GPS Augmentation Systems Status

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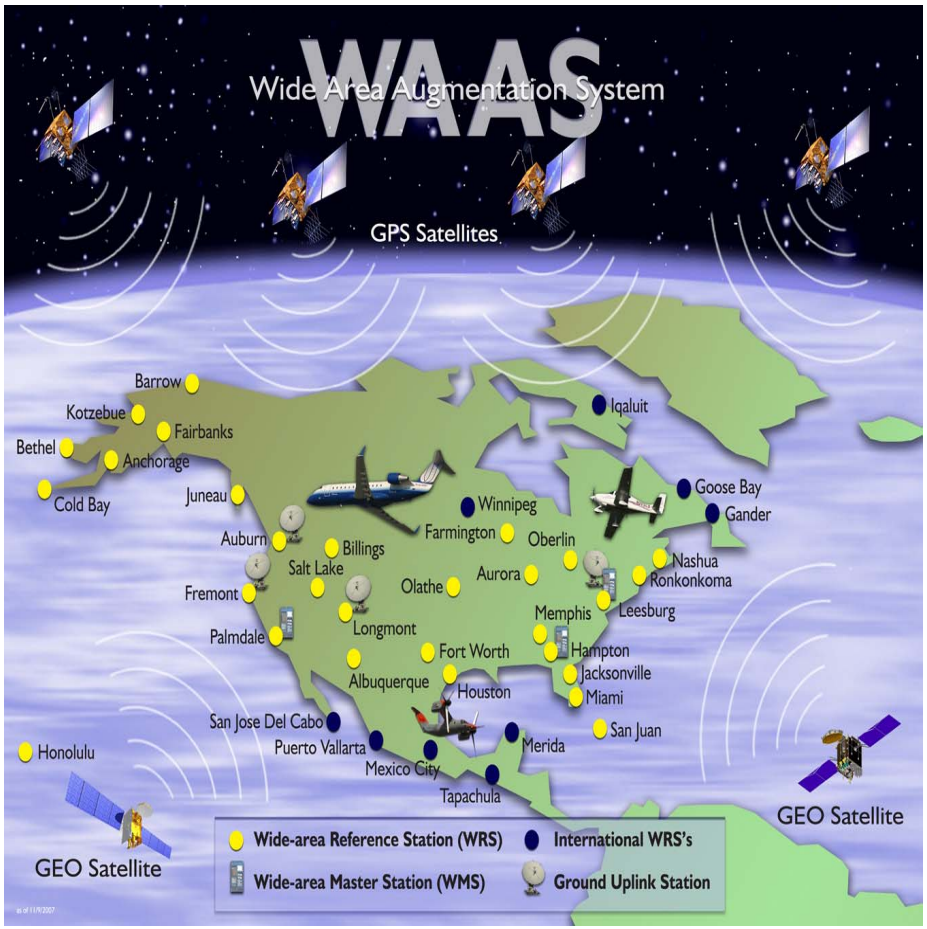
Federal Aviation Administration (FAA)
September 2009

FAA GPS Augmentation Programs

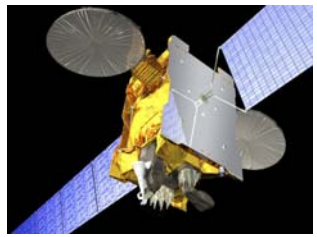
WAAS Architecture



38 Reference Stations

3 Master Stations

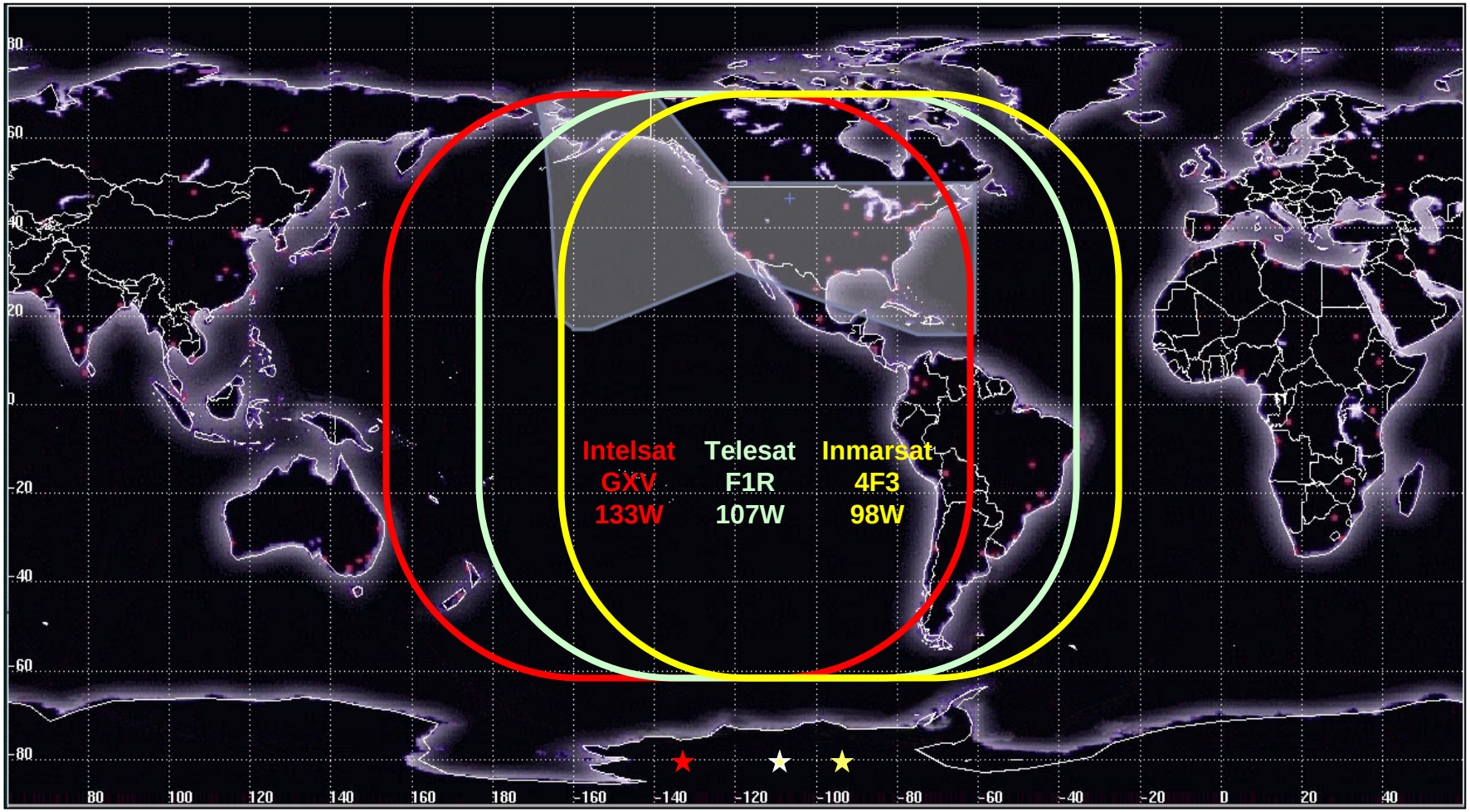
4 Ground Earth Stations



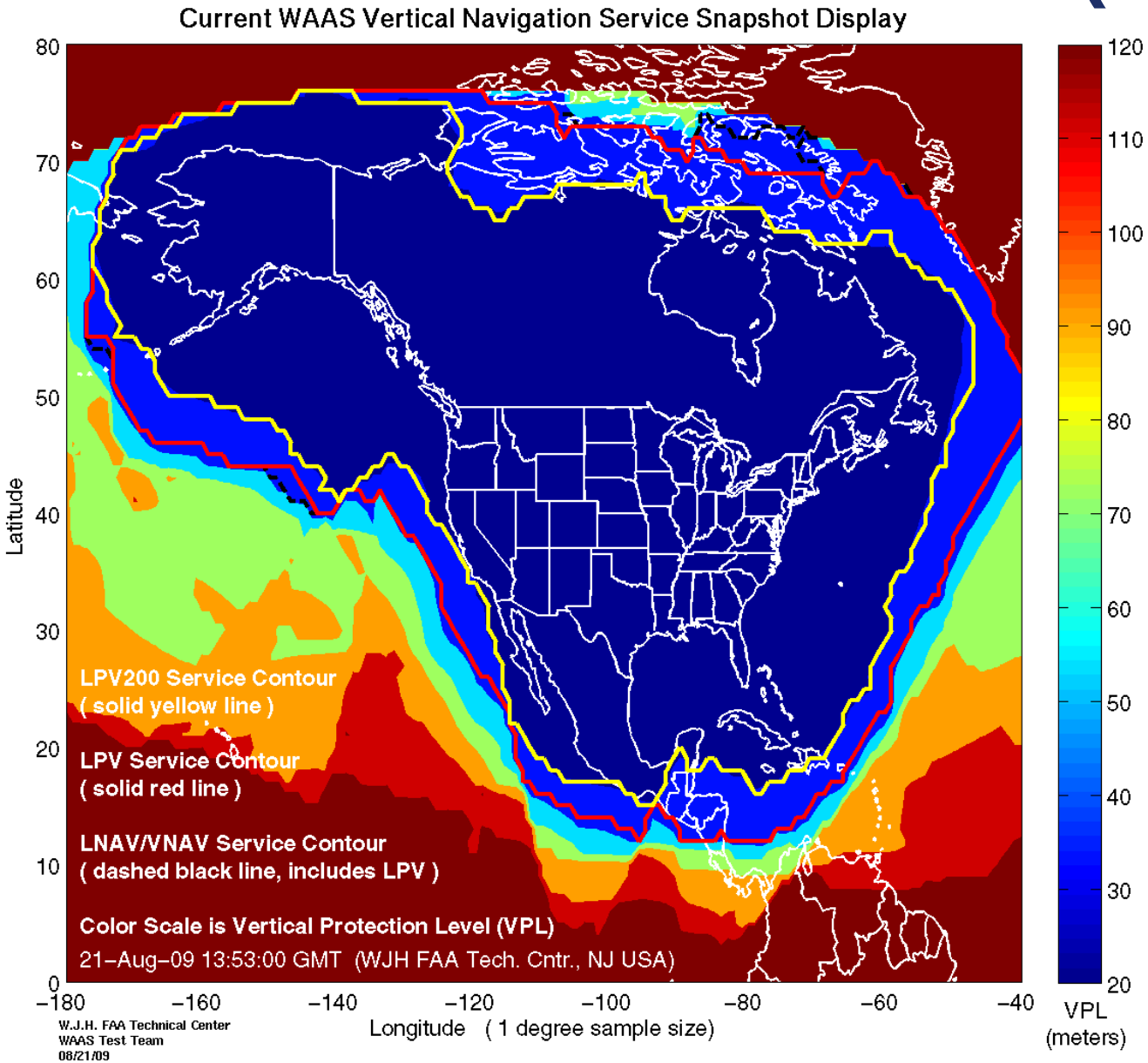
2 Geostationary Satellite Links

2 Operational Control Centers

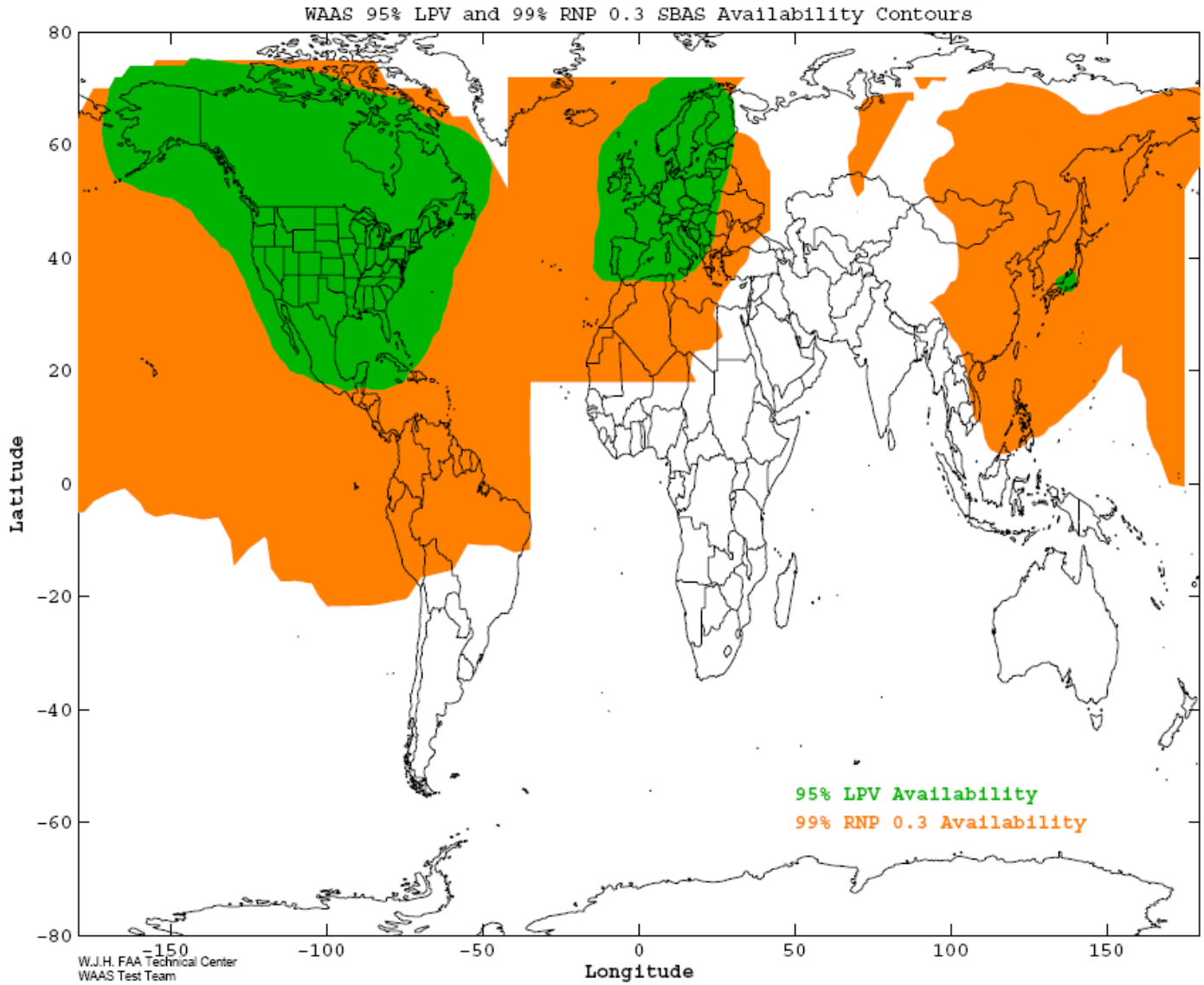
GEO Satellite Coverage Plot



Localizer Performance Vertical (LPV)



Global SBAS Coverage



Airports with WAAS Supported Instrument Approaches with Vertical Guidance

As of Aug 27th, 2009

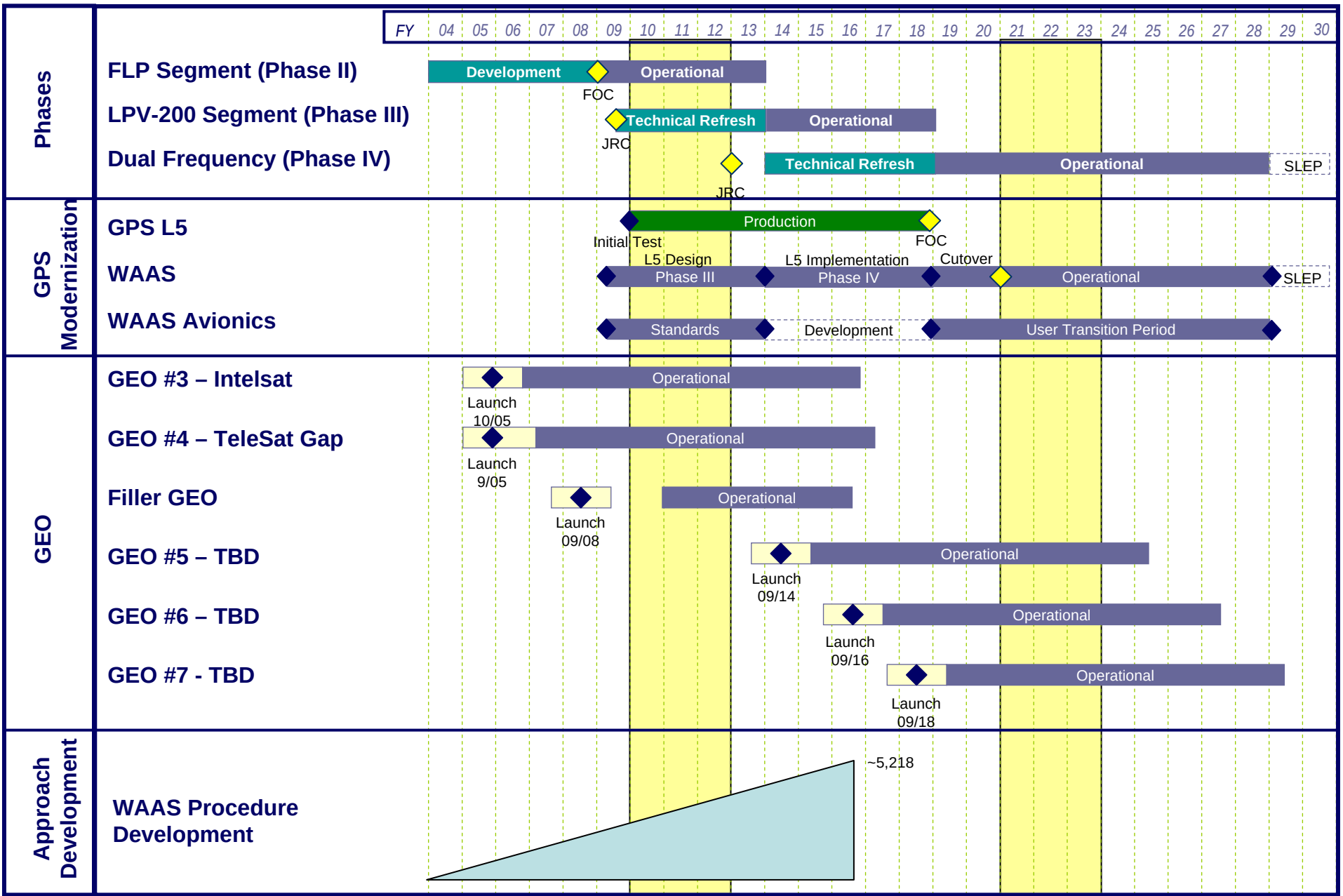
-1,822 LPVs serving 970 Airports

- 1049 LPVs to non ILS Runways

- LPVs to 678 non-ILS Airports

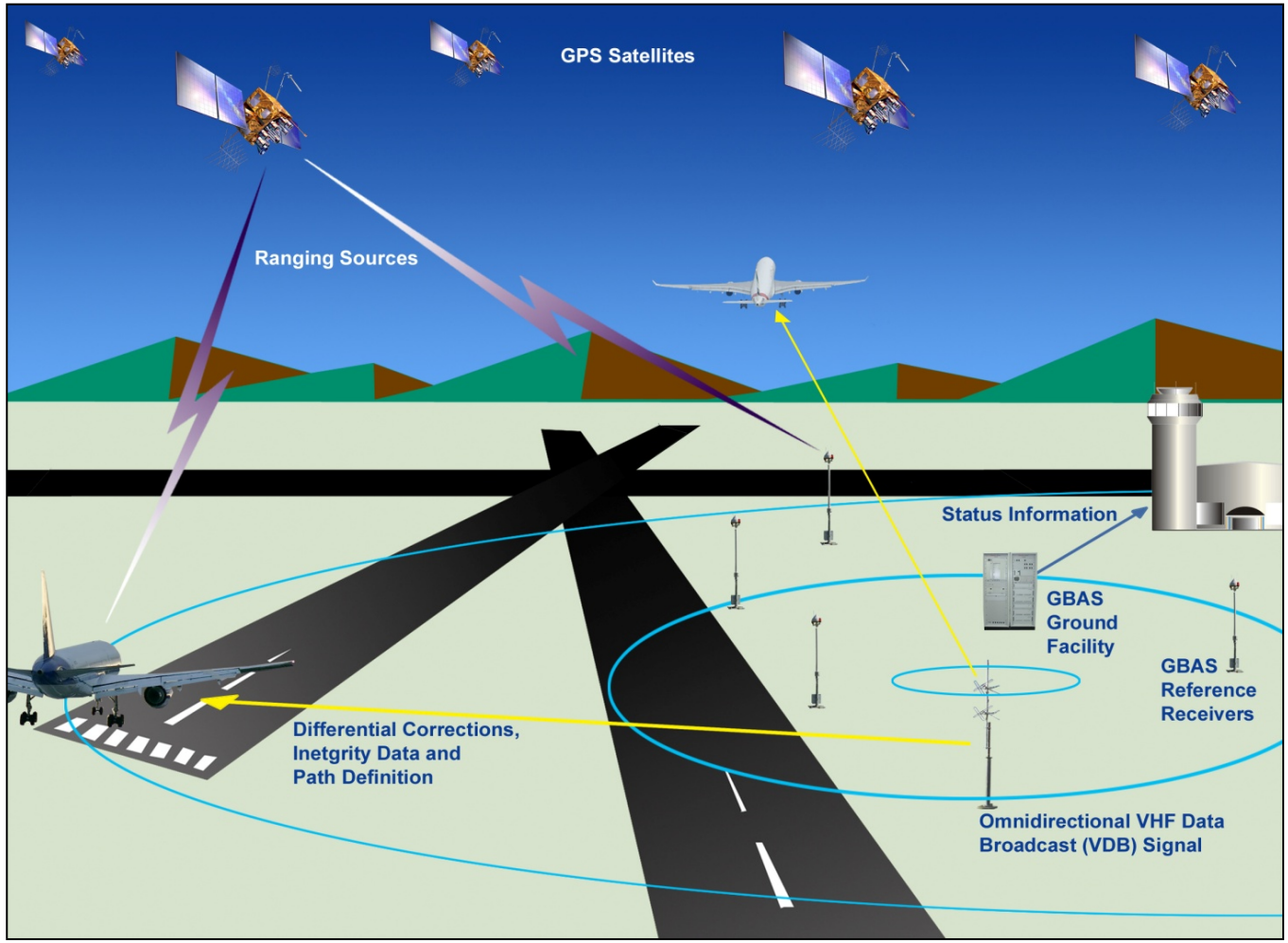
- 773 LPVs to ILS runways

WAAS Enterprise Schedule



Local Area Augmentation System (LAAS)

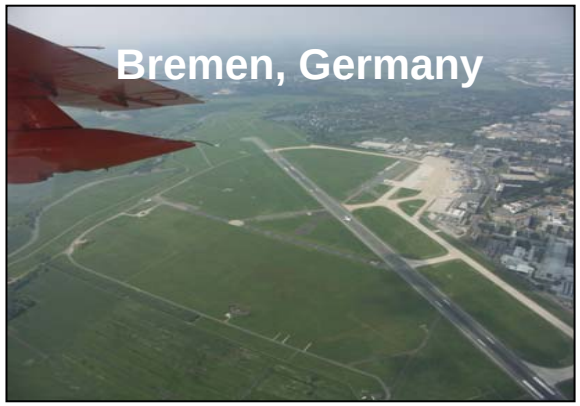
- Precision Approach For CAT- I, II, III
- Multiple Runway Coverage At An Airport
- 3D RNP Procedures (RTA), CDAs
- Navigation for Closely Spaced Parallels
- Super Density Operations



GBAS Pathway Forward

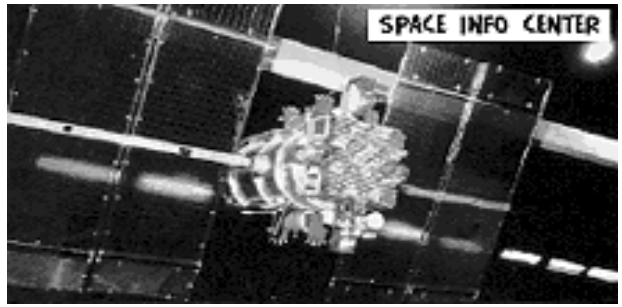
- **Cat-I System Design Approval at Memphis – Complete**
- **Cat-III Validation by - 2010**
- **Cat-III Final Investment Decision by - 2012**

LAAS/GBAS International Efforts



Future Considerations

Galileo (EU)



GLONASS

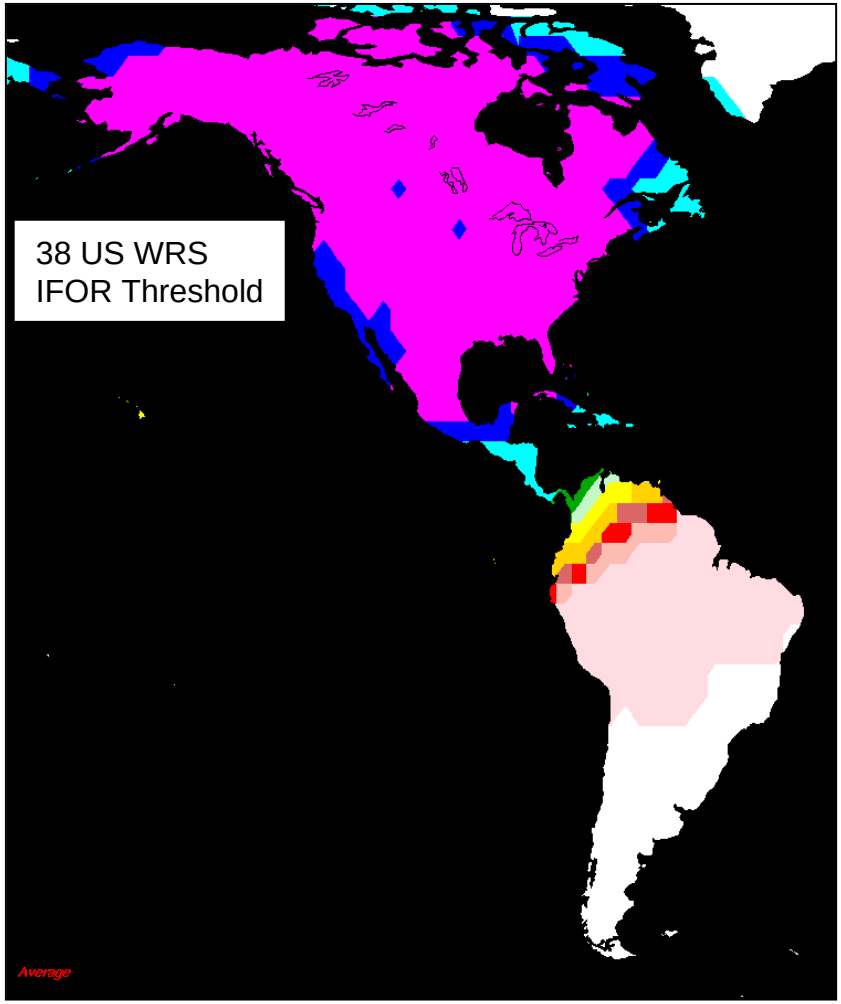
COMPASS

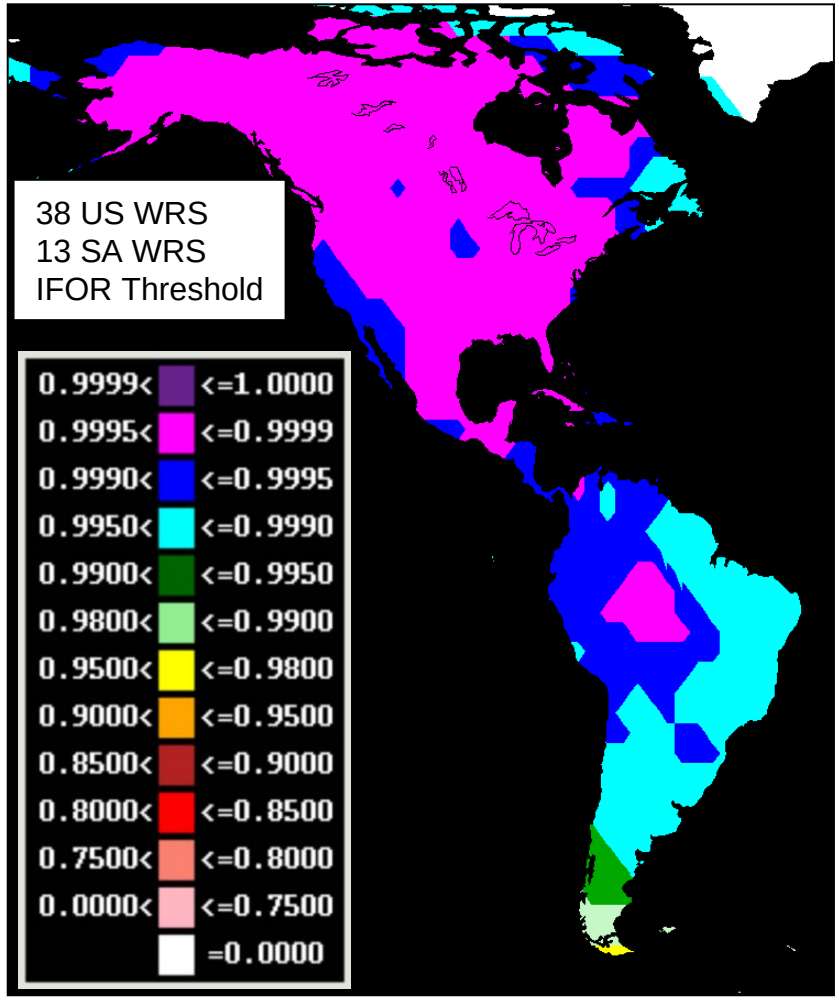
GPS

Two Civil Frequencies

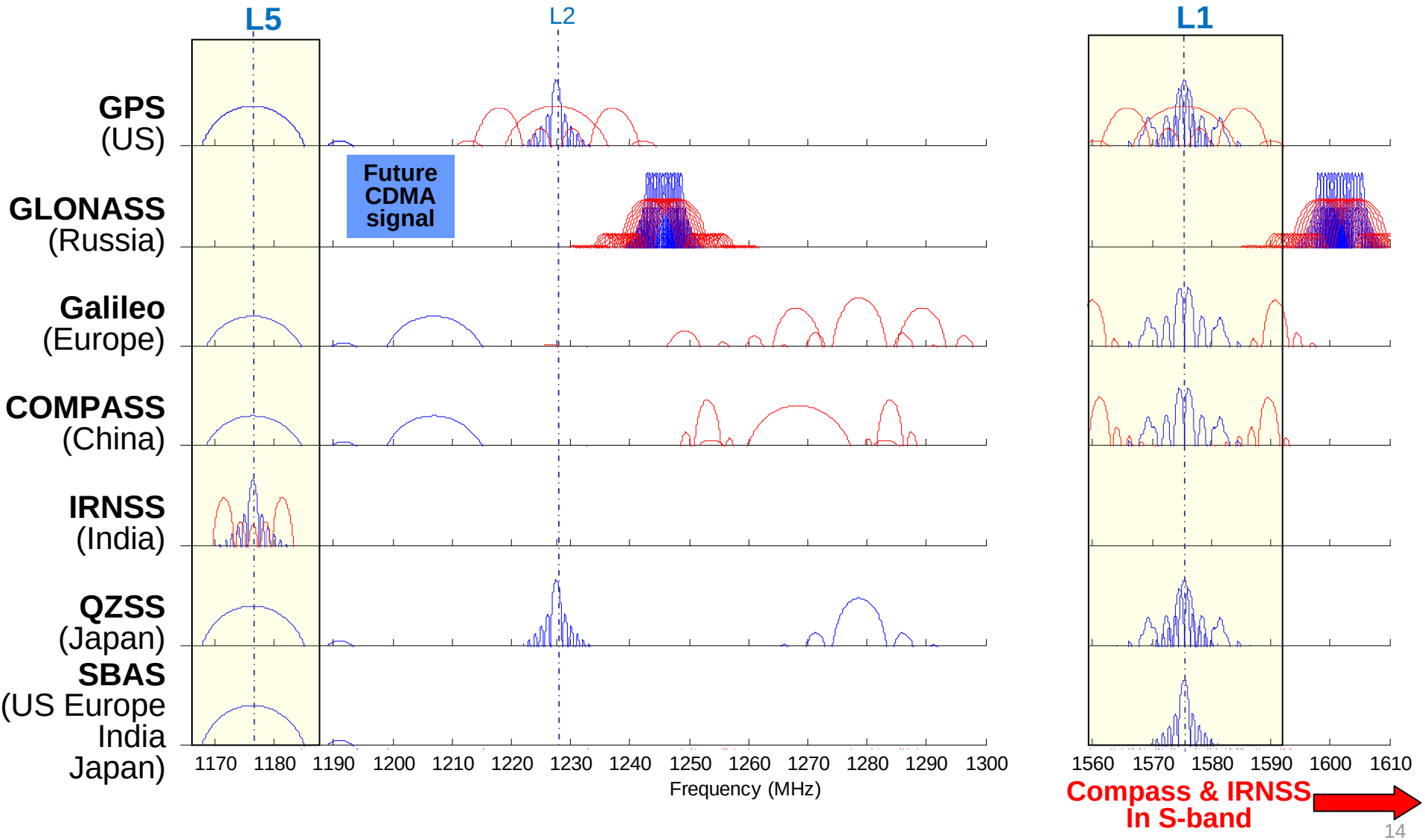
- **The ionosphere creates the largest source of uncertainty affecting today's use of GPS for aviation**
- **When GPS L5 becomes widely available it will be possible for the user receivers to directly remove the ionosphere delay errors**
- **However, the two frequency combination amplifies the effects of other error sources**
  - More satellites tend to reduce the magnitude of the errors

WAAS Dual Frequency User Potential
(No "RDM Constraint")

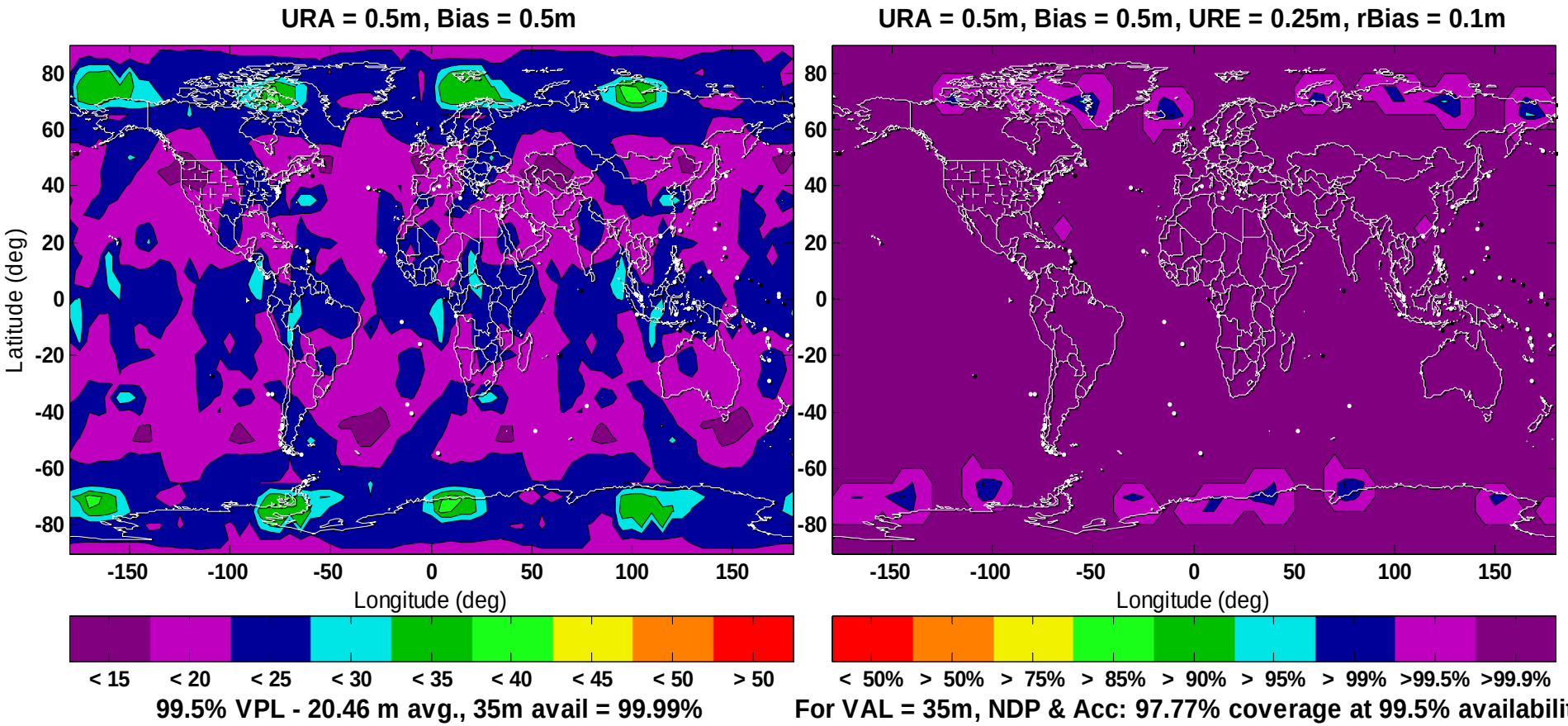




Current International Signal Plans



ARAIM Results for 30 SVs & URA = .5 m



ARAIM currently predicated upon a user update rate of ~ 1hour

Summary

- **WAAS currently providing service to aviation in the U.S. National Airspace System**
- **LAAS system design approval for Category-I completing in September**
- **LAAS activity to continue to Category-II/III**
- **Dual Frequency GNSS Offers Significant Potential for Aviation**