

GPS in the National Airspace System

Presented To: PNT Advisory Board
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**Federal Aviation
Administration**



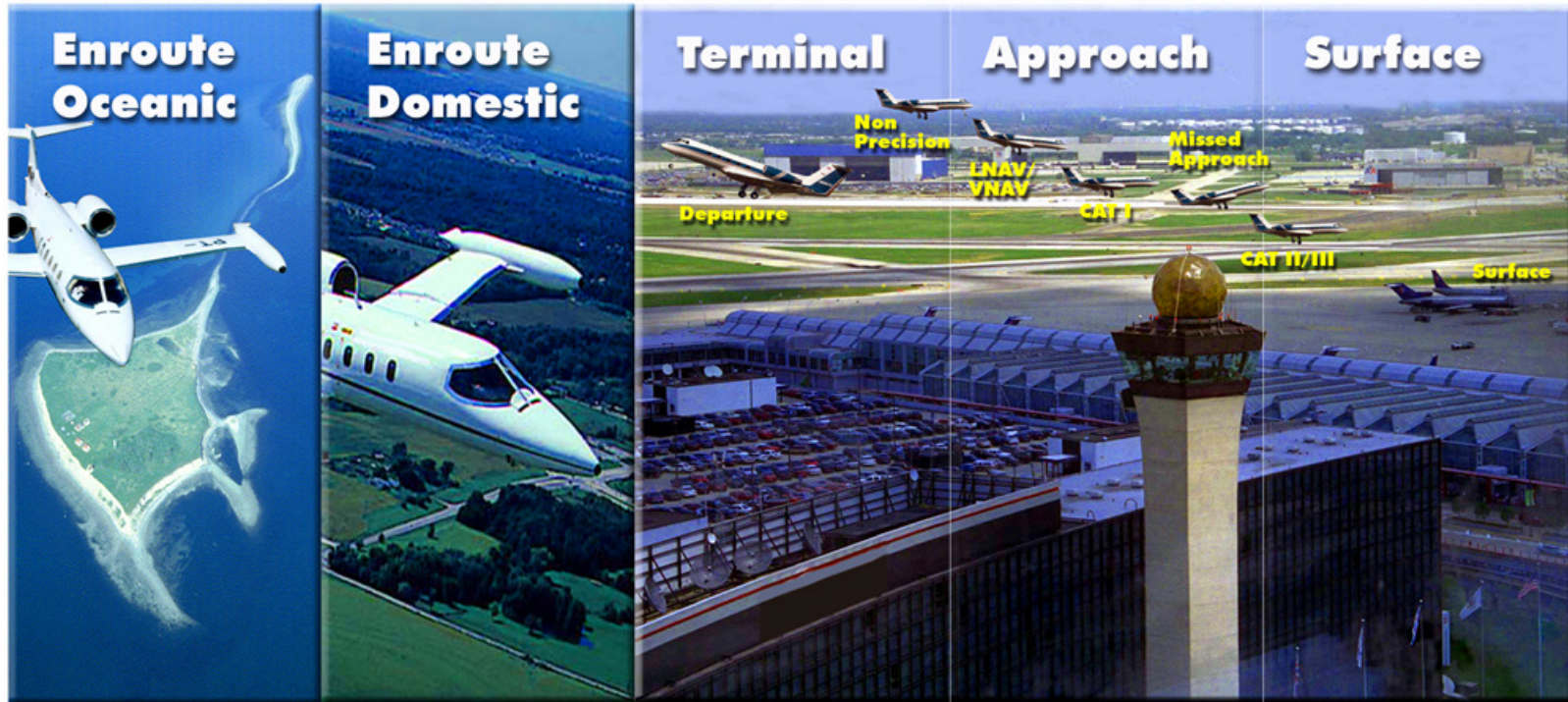
Overview

- **Wide Area Augmentation System (WAAS) Status**
- **Local Area Augmentation System (LAAS) Status**
- **Automated Dependent Surveillance Broadcast (ADS-B) Status**



FAA Satellite Navigation Program

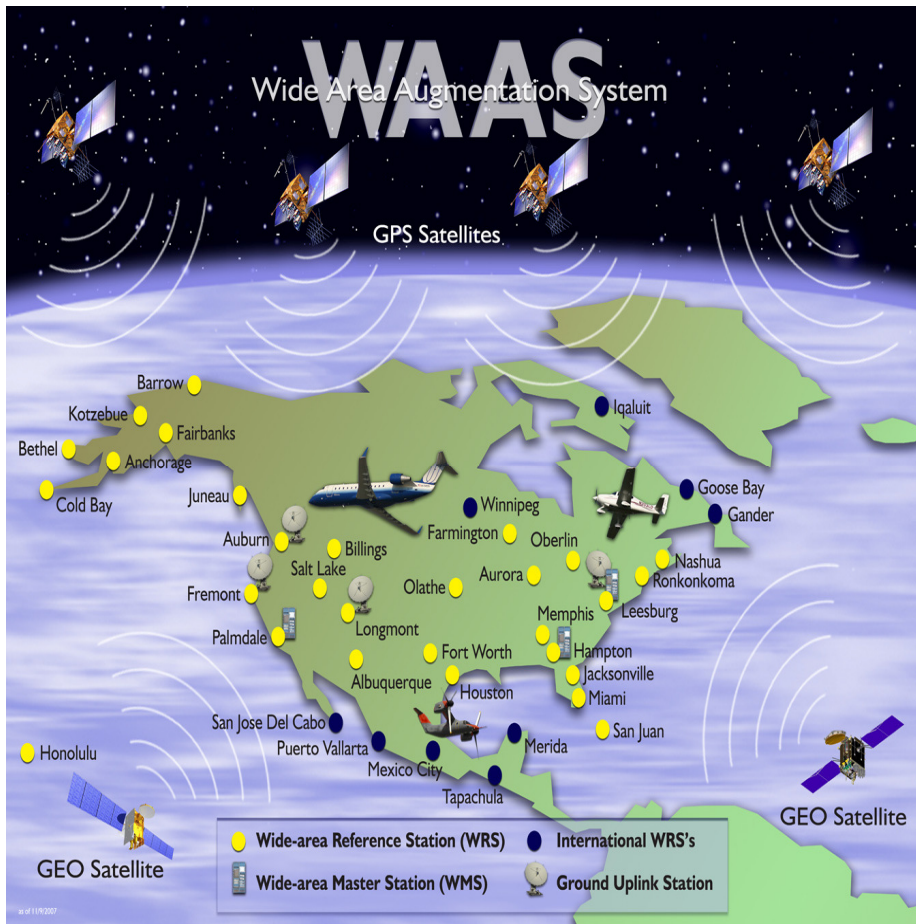
WAAS



LAAS



WAAS Architecture



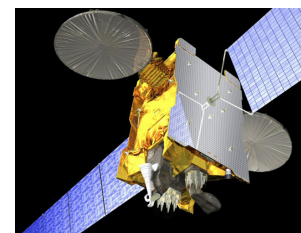
38 Reference Stations



3 Master Stations



4 Ground Earth Stations

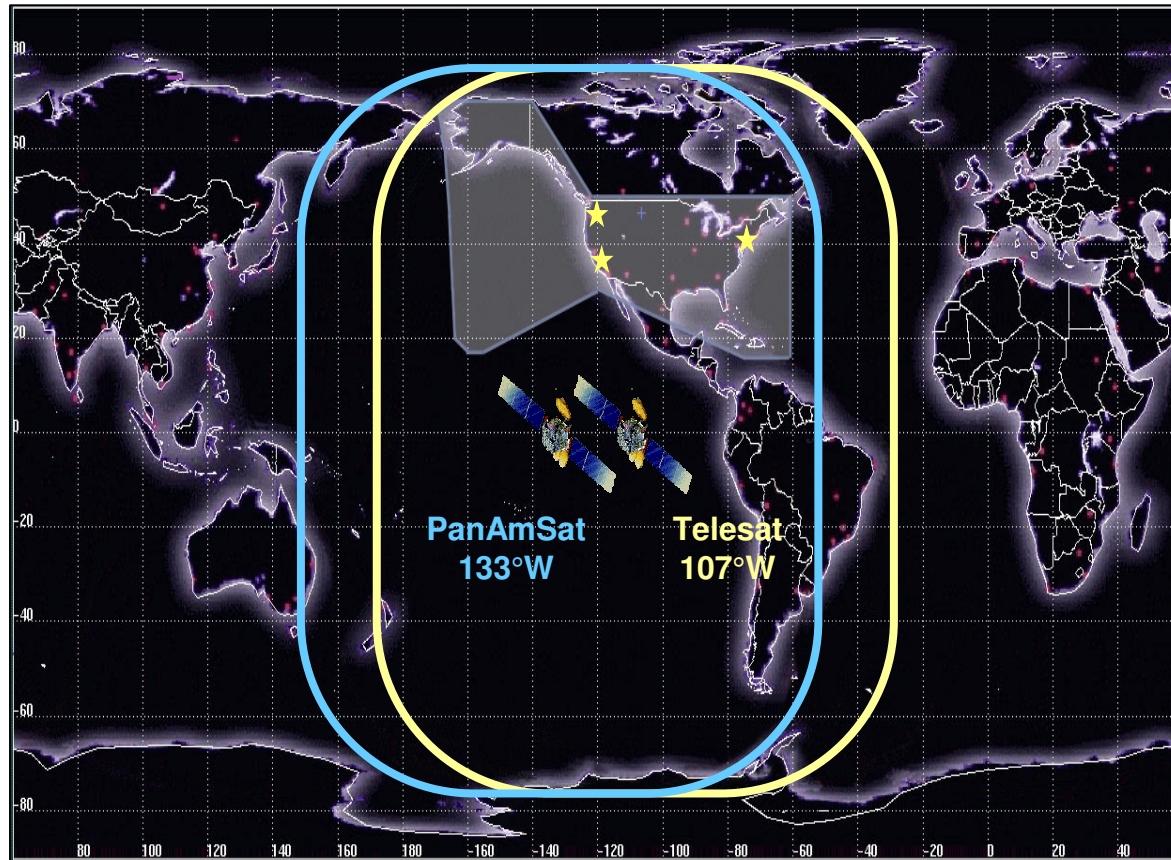


2 Geostationary Satellite Links

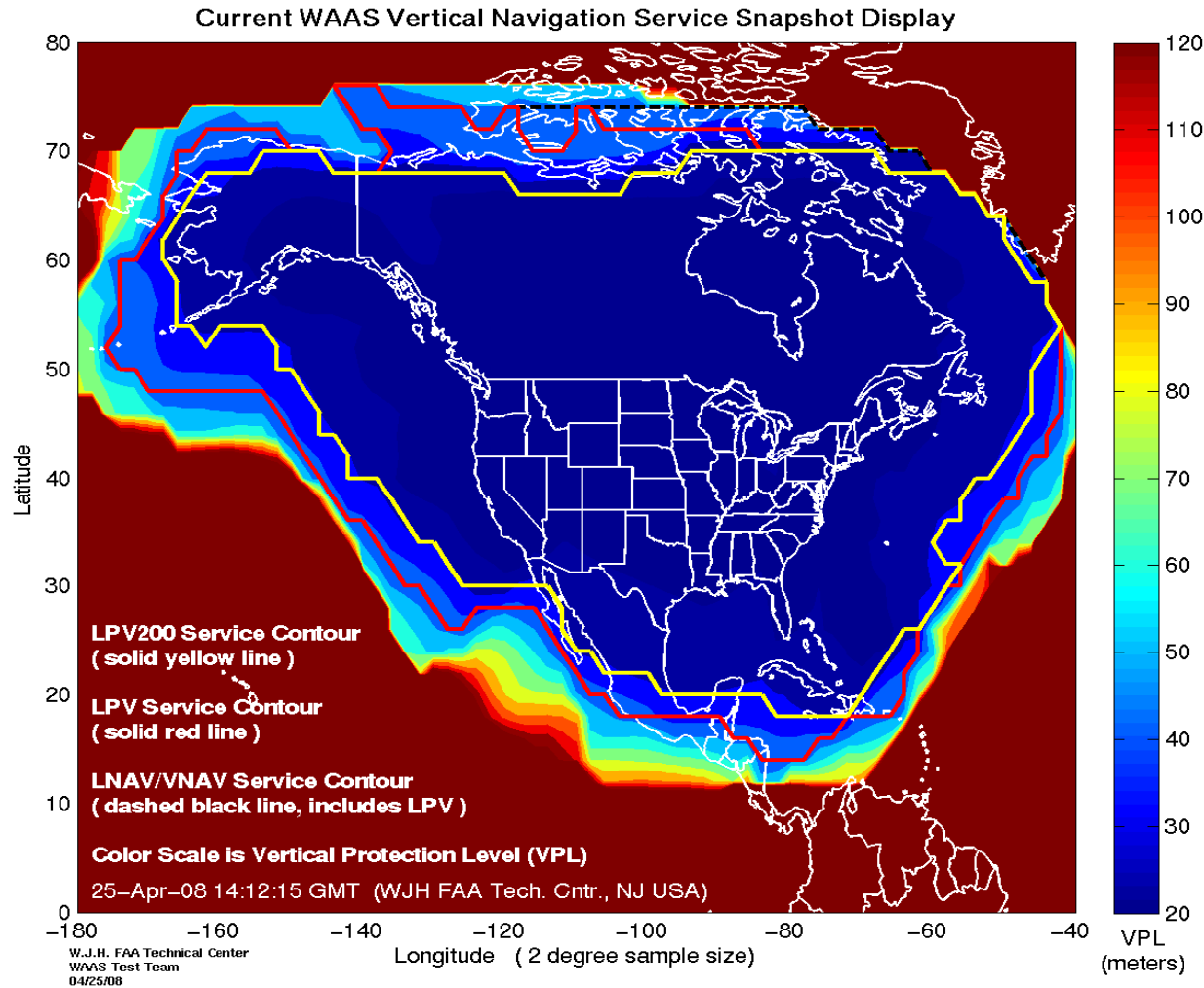


2 Operational Control Centers

Geostationary Satellites (GEO)



Localizer Performance Vertical (LPV) Coverage



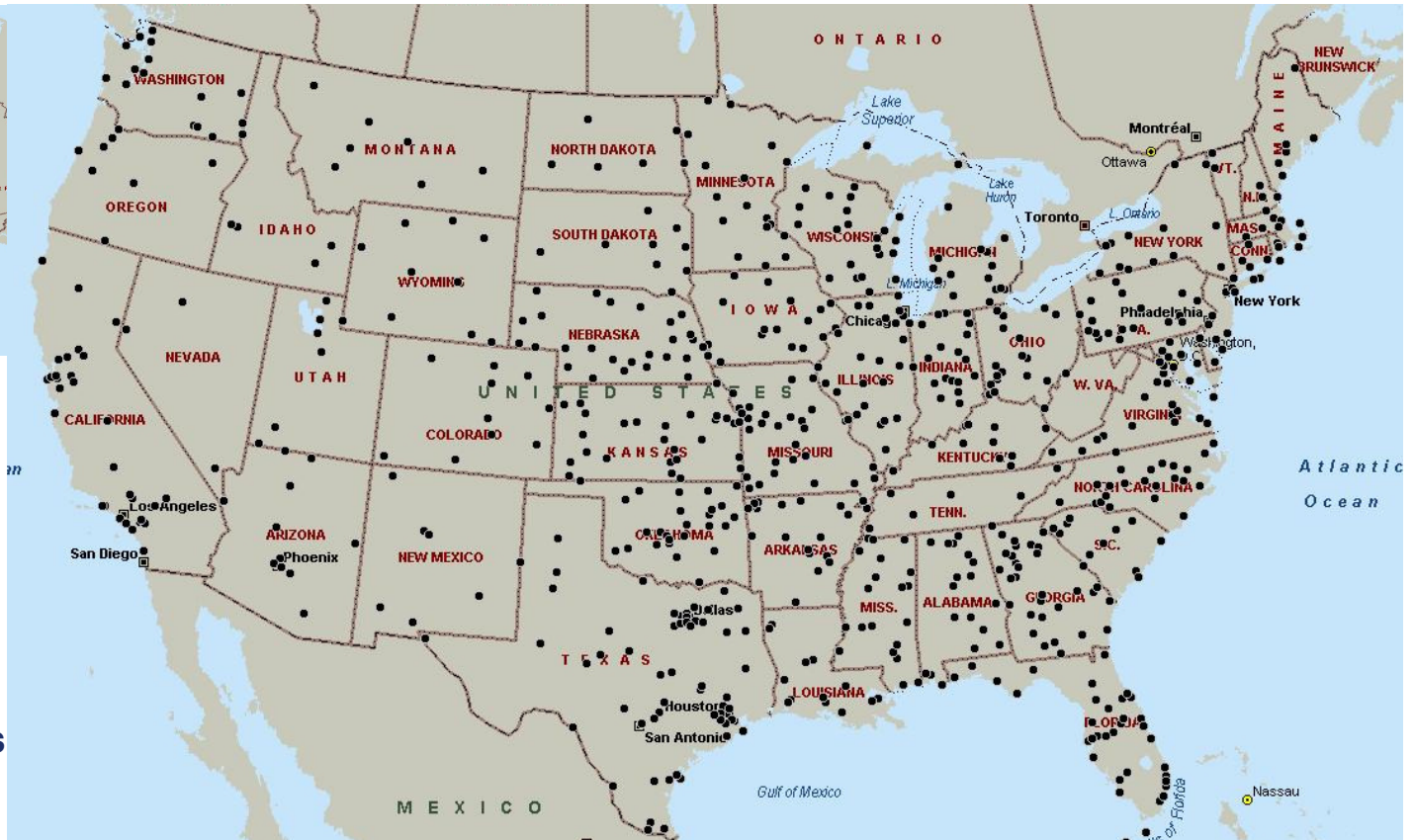
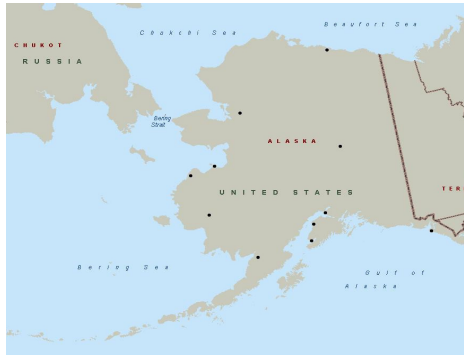
WAAS Avionics Status

- **General Aviation**
 - Over 37,000 Units Sold
 - Increasing at ~1000 Units Per Month
 - New Products Coming to Market in Late 2008
- **Business & Regional Aircraft**
 - Over 500 Units Sold Since 2007
 - Two Additional Products Coming to Market in Late 2008
 - Cessna CJs Delivering with WAAS Avionics in 2009
 - Acceptance Rates Should Increase Significantly in 2009
- **Air Carrier & Cargo Aircraft**
 - Southwest Airlines Equipping 200 Boeing 737s
 - Federal Express Has Equipped 253 Caravan Aircraft
 - Horizon Airlines Equipping 48 Bombardier Aircraft
- **Helicopter Aircraft Implementing WAAS**
 - Significant Growth Projected for First Responders
- **WAAS Avionics are Interoperable with Other SBASs**



WAAS Approach Procedures

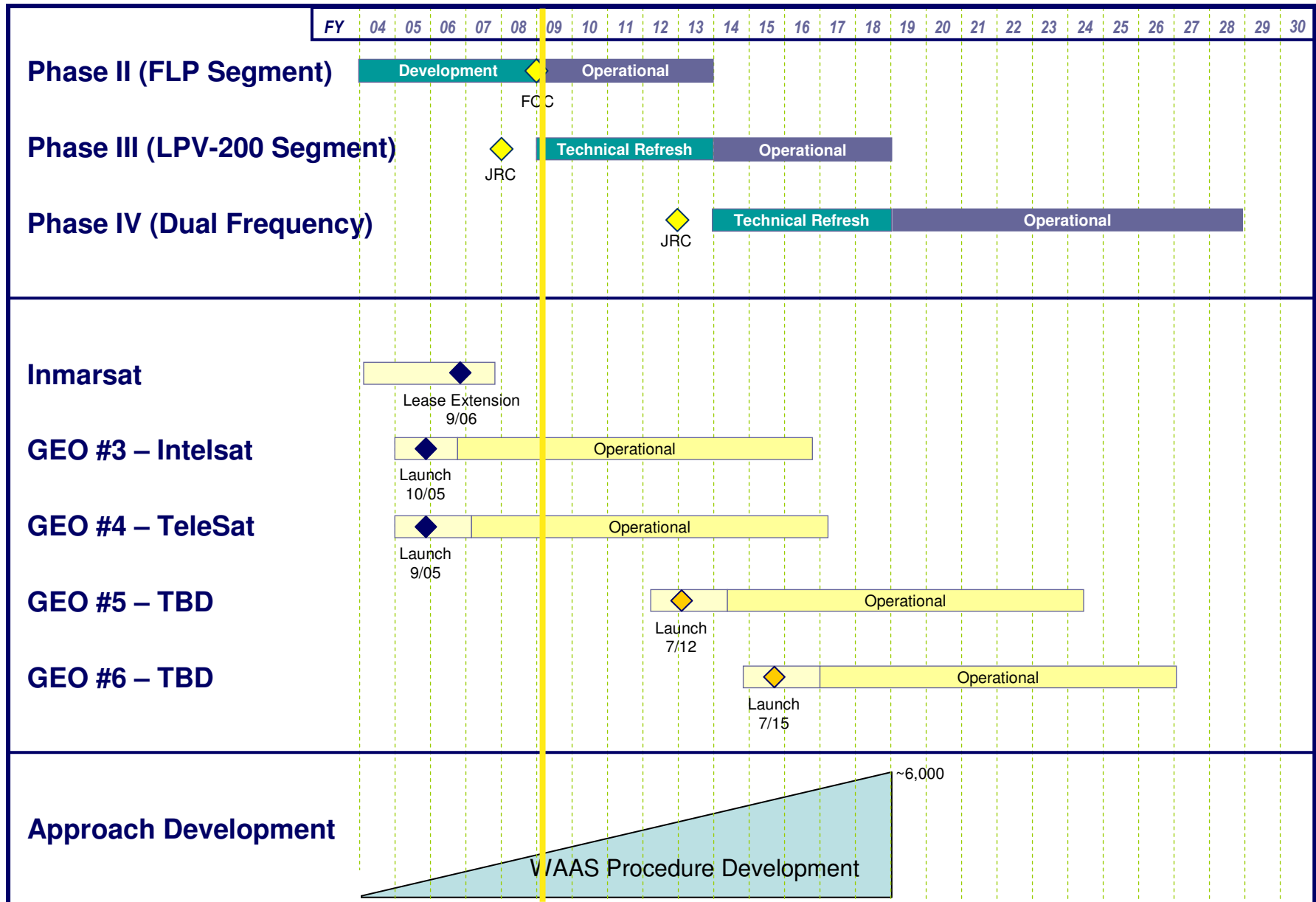
- Exceeded Instrument Landing Systems (ILS) - September 2008



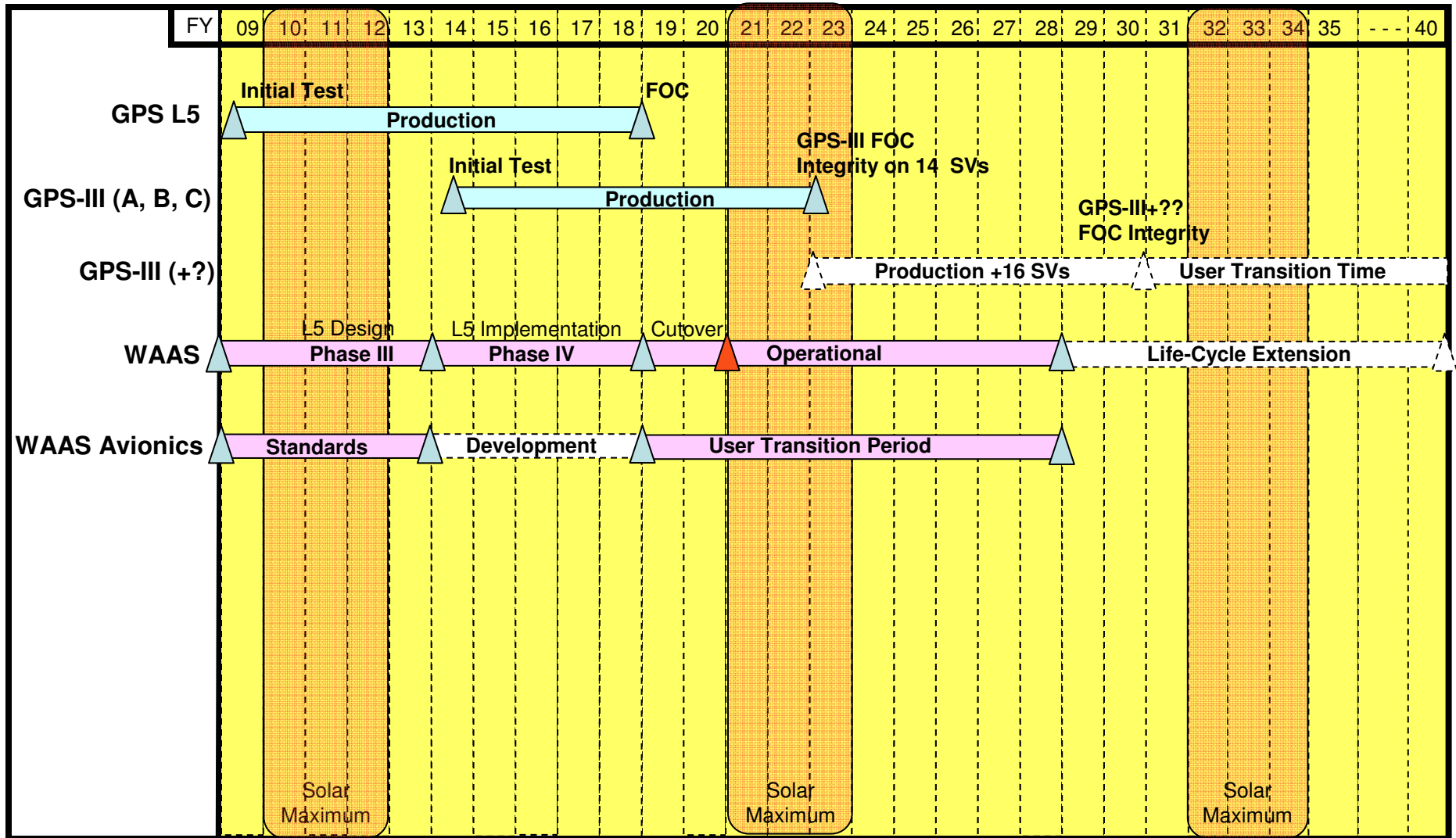
- 1,333 WAAS LPV Approach Procedures
- 785 to Non-ILS Runways
- 327 to Non-ILS Airports

WAAS Procedures to be Published to All Instrument Runways in the NAS by 2018

WAAS Enterprise Schedule



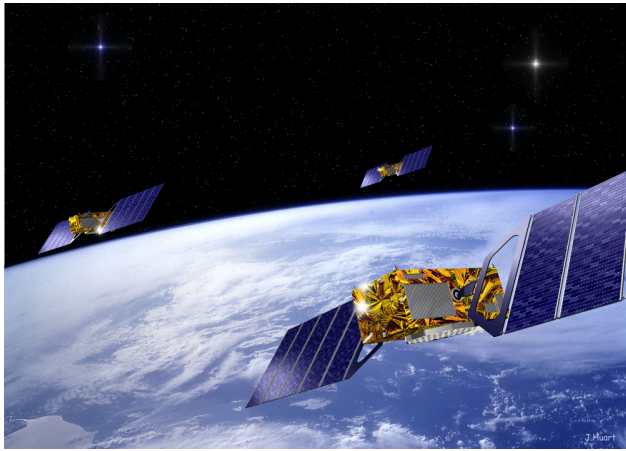
Long Term Schedule



TBD/Unfunded

▲ L2 Semi-Codeless Transition

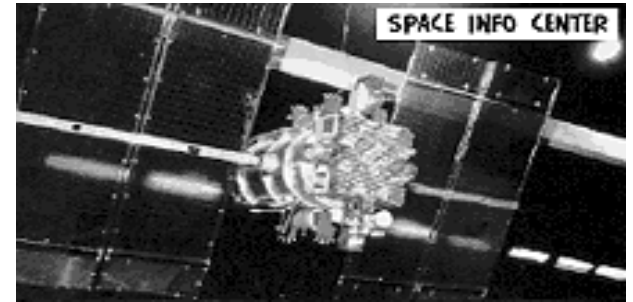
Future Considerations



Galileo (EU)



Other?



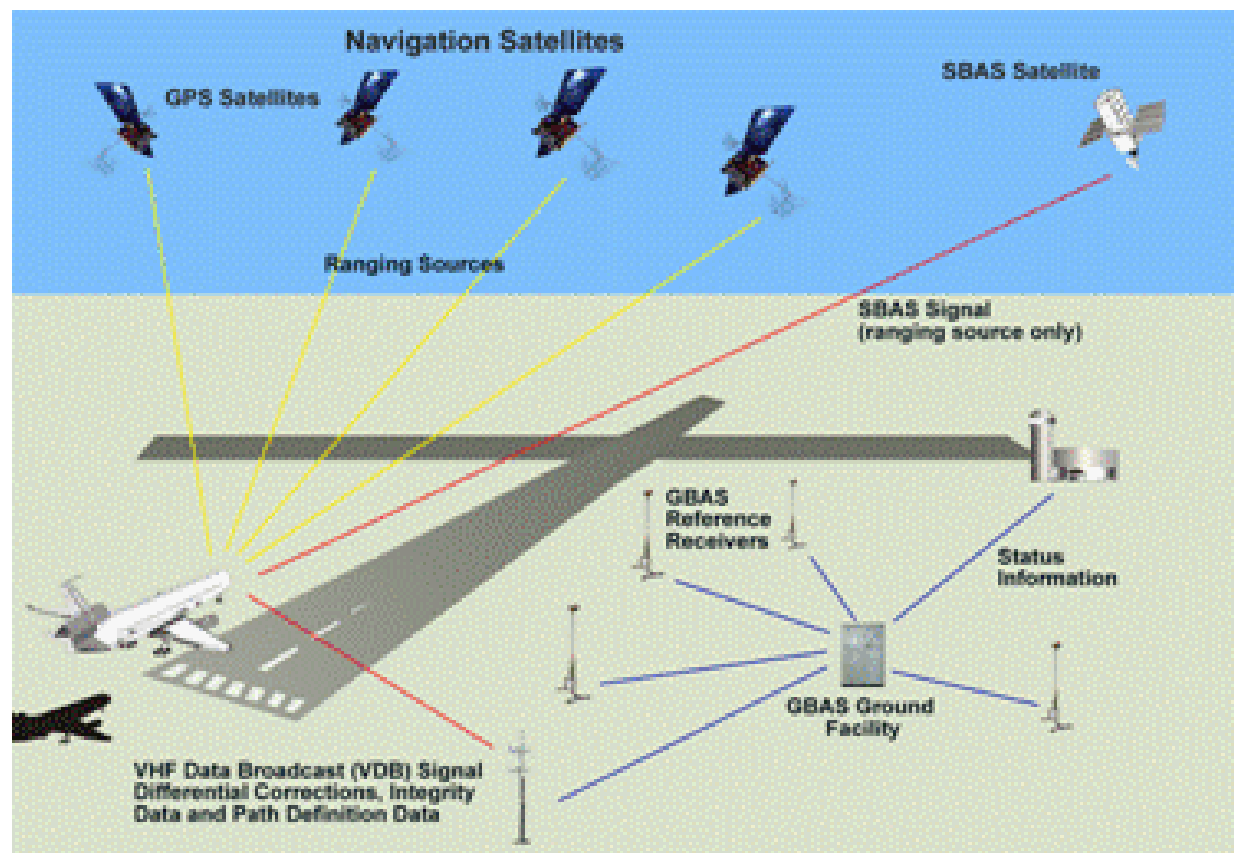
GLONASS



GPS

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

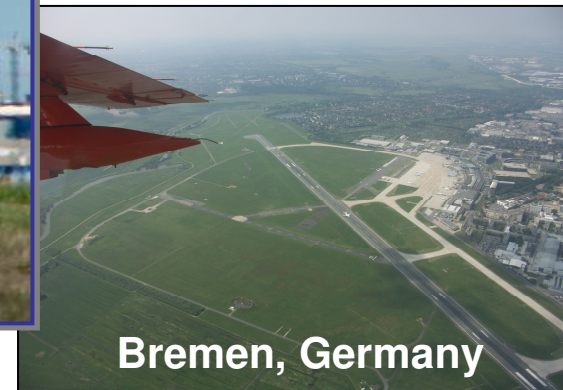
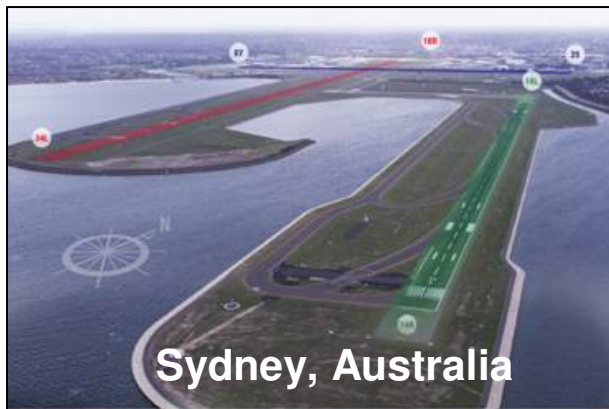


GBAS Pathway Forward

- **Cat-I System Design Approval at Memphis – Early 2009**
- **Cat-III Prototype Validation by - 2010**
- **Cat-III System Design Approval by - 2012**
- **Evaluating Potential to Leverage Resources with DoD Joint Precision Approach Landing System (JPALS)**



LAAS/GBAS International Efforts



Automatic Dependent Surveillance - Broadcast (ADS-B)

- **Automatic**
 - Periodically transmits information with no pilot or operator input required
- **Dependent**
 - Position and velocity vector are derived from the Global Positioning System (GPS)
- **Surveillance -**
 - A method of determining position of aircraft, vehicles, or other asset
- **Broadcast**
 - Transmitted information available to anyone with the appropriate receiving equipment



Notice of Proposed Rulemaking (NPRM)

- **Aviation Rulemaking Committee (ARC)**
 - ARC is considering 36 summary recommendations
 - 26 recommendations will be resolved before any rule is adopted
 - ADS-B Link Strategy
 - ADS-B Program and Business Case
 - Performance Requirements
 - Required Equipment
 - Communication, Navigation and Surveillance Equipment
 - 10 recommendations for future consideration
 - ADS-B Program and Business Case
 - Required Equipment
 - Communication, Navigation and Surveillance Equipment
 - Security, Privacy, and Malicious Use
 - 4 recommendations have PNT considerations



Summary of Recommendations for Final Rule

Recommendation #	Summary
Performance Requirements	
Recommendation #14	Performance Requirements per domain
Recommendation #15	Latency recommendations
Recommendation #16	Not apply vertical position accuracy in NAC 9
Recommendation #17	Allow for foreign satellite constellations
Recommendation #18	Non-Diversity Antenna
Recommendation #19	Use DO-289 MASPS to define SIL
Recommendation #20	Broadcast message element recommendations
Recommendation #21	Calculate/report continuity of RNP parameters
Recommendation #22	Specify continuity requirement
Recommendation #23	Specify 2 continuity requirements for ASSA and FAROA



Summary of Longer Term Recommendations

Recommendation #	Summary
ADS-B Program and Business Case	
Recommendation #27	Define strategy for ADS-B In
Recommendation #28	Fuse data in automation to accommodate lack of Mode 3/A Code
Recommendation #29	3nm en route separation
Required Equipment	
Recommendation #30	Implement transponder removal for low altitude operators not equipped with ACAS
Recommendation #31	Enhance ELT with tracking service
Recommendation #32	Replace ELTs
Communication, Navigation, and Surveillance Equipment	
Recommendation #33	Integrated CNS strategy to deal with GNSS outages
Security, Privacy and Malicious Use	
Recommendation #34	ICAO codes treated under privacy laws
Recommendation #35	Use Anonymity for UAT, develop a feature for it on 1090 MHz
Recommendation #36	Assign ICAO codes so they don't correlate with tail numbers



Rulemaking Next Steps

Milestone	Planned Date of Completion
ARC Recommendations finalized and submitted to the FAA	September 26, 2008
Internal Stakeholders Meeting	October 30, 2008
Comment period on ARC recommendations closes	November 3, 2008
Internal Stakeholders Meeting (ISD Focus)	November 20, 2008
FAA Rulemaking Team finalizes RPR Phase 3	November 30, 2008
RPR Phase 3 Approval (Director and Associate Level)	December 8, 2008
Internal Stakeholders Meeting	December 18, 2008 (Tentative)
RPR Phase 3 Approval (Associate Administrator / COO / AGC-1)	December 19, 2008
RPR Phase 3 Submitted to ARM	December 30, 2008
Rulemaking Council Approval of RPR	January 27, 2009



Summary

- **The WAAS Program Has Matured Through Development and is Rapidly Progressing Through Operational Implementation**
- **The First Certified LAAS is Expected In Early 2009**
- **LAAS is Expected to Achieve Category-III By 2012**
- **ADS-B Program Progressing On Track**

