



# ***United States GNSS Update***

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***Asia-Oceania Regional GNSS Workshop  
Bangkok, Thailand***

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# *Overview*

- **Systems Status**
- U.S. Space-based PNT Policy
- International Cooperation Activities





## *GPS Constellation Status*

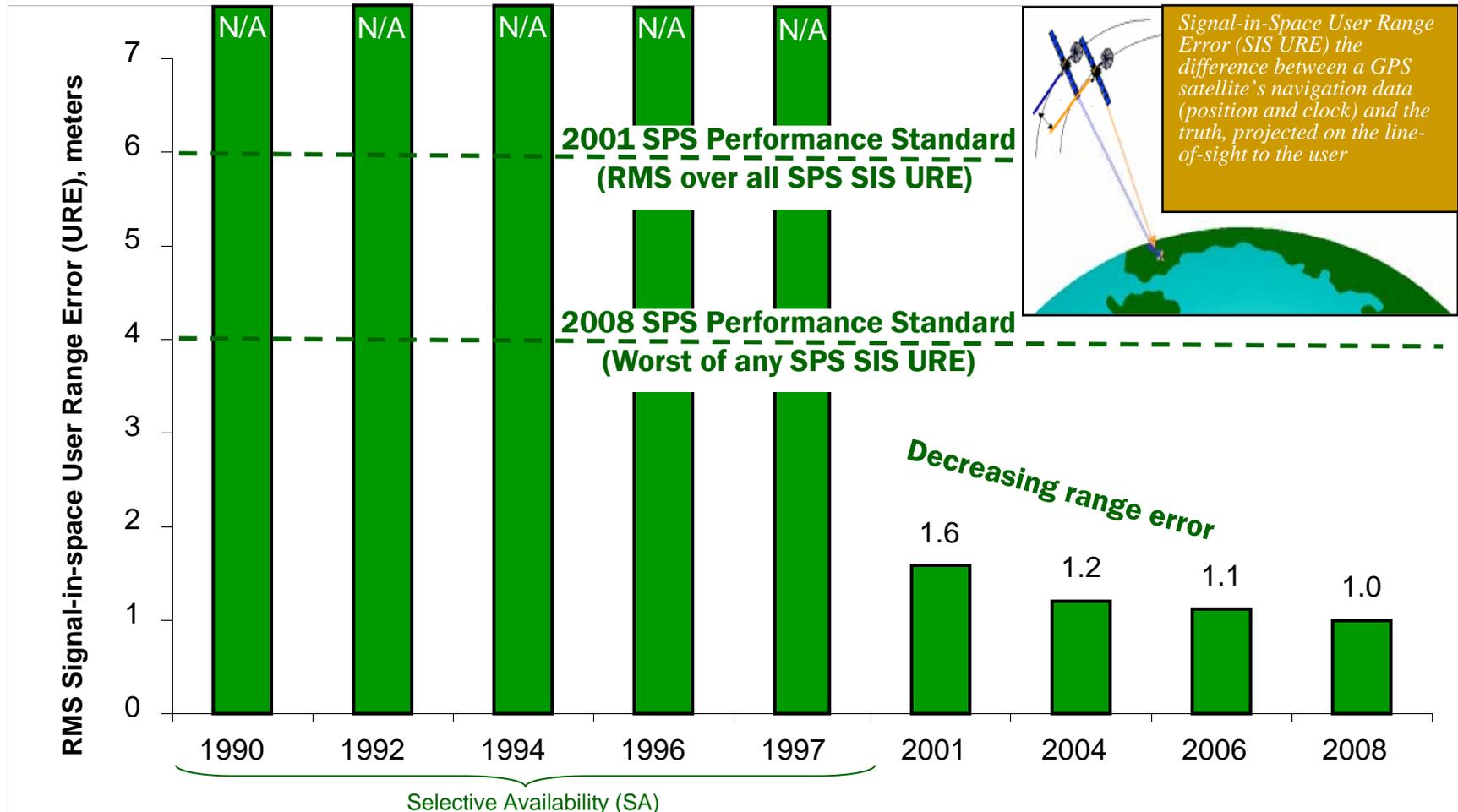
### *30 Healthy Satellites (Baseline Constellation: 24)*

- 11 Block IIA
- 12 Block IIR
- 7 Block IIR-M
  - 1 IIR-M in on-orbit testing
  - 4 additional satellites in residual status
- Next launch (IIF) scheduled for June 2010
- Global GPS civil service performance commitment met continuously since December 1993





# SPS Signal in Space Performance

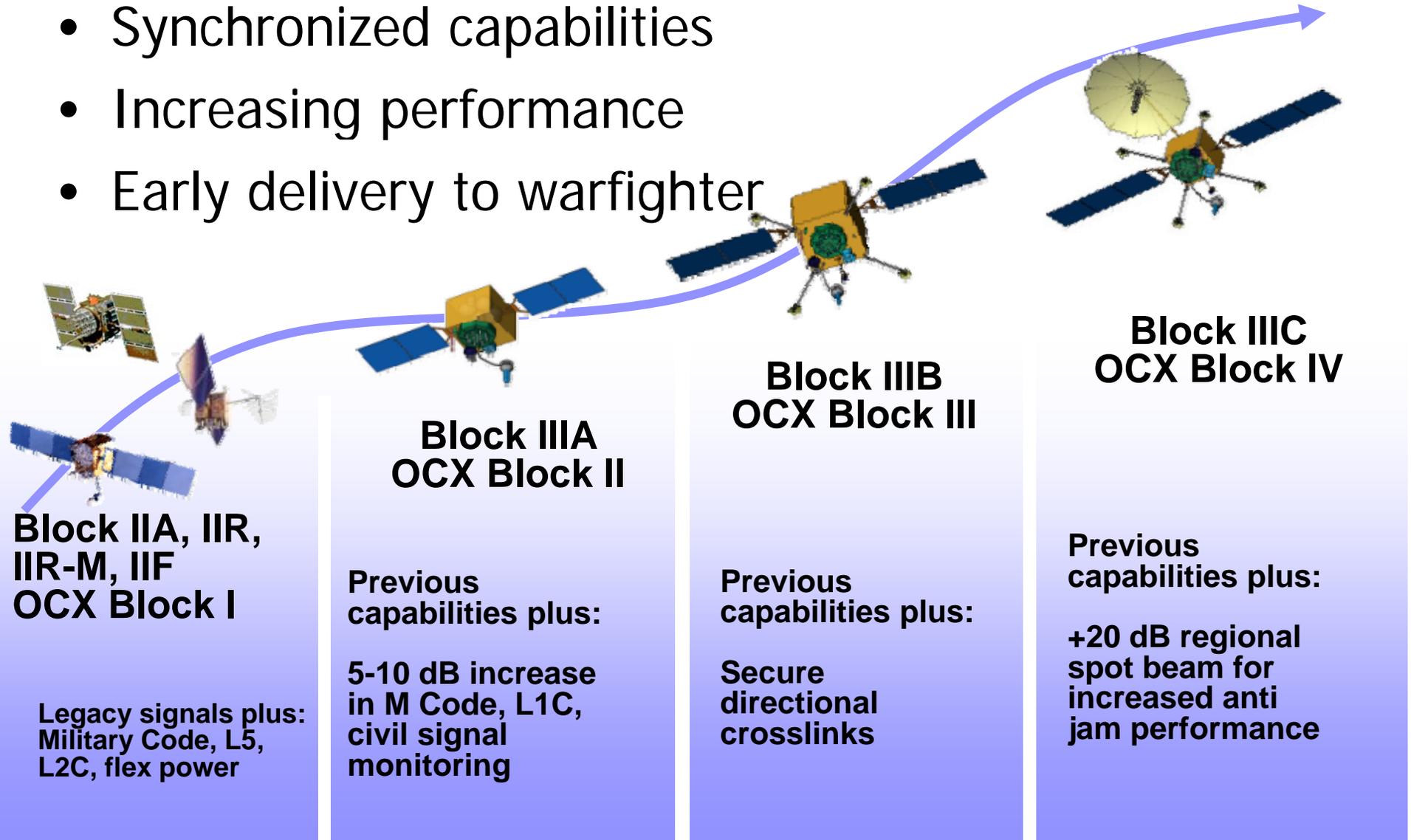


*System accuracy exceeds published standard*



# GPS III Incremental Approach

- Synchronized capabilities
- Increasing performance
- Early delivery to warfighter





## *Recent Program Successes*

### Space Segment

- SVN 49 launched in March 09
  - L5 demo payload secured frequency filing
  - Signal distortion investigation still underway
- SVN 50 launched in August 09
  - Set healthy
  - Completed GPS Delta II launches
- GPS IIF completed Pathfinder testing
- GPS IIIA completed Preliminary Design Reviews



### Ground Segment

- Delivered new version of OCS (AEP 5.5) to final regression testing with SAASM capability
- Completed successful OCX, SDR, Modernized Capability Demo and RFP release





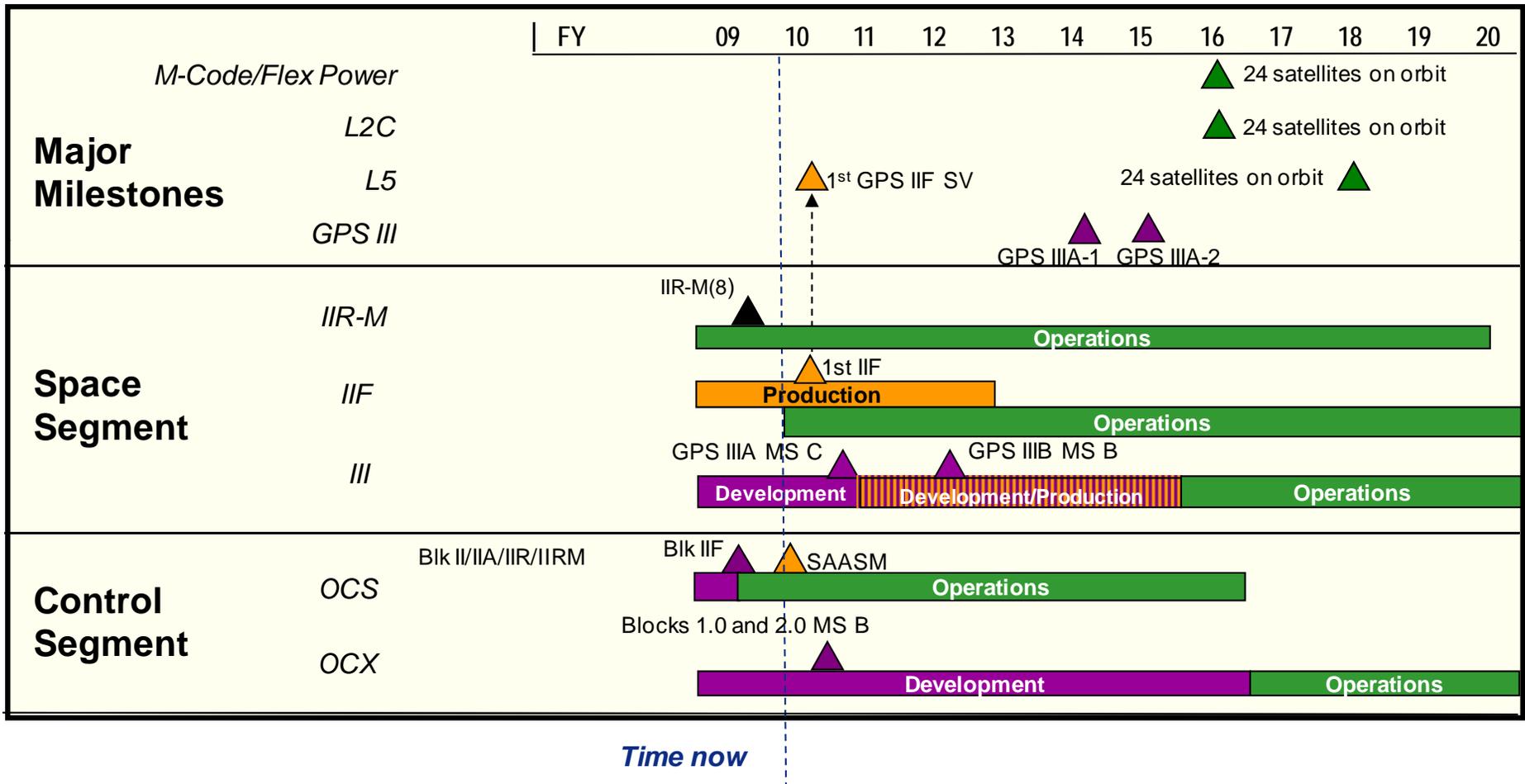
## *Civil Capability Improvements*

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- L2C
  - 24 operational satellites in FY16
  - Defined in IS-GPS-200
- L5
  - Demonstration payload on IIR-20(M) to ensure frequency spectrum protection
  - 24 operational satellites in FY18
  - Defined in IS-GPS-705
- L1C
  - 24 operational satellites in FY21
  - Defined in IS-GPS-800
- Integrity Monitoring
  - GPS III integrity enhanced by SV reliability and on-board clock monitoring



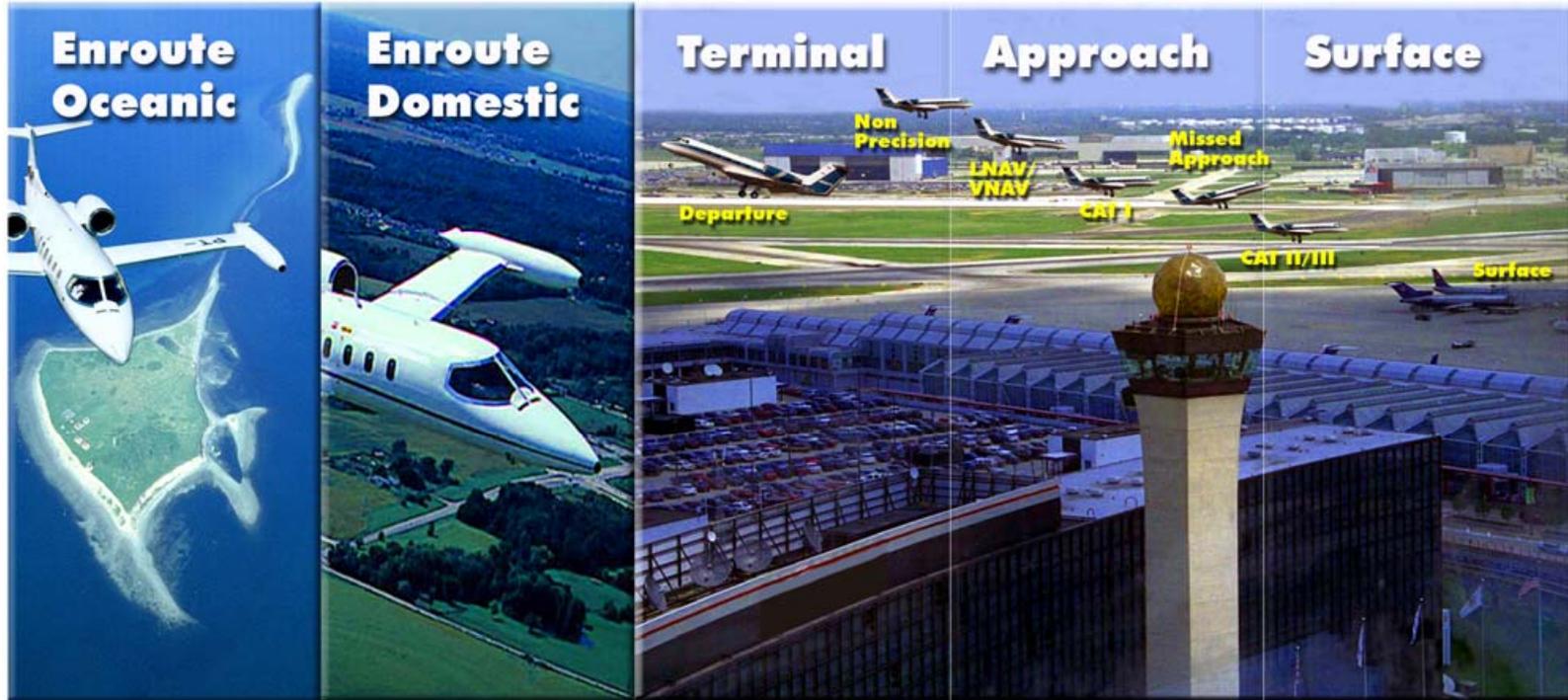
# GPS Enterprise Schedule





# FAA GPS Augmentation Programs

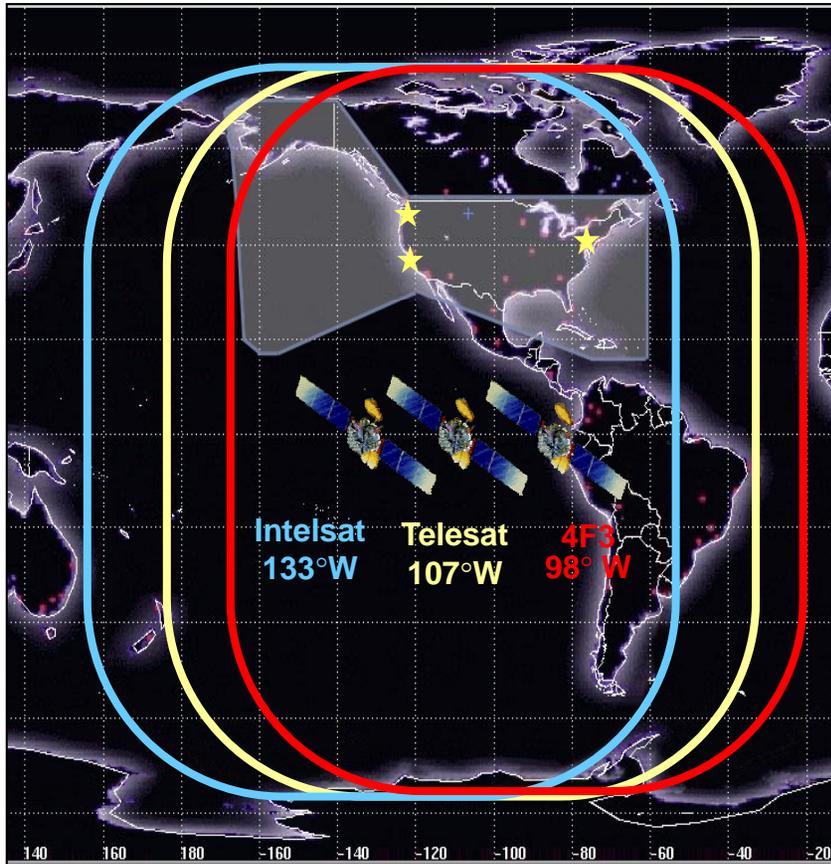
## WAAS



## LAAS



# WAAS Architecture



38 Reference Stations



3 Master Stations



4 Ground Earth Stations



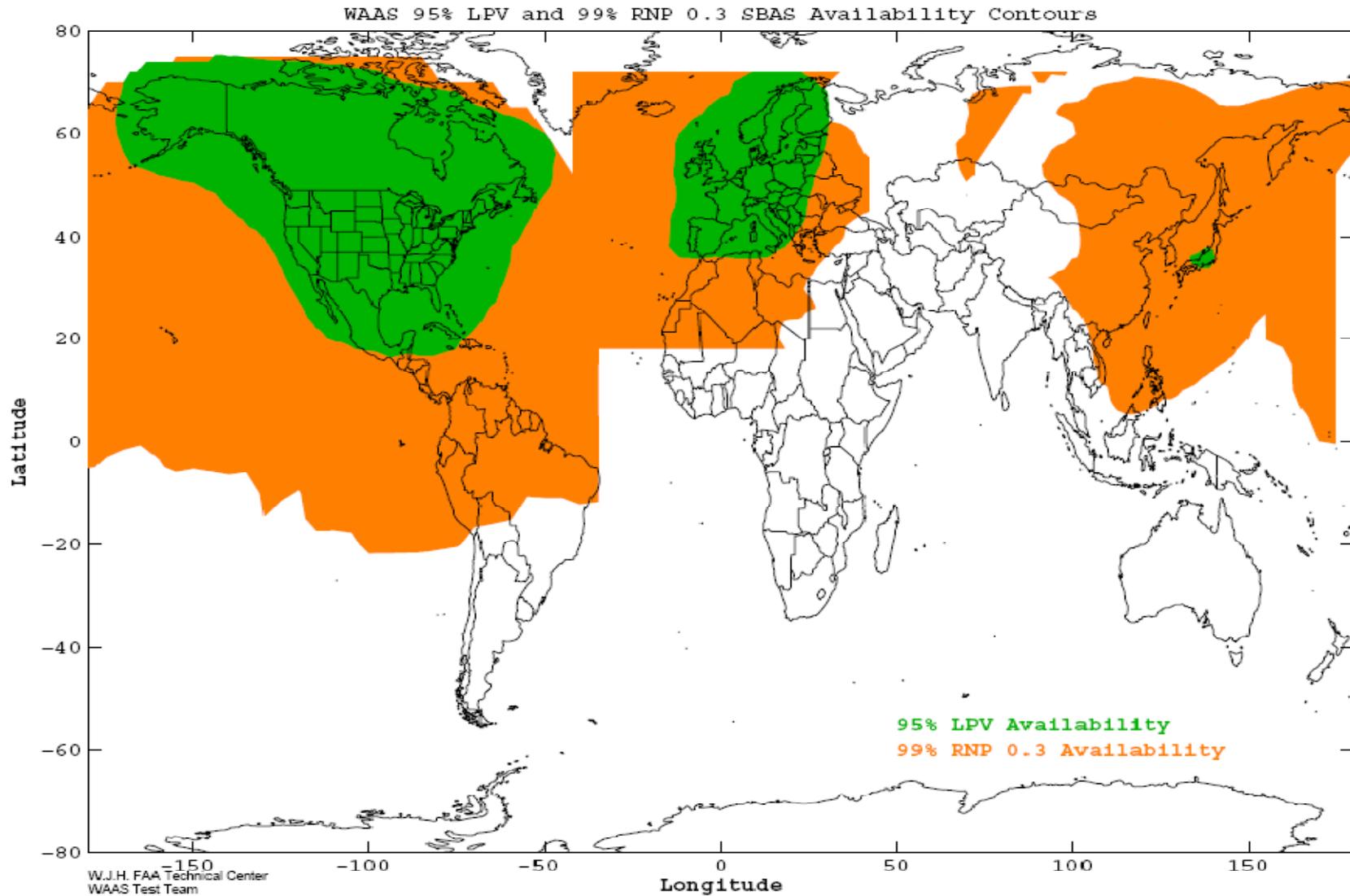
(2+1) Geostationary Satellite Links



2 Operational Control Centers



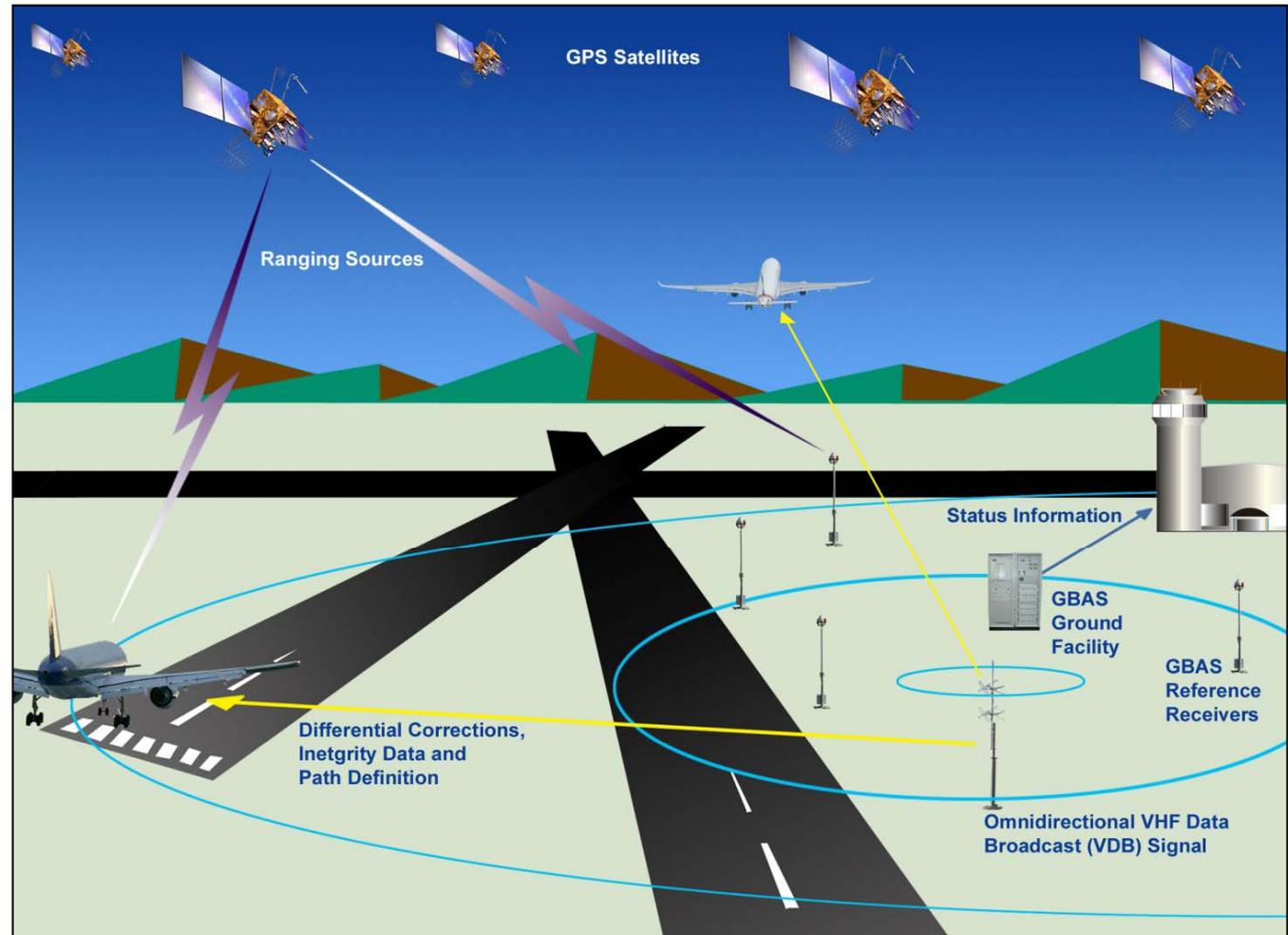
# Global SBAS Coverage





# Local Area Augmentation System (LAAS)

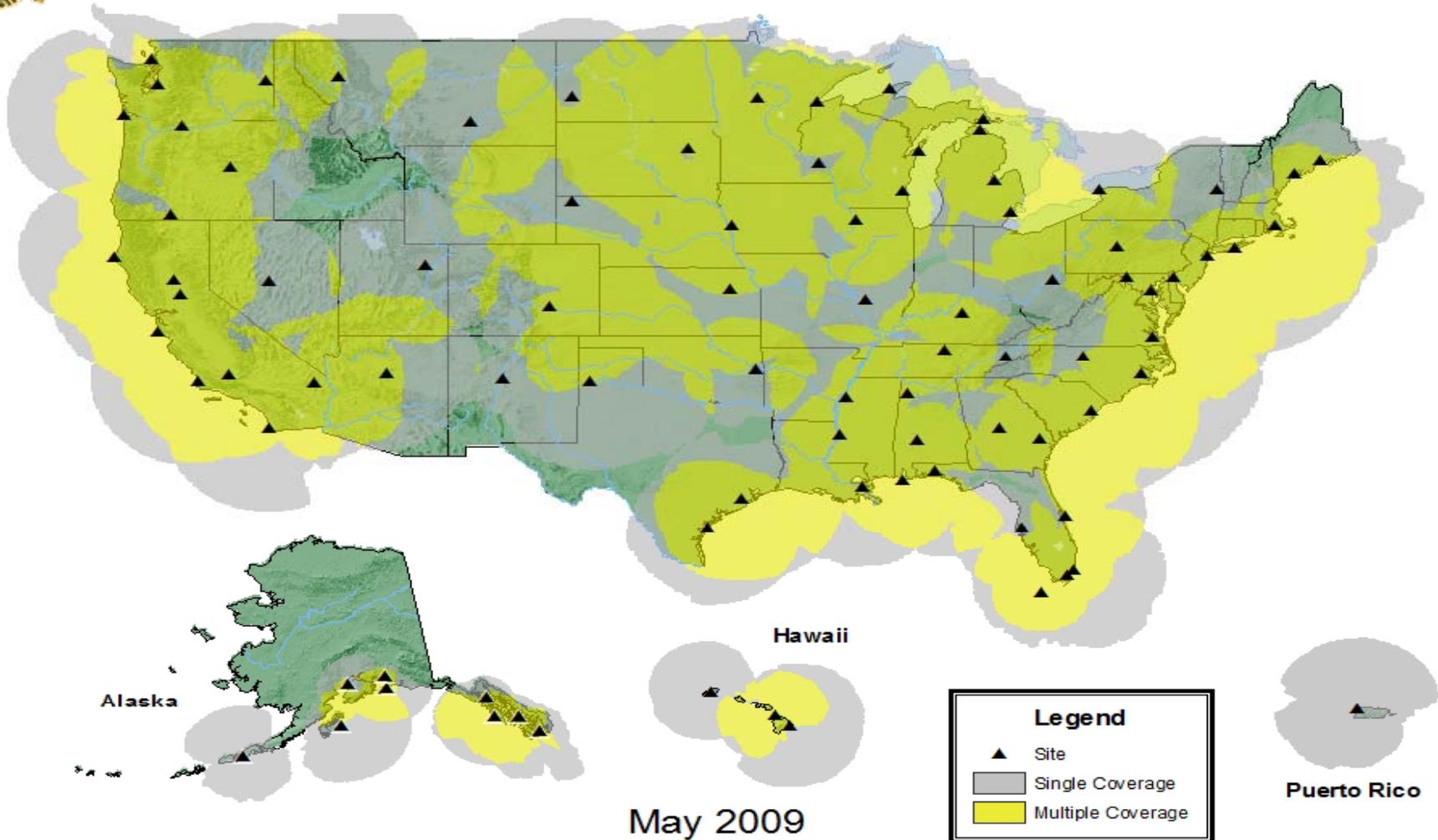
- Precision Approach For CAT- I, II, III
- Multiple Runway Coverage At An Airport
- 3D RNP Procedures (RTA), CDAs
- Navigation for Closely Spaced Parallels
- Super Density Operations



- LAAS is Expected to Achieve Category-III By 2012



# *Nationwide Differential GPS*

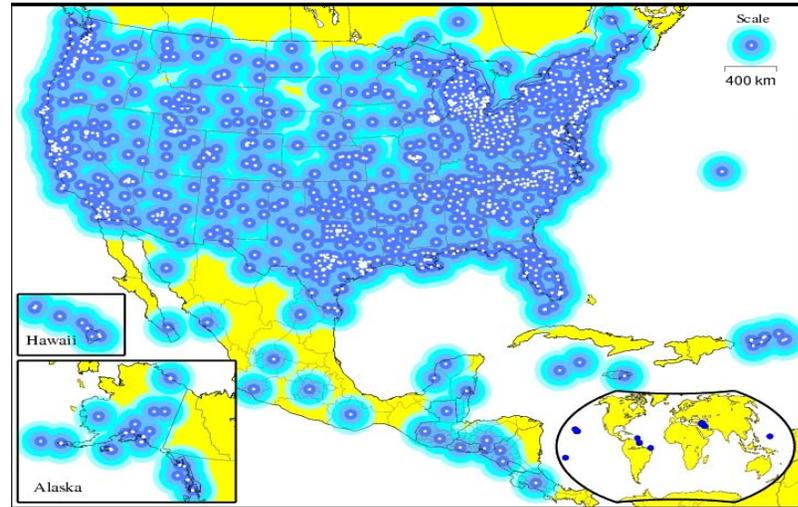


- Expansion of maritime differential GPS (DGPS) network to cover terrestrial United States
- Built to international standard adopted in 50+ countries



# *National Continuously Operating Reference Stations (CORS)*

- Enables highly accurate, 3-D positioning
  - Centimeter-level precision
  - Tied to National Spatial Reference System
- **1,200+** sites operated by 200+ public, private, academic organizations
- NOAA's Online Positioning User Service (OPUS) automatically processes coordinates submitted via the web from around the world
- OPUS-RS (Rapid Static) declared operational in 2007
- NOAA considering support for real-time networks





- Systems Status
- **U.S. Space-based PNT Policy**
- International Cooperation Activities





## *U.S. Space-Based PNT Policy*

*GOAL: Ensure the U.S. maintains space-based PNT services, augmentation, back-up, and service denial capabilities that...*

- Provide uninterrupted availability of PNT services
- Meet growing national, homeland, economic security, and civil requirements, and scientific and commercial demands
- Remain the pre-eminent military space-based PNT service
- Continue to provide civil services that exceed or are competitive with foreign civil space-based PNT services and augmentation systems
- Remain essential components of internationally accepted PNT services
- Promote U.S. technological leadership in applications involving space-based PNT services



## *U.S. Policy Promotes Global Use of GPS Technology*

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- No direct user fees for civil GPS services
  - Provided on a continuous, worldwide basis
- Open, public signal structures for all civil services
  - Promotes equal access for user equipment manufacturing, applications development, and value-added services
  - Encourages open, market-driven competition
- Global **compatibility** and **interoperability** with GPS
- Service improvements for civil, commercial, and scientific users worldwide
- Protection of radionavigation spectrum from disruption and interference



- Systems Status
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## *U.S. Objectives in Working with Other GNSS Service Providers*

- Ensure **compatibility** – ability of U.S. and non-U.S. space-based PNT services to be used separately or together without interfering with each individual service or signal
  - Radio frequency compatibility
  - Spectral separation between M-code and other signals
- Achieve **interoperability** – ability of civil U.S. and non-U.S. space-based PNT services to be used together to provide the user better capabilities than would be achieved by relying solely on one service or signal
  - Primary focus on the common L1C and L5 signals
- Ensure fair trade/open markets (non-discrimination)

***Pursue through Bilateral and Multilateral Cooperation***



## *Bilateral Cooperation*

- **U.S.-Japan** Joint Statement on GPS Cooperation in 1998
  - Japan's Quasi Zenith Satellite System (QZSS) designed to be fully compatible and highly interoperable with GPS
  - Bilateral agreements to set up QZSS monitoring stations in Hawaii and Guam. **Guam station completed!**
  - Plenary Meeting just held January 13 in Washington, D.C.
- **U.S.-India** Joint Statement on GNSS Cooperation in 2007
  - Technical Meetings focused on GPS-India Regional Navigation Satellite System (IRNSS) compatibility and interoperability held in 2008 and 2009



## *Bilateral Cooperation (continued)*

- **U.S.-China** operator-to-operator coordination under ITU auspices
  - Bilateral Meetings at Geneva, June 2007; Xian, China, May 2008; Geneva, October 2008; San Ya, China, December 2009
- **U.S.-Australia** Joint Delegation Statement on Cooperation in the Civil Use of GPS signed April 19, 2007
  - Cooperation expands upon existing efforts to ensure interoperability between GPS and Australia's augmentation systems
  - U.S. Coast Guard NAVCEN posts a daily Position Dilution of Precision (PDOP) report in response to Australia's concerns over planned GPS outages



## *Bilateral Cooperation (continued)*

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- **U.S.-Russia** Joint Statement issued in December 2004
  - Negotiations for a U.S.-Russia Agreement on satellite navigation cooperation underway since late 2005
  - Working Groups on compatibility/interoperability, search and rescue
- **U.S.-EU** GPS-Galileo Cooperation Agreement signed in 2004
  - Four working groups were set up under the agreement
  - Improved new civil signal (MBOC) adopted in July 2007
  - First Plenary Meeting successfully held in October 2008
  - Planning for the next Plenary meeting to be held this Spring



# *Multilateral Cooperation*

## *International Committee on GNSS (ICG)*

- Emerged from 3rd UN Conference on the Exploration and Peaceful Uses of Outer Space July 1999
  - Promote the use of GNSS and its integration into infrastructures, particularly in developing countries
  - Encourage compatibility and interoperability among global and regional systems
- Members include:
  - **GNSS Providers** (U.S., EU, Russia, China, India, Japan)
  - Other Member States of the United Nations
  - International organizations/associations



[www.icgsecretariat.org](http://www.icgsecretariat.org)



## *Fourth Meeting of the ICG St. Petersburg, Russia, September 2009*

- Working Group on Compatibility and Interoperability will continue working on these important principles and their definition
  - Process of seeking users and manufacturers views on interoperability will continue – *workshop held on Nov. 30 in Australia*
- **Adopted new principle on transparency:** Every provider should publish documentation that describes signal and system information, policies of provision and minimum levels of performance for its open services
- Established Time and Geodesy Task Forces to pursue traceability to international standards, enhancing interoperability for the user
- Agreed to support a proposal for a multi-GNSS Demonstration Project in the Asia/Oceania region

*Fifth Meeting of ICG will be jointly hosted by Italy and the European Union, October 18 – 22, 2010 in Turin, Italy*



# *Multilateral Cooperation*

## *APEC GNSS Implementation Team*

- The Asia-Pacific Economic Cooperation (APEC) forum facilitates economic growth, cooperation, trade and investment in the Asia-Pacific region for its 21 member economies
- The APEC GNSS Implementation Team (GIT) has focused on air traffic control and aviation issues
  - The group has broadened its focus to the **application of GNSS in all transportation sectors**
  - Additional participation of GNSS government and industry experts at APEC GIT-13 at Singapore in July 2009; project proposal made on surface transportation
  - **APEC GIT-14 meeting will be held in Seattle, Washington, June 21-24, 2010**





## *Summary*

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- **GPS is highly dependable** and its performance continues to improve
- U.S. Space-based PNT policy **encourages worldwide use** of civil GPS and augmentations
  - Policy **stability** and **transparency** improve industry confidence and investment
- The U.S. is actively engaged in **bilateral, and multilateral GNSS cooperation**
  - As new regional and global navigation satellite systems are emerging, **interoperability** is the key to **“success for all”**



## *Contact Information*

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