/15)**

Bangkok, Thailand, 18 - 20 April 2016

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**Agenda Item 4:      Review States activities and interregional issues of ADS-B and  
Multilateration**

**ADS-B OUT**

(Presented by Rockwell Collins)



## ICAO ADS-B Out

Date April, 2016  
Bangkok, Thailand

**Rockwell  
Collins**

# Global View of Mandates

- **North America**
  - FANS in NAT
    - All Tracks FL350-390 in Feb, 2015
  - Entire NAT Region FL350-390 in Dec, 2017
  - Entire NAT Region >FL290 in Jan, 2020
  - ADS-B Out after Jan, 2020
    - DO-260B Transponder
    - Enhanced GNSS Perf
    - Exemption 12555
  - ADS-Out, Mexico following US Requirements
- **South America**
  - ADS-B Out (DO-260B) Expect Some Countries to Follow EU and/or US (Columbia first to release rule in May, 2016)
- **Europe**
  - ADS-B Out (DO-260B)
    - FF in June, 2016
    - RF in June, 2020
  - TCAS 7.1 in Dec, 2015
  - Link 2000+ in Jan, 2020
  - Performance Based Nav starting in 2020
- **Middle East**
  - TCAS 7.1 in Dec, 2015
- **Other Asia Pacific**
  - ADS-B Out (DO-260) in Singapore in 2014
  - ADS-B Out (DO-260) in Taiwan in 2017
  - ADS-B Out (DO-260) in Indonesia in 2018
- **China**
  - ADS-B Out (DO-260) in Honk Kong above FL290 – Dec, 2014
  - HUD Equipage
    - 10% in 2015
    - 50% in 2020
    - 100% in 2025
  - SATCOM
    - 50% by 2014
    - 100% by 2015
- **Australia**
  - ADS-B Out (DO-260)
    - All Aircraft Registered after Feb, 2014
    - Any Aircraft Operated Under IFR after Feb, 2017
  - GNSS Navigation after Feb, 2016
  - TCAS 7.1 after Jan, 2014

# ADS-B Timeline

Equip for ADS-B Out

2020

2025  
and  
Beyond

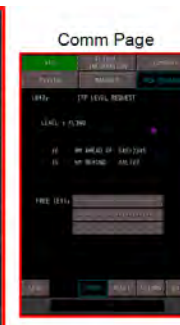
Utilize 100% Equipage

TPR-901

ISS-2100

GLU-925

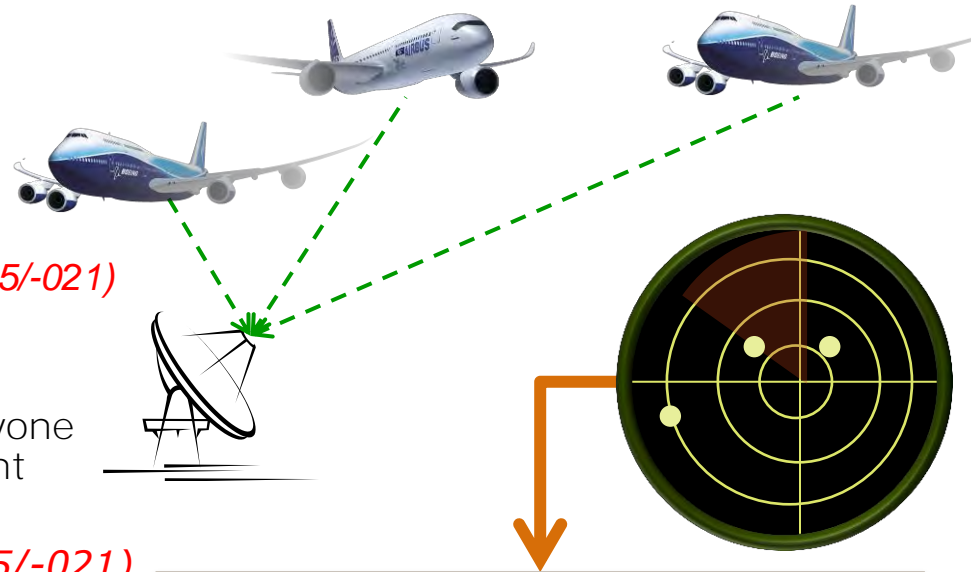
**\*NEW\***  
**GLU-2100**



# Surveillance – ADS-B Out Current Status

## With corresponding transponder types

- **Secondary Surveillance Radar**
  - Mode A/C/S (*TPR-720/900*)
- **Secondary Surveillance Radar**
  - Elementary / Enhanced Surveillance
  - EU Mandate March '07 (*TPR-901-003/-005/-021*)
- **ADS-B Out**
  - Transmitted information available to anyone with the appropriate receiving equipment
  - Mandates for Retrofit:
    - Today: DO-260 (*TPR-901 -003/-005/-021*)
      - Australia/Hudson Bay
      - Singapore/Hong Kong...
    - 2020: DO-260B (*TPR-901 -205/-225*)
      - USA
      - Europe



- DO 260/260B Extended Squitter (ES)
  - Airborne Position
    - Lat/Lon
  - Surface Position
  - A/C Identification
  - Velocity
  - Emergency Status Messages ...



# ADS-B Out Implementation



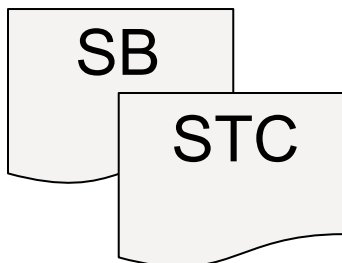
Enhanced/Extended Squitter Wiring  
OEM SB and STCs Available



Compliant Transponder and GNSS Source  
Rockwell Collins SB Available



Failure Annunciation  
Addressed during Certification



Certification  
OEM SBs and STCs Available

## ADS-B In and Traffic Applications

- Airspace Modernization is About Moving Aircraft in the Air and On the Ground More Efficiently and Safely
  - Less Spacing
  - More Accurate Surveillance
  - Improved Situational Awareness
- Time and Fuel Savings is Primary Benefit
- Airspace Modernization Initiatives are updating Infrastructure to Facilitate Automation
- Airborne Equipage is Inevitable

# Rockwell Collins Traffic Applications

- **Traffic Applications**
  - **Provides Situational Awareness**
  - **Enhances Safety**
  - **Improves Efficiency**
  - **Airborne Traffic Display (AIRB)**
  - **Visual Separation on Approach (VSA)**
  - **In-Trail Procedures (ITP)**





## 787 Surveillance Subsystem

- The Surveillance Subsystem performs Terrain Awareness and Warning System (TAWS), Airborne Collision Avoidance System (ACAS), transponder, and weather radar functions. This subsystem communicates with other aircraft systems via the common data network (CDN).
  - Two Integrated Surveillance System (ISS)
  - One Alerting & Transponder Panel (ATP)
  - Two Traffic System Antenna (TSA)
  - One Weather Radar Antenna Unit (WRAU)
  - Two Antenna Receiver/Transmitter (RTM)
  - One Antenna Pedestal (DRV)
  - One Antenna Flat Plate (WFA)



# TTR-2100 TCAS with Traffic Computer

## Next Generation TCAS and Traffic Computer

- Change 7.1 Compliant
- Traffic Computer Capable (ADS-B In Apps)
- Common traffic computer applications



**TSS-4100**  
-4 MCU  
TCAS, Traffic  
Computer, Transponder

Business and Regionals



A320



**TTR-2100**  
-6 MCU  
Federated TCAS II  
Traffic Computer

Airbus  
Boeing



ISS-2100  
Sole Source on  
Boeing 787



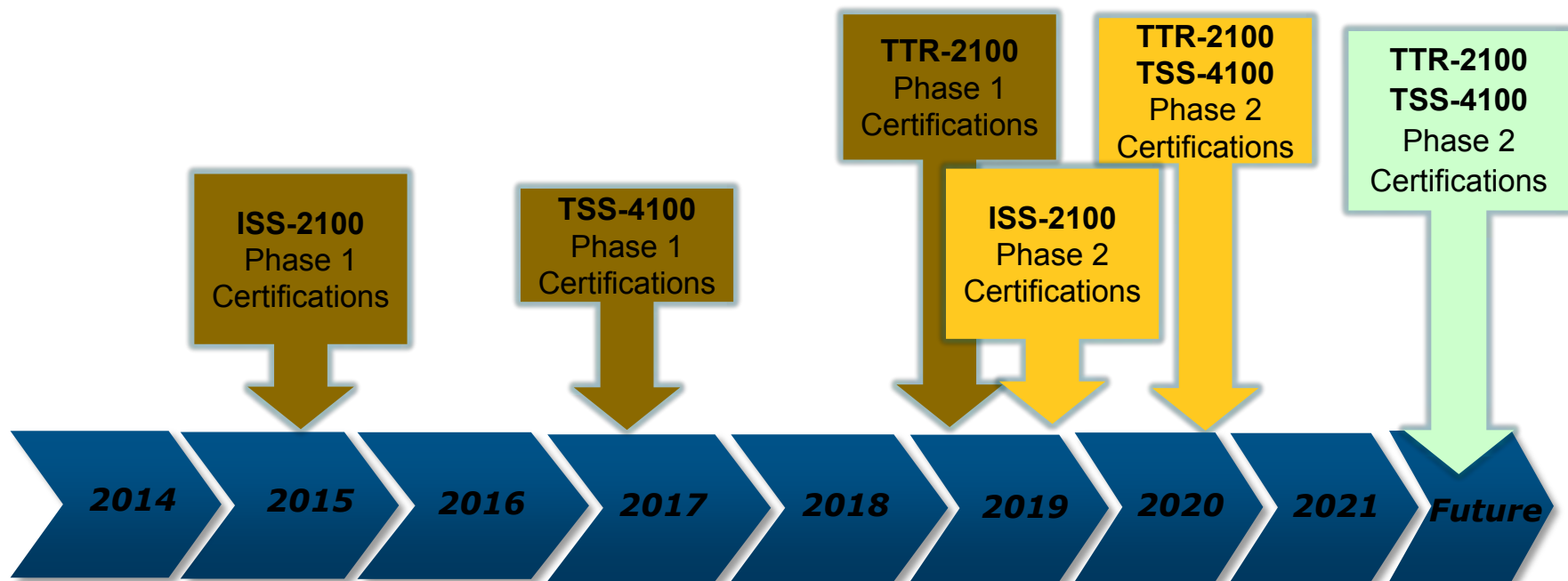
**ISS-2100**  
-8 MCU  
TCAS function/Traffic Computer  
Transponder, Weather Radar and Terrain  
Warning functions

Boeing 787

Common  
Traffic  
Computer  
and  
Traffic  
Apps.

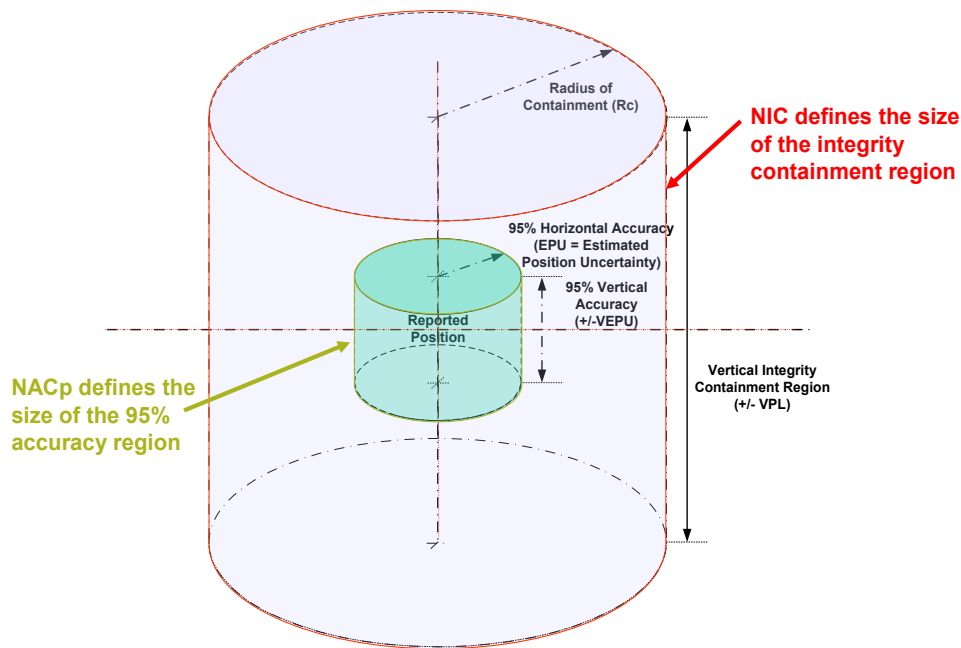
**Common Traffic Computer Design Enables Upgrades Based on  
Different Market Segments**

# ADS-B Traffic Applications Roadmap

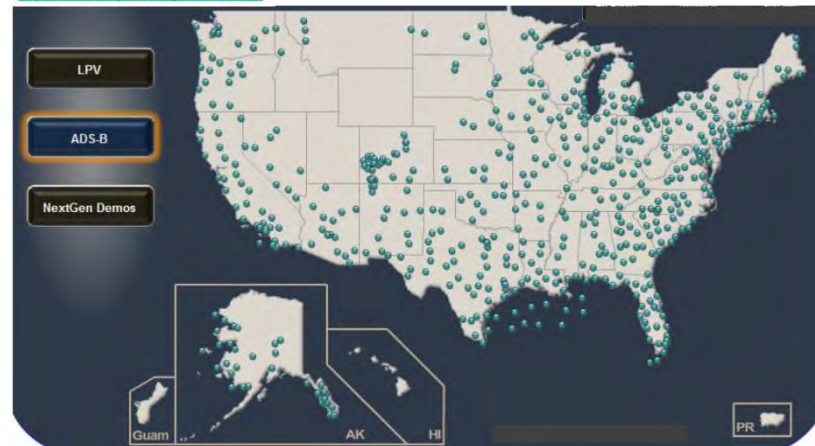


<p><b>ADS-B In Phase 1 (planned)</b></p> <p>Basic CDTI (AIRB,VSA,Basic SURF) In-Trail-Procedures (ITP)</p>	<p><b>ADS-B In Phase 2</b></p> <p>CDTI Assisted Visual Separation (CAVS) Flight Deck Interval Management (Merging and Spacing)</p>	<p><b>ADS-B In Phase 3</b></p> <p>SURF IA Closely Spaced Parallel Approaches Advanced Merging &amp; Spacing</p>
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# GNSS in ADS-B Out Mandate



<http://www.faa.gov/nextgen/flashmap/>

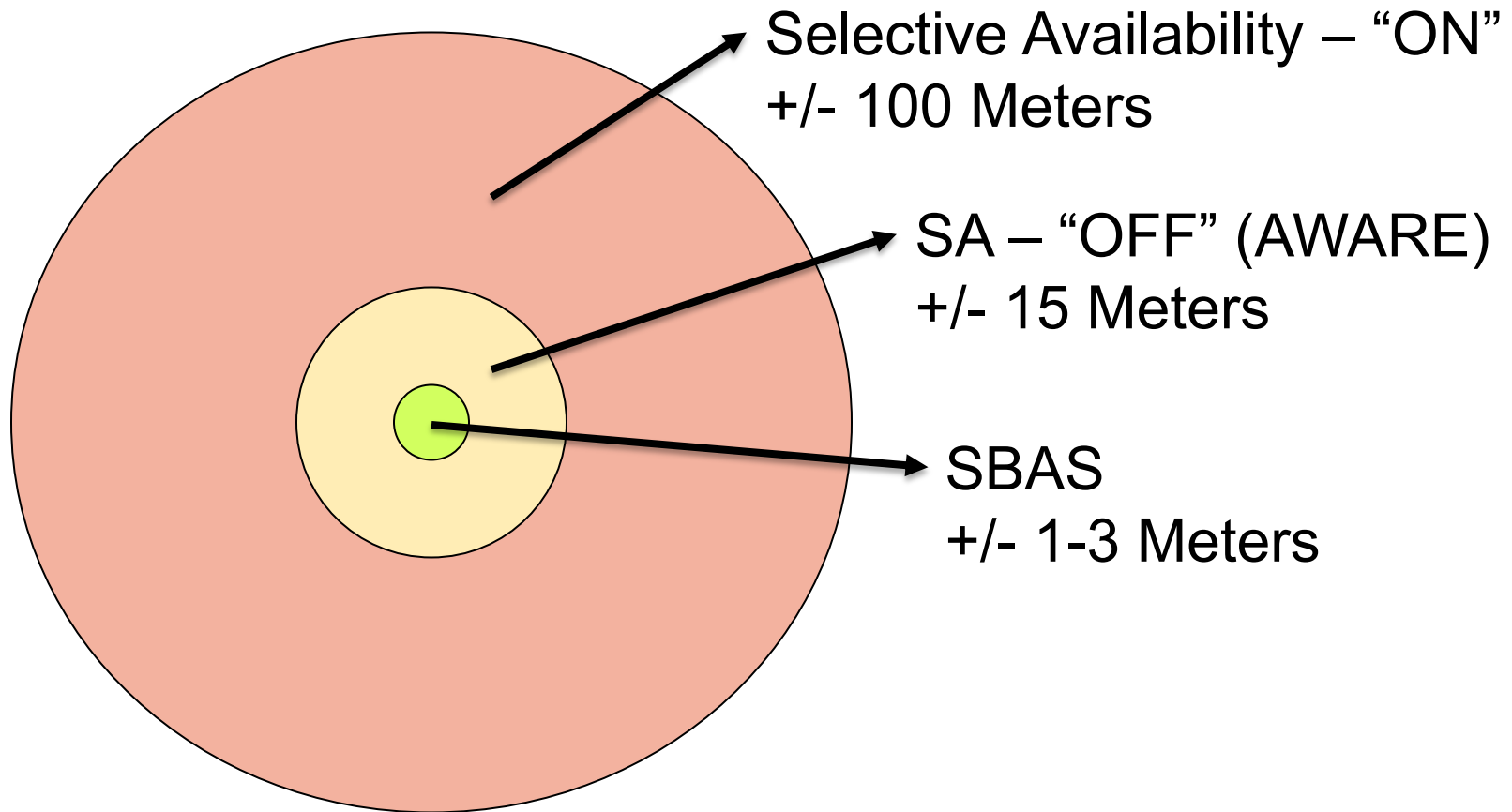


Federal Aviation  
Administration

## Important Notes:

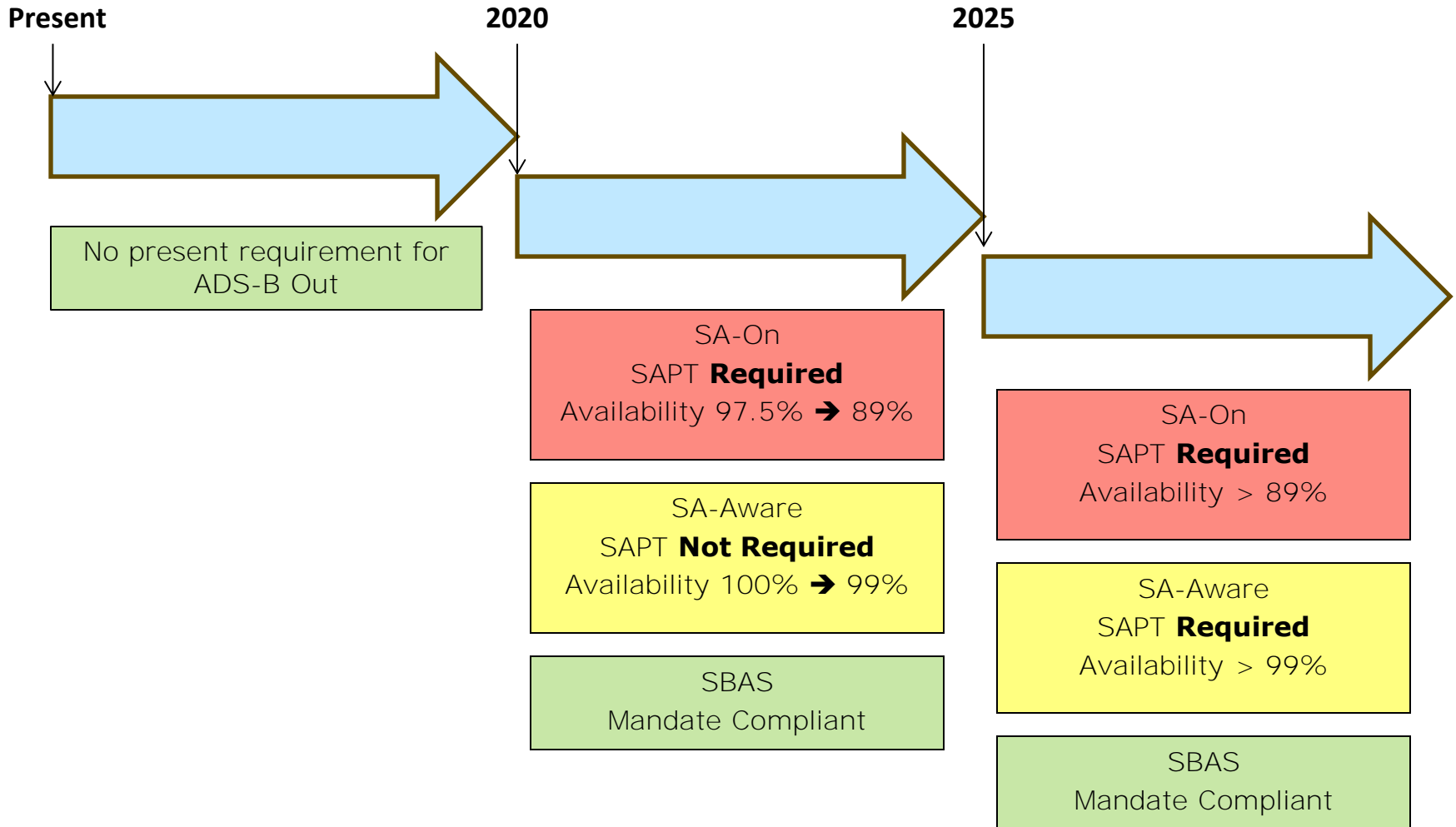
- ADS-B GNSS Requirements are different for various regions of the world
  - US requirements are currently the most stringent
- There are many GNSS factors to consider;
  - Accuracy
  - Latency (direct wire to Xpdr, refresh rate of GNSS)
  - Availability (affected by SA, Baro Aiding, SBAS)
  - Integrity (affected by FDE, SBAS, MF/MC)
- Not all GNSS sources are created equal

## GNSS Performance – 95% Probability



**“SBAS-Like” Performance Required to Meet US Mandate**

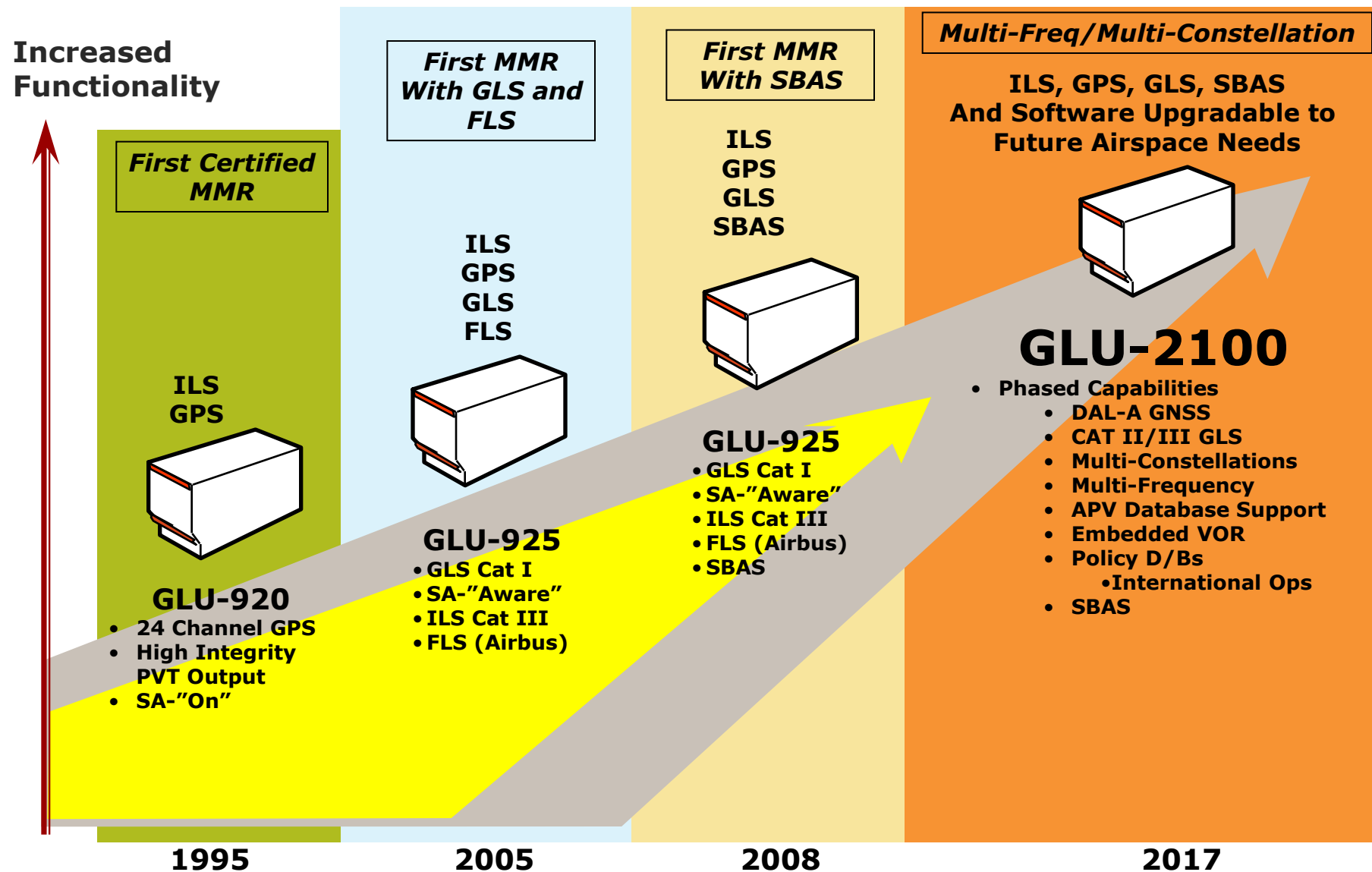
# Current GNSS Position Source FAA Exemption 12555



**NOTE: Use of SAPT implies potential for dispatch delay**



# Multi Mode Receiver Roadmap



# GLU-2100 Roadmap - Feature and Functionality



## Development of Phase I Capabilities

### Phase I Capabilities:

- 3MCU Backward Compatible
- Dual thread GPS L1 + L1 SBAS
- Level A ILS HW & S/W (CAT III ILS)
- Level A GNSS HW (growth to GLS II/III)
- CAT I GLS Software
- SBAS Augmented PVT
- Embedded VOR

### HW compatible for SW-Only Growth:

- Multi-Frequency/ Multi-Constellation
- ABAS Inertial Blending Computations
- LPV Database Hosting
- On Wing Dataloading
- Policy Database Hosting
- SDR for 80+ RF Channels
- Growth to GLS CAT II/II S/W

## Development of Phase II Capabilities

### Phase II Capabilities

- SBAS LPV Support
- ABAS Inertial Coasting / Blending
- GLS II / III S/W
- Synthesized ILS (SILS)
  - Aftermarket GLS Implementation

## Development of Phase III Capabilities

### Phase III Capabilities

- Multi-Frequency/Multi-Constellation
- Blended Constellation PVT Outputs
- Modified Policy Database Logic
- Advanced RAIM



A light gray world map is centered on the slide. Overlaid on the map are several thin, light gray curved lines representing global network connections. These lines connect various points marked with small red dots across the continents. The dots are located in North America, South America, Europe, Africa, Asia, and Australia. The word "Questions?" is written in a large, bold, orange font, centered over the map.

# Questions?