

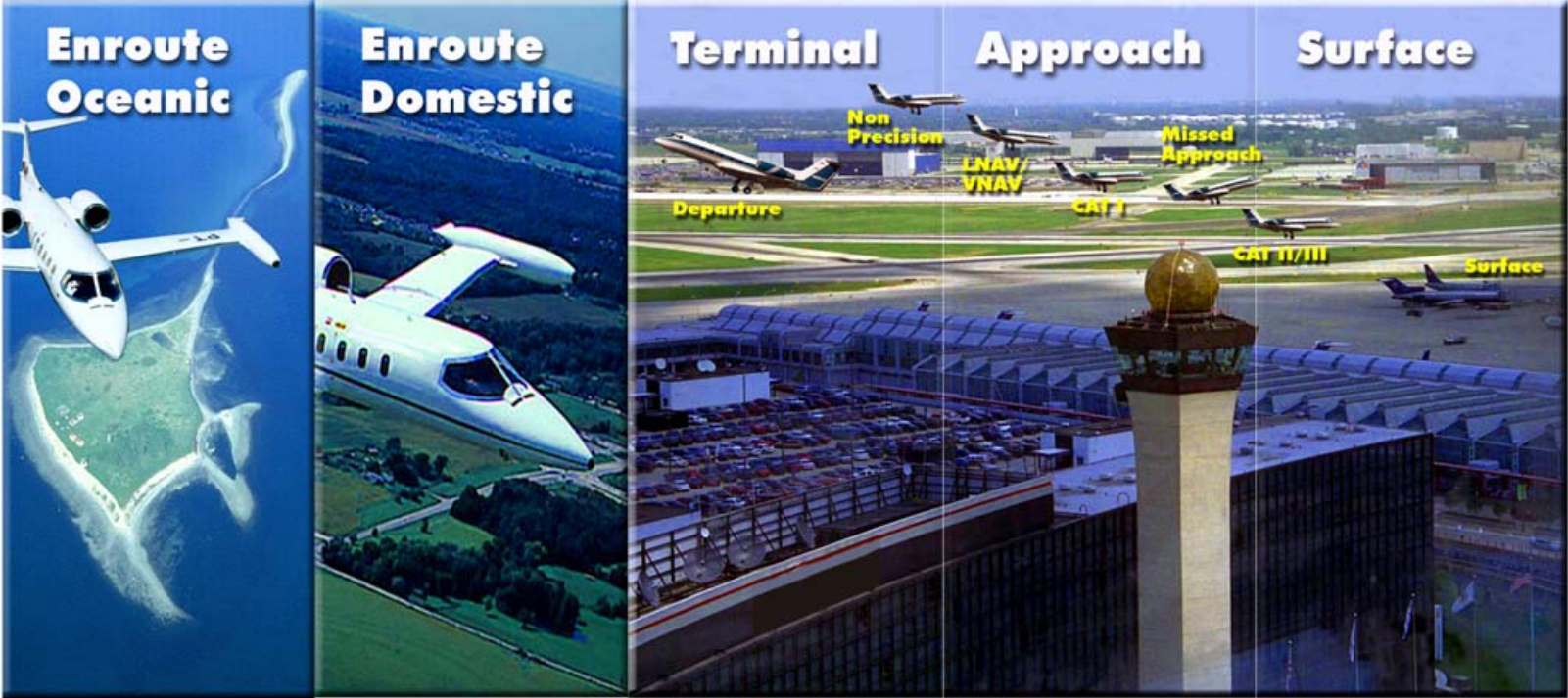
Wide Area Augmentation System (WAAS)

UN ICG Experts Meeting
July 15, 2008



FAA Satellite Navigation Program

WAAS



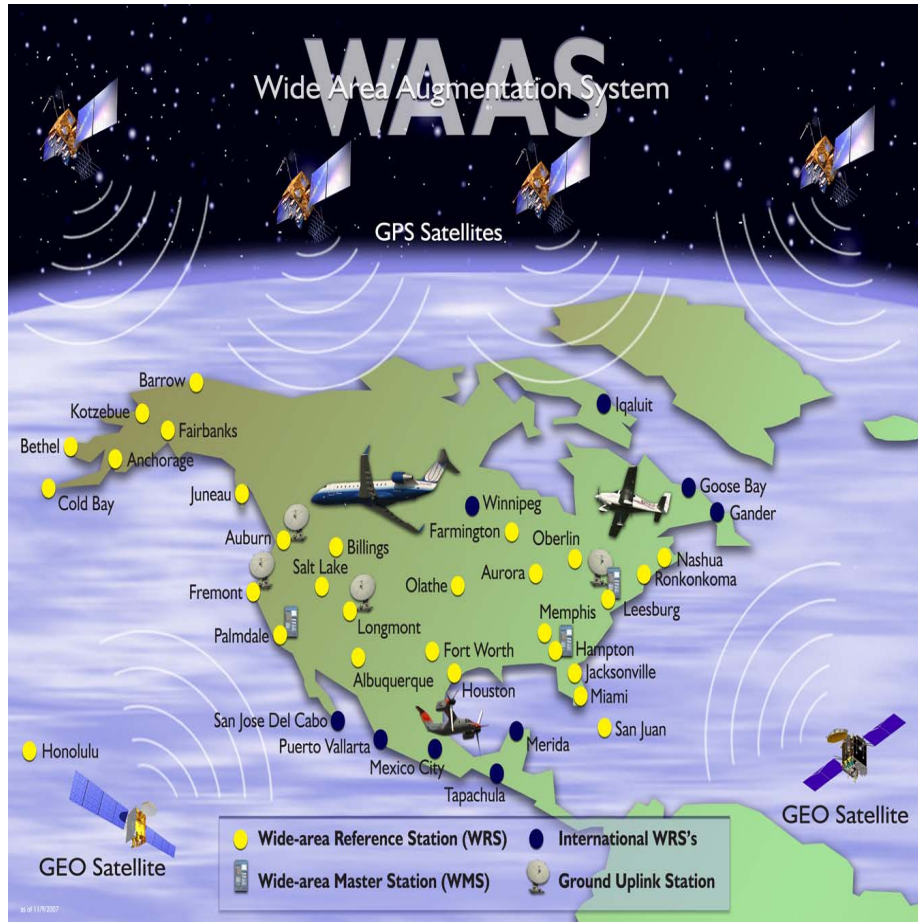
LAAS

Wide Area Augmentation System (WAAS)
July 15, 2008



Federal Aviation
Administration

WAAS Architecture



38 Reference Stations



3 Master Stations



4 Ground Earth Stations



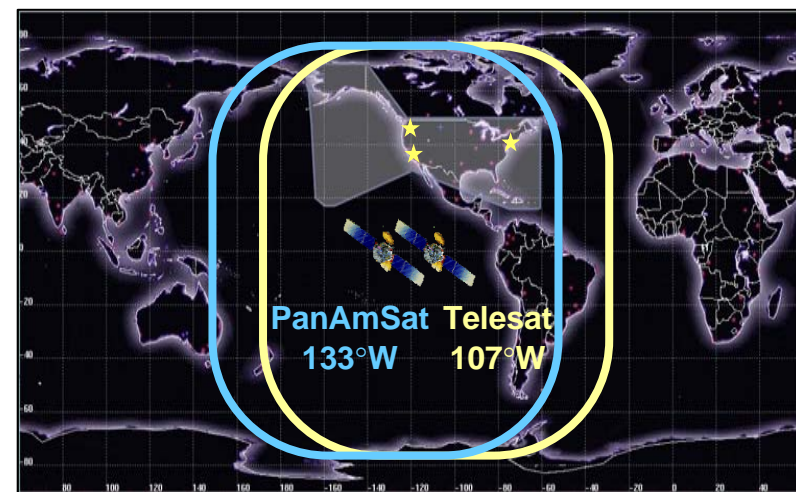
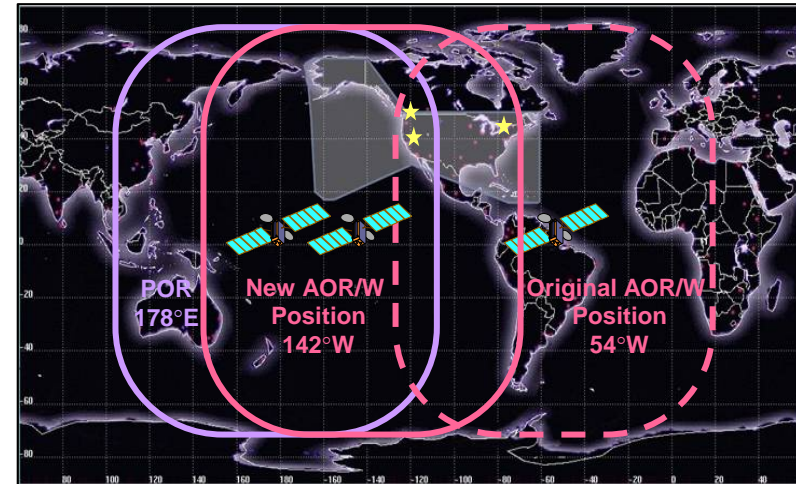
2 Geostationary Satellite Links



2 Operational Control Centers

GEO Satellites

- **Phase I (IOC) – FY2003**
 - Inmarsat Satellites
 - AOR-W – 54W
 - POR – 178E
 - AOR-W Moved to 142W
 - Leases Expired July 2007
- **Phase II – FY2008**
 - New GEOs
 - Intelsat (Galaxy XV) – 133W
 - Telesat Canada (Anik F1R) – 107W
 - Operational July 2007
 - 10 Year Lease
- **Actively seeking third GEO ~ 125W**



WAAS Signals

- **Current:**
 - Center frequency: 1575.42 MHz (GPS L1)
 - Similar modulation as GPS C/A code signals, but with unique length-1023 Gold pseudorandom noise (PRN) sequences
 - 250 bit/s data (500 symbols/s with forward error correction)
 - Minimum received power level: -158.5 dBW
- **Future:**
 - Additional signal per GEO at 1176.45 MHz (GPS L5) planned
 - Envisioned design (subject to change):
 - Similar modulation as GPS L5 signals
 - Unique length-10230 PRN sequences from same code family
 - 250 bit/s data (500 symbols/s with forward error correction)
 - No pilot component
 - L5 signals are being broadcast by current WAAS GEOs, but for internal system use only

WAAS Network Time and Geodetic Reference Frame

- **WAAS has its own internal timescale, referred to as WAAS Network Time (WNT)**
 - Continually steered to within 50 ns of GPS time
- **World Geodetic System 1984 (WGS-84)**
 - Consistent with International Terrestrial Reference Frame (ITRF) 2000 to ~centimeter level



WAAS Accuracy Performance

	GPS Standard	GPS Actual	WAAS LPV-200 Standard	WAAS LPV-200 Actual
Horizontal 95%	36 m	2.74 m	16 m	1.08 m
Vertical 95%	77 m	*3.89 m	4 m	1.26 m

**** Use of GPS vertical not authorized for aviation without augmentation (SBAS or GBAS)***

WAAS Performance evaluated based on a total of 1,761 million samples (or 20,389 user days)

WAAS Phases

- **Phase I: Initial Operating Capability (July 2003)**
 - Provided LNAV/VNAV/Limited LPV Capability
- **Phase II: Full LPV (2003 – 2008)**
 - Improved LPV availability in CONUS and Alaska
 - Consists of additional WRS, hardware updates, software optimization, improved human factors, and GEO replacement
- **Phase III: Full LPV-200 (Cat I Equivalent) Performance (2009 – 2013)**
 - Development, modifications, and enhancements to include tech refresh
 - Steady state operations and maintenance
- **Phase IV: Dual Frequency Operations (2013 – 2028)**
 - Scheduled to align with GPS Modernization Program (L5)
 - Provide additional protection against unintentional GPS interference
 - Will significantly improve availability and continuity during severe solar activity
 - WAAS will continue to support single frequency users



Questions

<http://gps.faa.gov>



Instrument Approach Services

