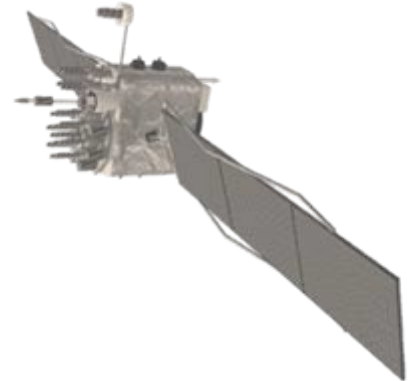# U.S. Space-Based Positioning, Navigation and Timing Policy and Program Update

5th International Committee on GNSS

18 October 2010

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Director, National Coordination Office
United States of America

Overview

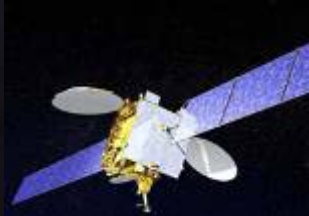U.S. Space-Based PNT Policy

Global Positioning System
Description

GPS Augmentations

Summary

GNSS is Essential to Our Economies and National Critical Infrastructures

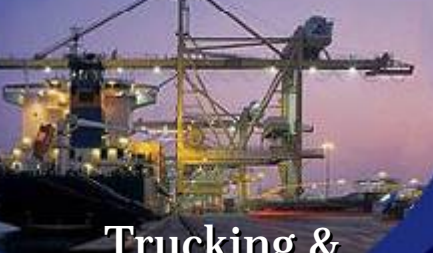Satellite Operation

Surveying & Mapping

Power Grids

Precision Agriculture

Transit Operations

NextGen

Trucking & Shipping

IntelliDrive

Telecom

Personal Navigation

Disease Control

Oil Exploration

Fishing & Boating

3

U.S. Policy: Maintain leadership in the service, provision and use of GNSS

- Provide continuous worldwide access for peaceful uses, free of direct user charges

- Encourage compatibility and interoperability with foreign GNSS services and promote transparency in civil service provisioning

- Operate and maintain constellation to satisfy civil and national security needs

  - *Foreign PNT services may be used to complement services from GPS*

- Invest in domestic capabilities and support international activities to detect, mitigate and increase resiliency to harmful interference

- Policy Stability
- Transparency
- Program Stability
- Sustained Performance and Credibility
- Continuous Improvement

Policy stability and transparency improve industry confidence and investment

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 a level playing field in the global marketplace

Pursue through Bilateral and Multilateral Cooperation

GPS Constellation Status

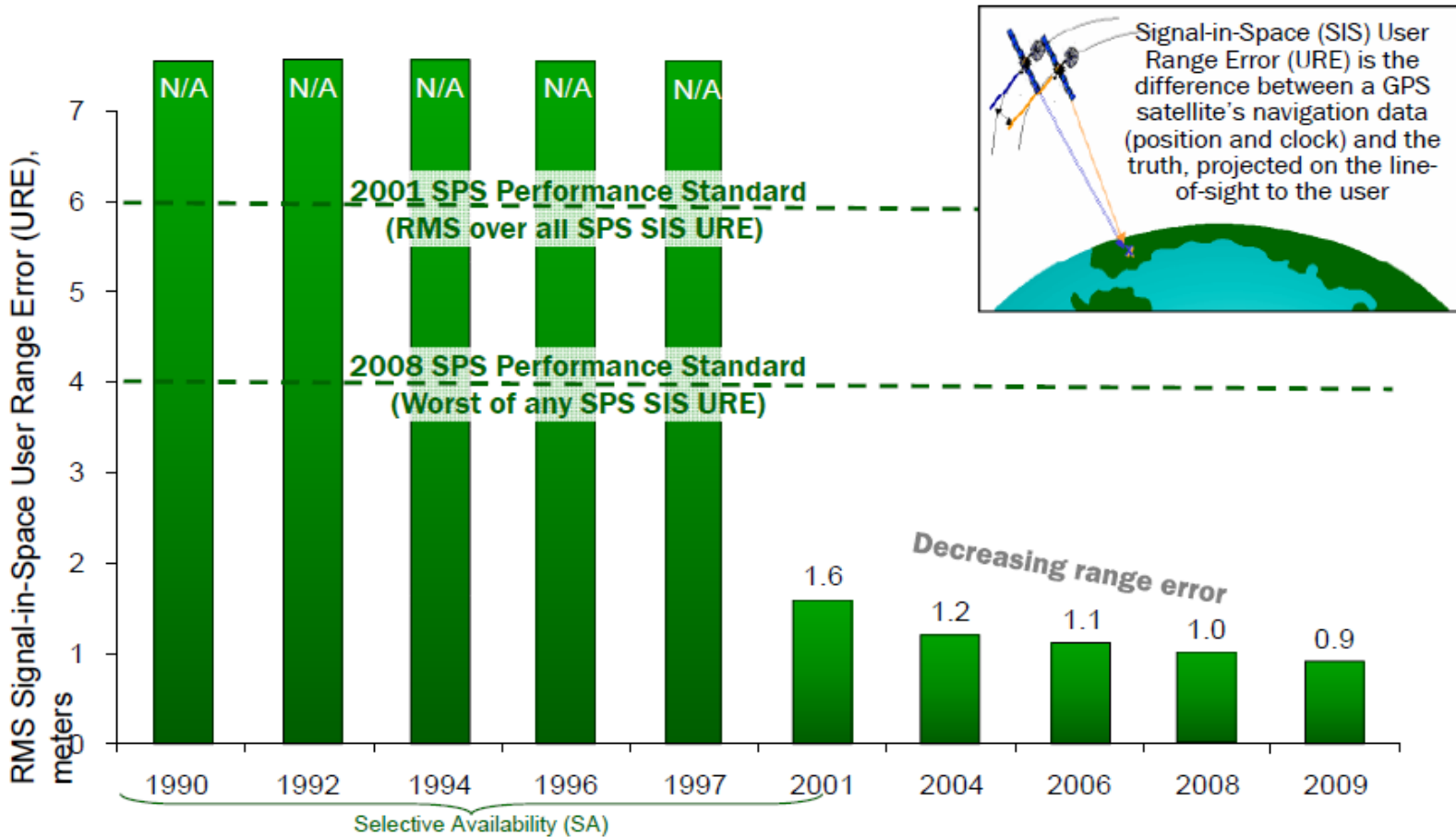## 31 Healthy Satellites
Baseline Constellation: 24

- 11 Block IIA satellites

- 12 Block IIR satellites

- 7 Block IIR-M satellites (8 operational)
  - 1 IIR-M in "test" mode – SVN-49

- 1 Block IIF satellite (SVN 62, PRN 25)
  - Launched June 2010
  - Set Healthy 27 August 2010
  - First Operational L5
  - Best GPS clock performance

- Next IIF Launch Mid 2011

SPS Signal in Space Performance

System accuracy exceeds published standard

Civil Capability Improvements

- 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
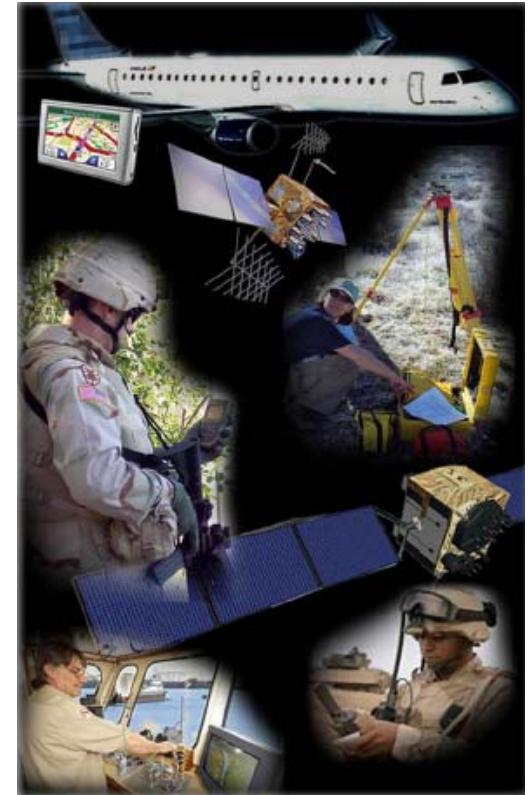
Public Interface Specifications

- **Current versions of the public GPS Signal-in-Space (SIS) Interface Specifications:**
  - **IS-GPS-200 – L1 P(Y) + C/A, L2 P(Y) + L2C**
  - **IS-GPS-705 – L5 I5 + Q5**
  - **IS-GPS-800 – L1 L1CP + L1CD**

  - **These, and other key IS/ICD documents available at: http://www.losangeles.af.mil/library/factsheets/factsheet.asp?id=9364**
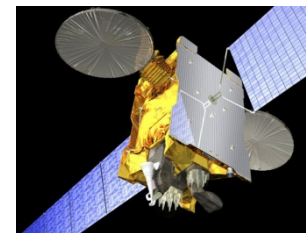
WAAS Architecture
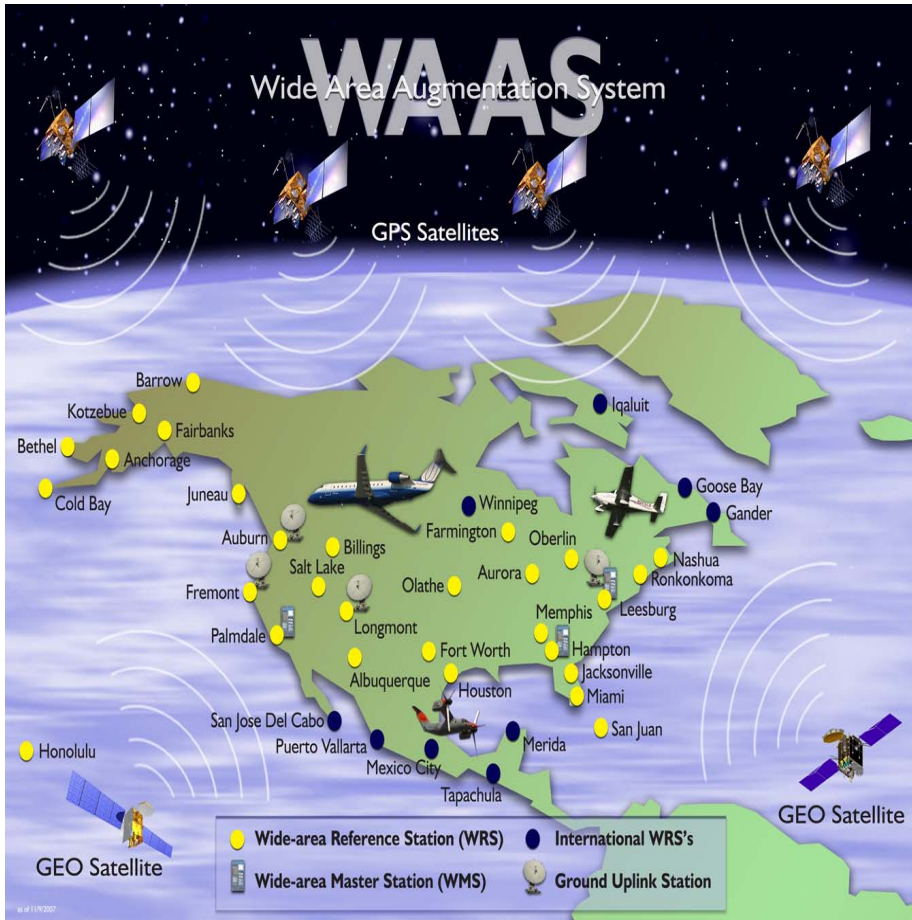
38 Reference Stations

3 Master Stations

4 Ground Earth Stations
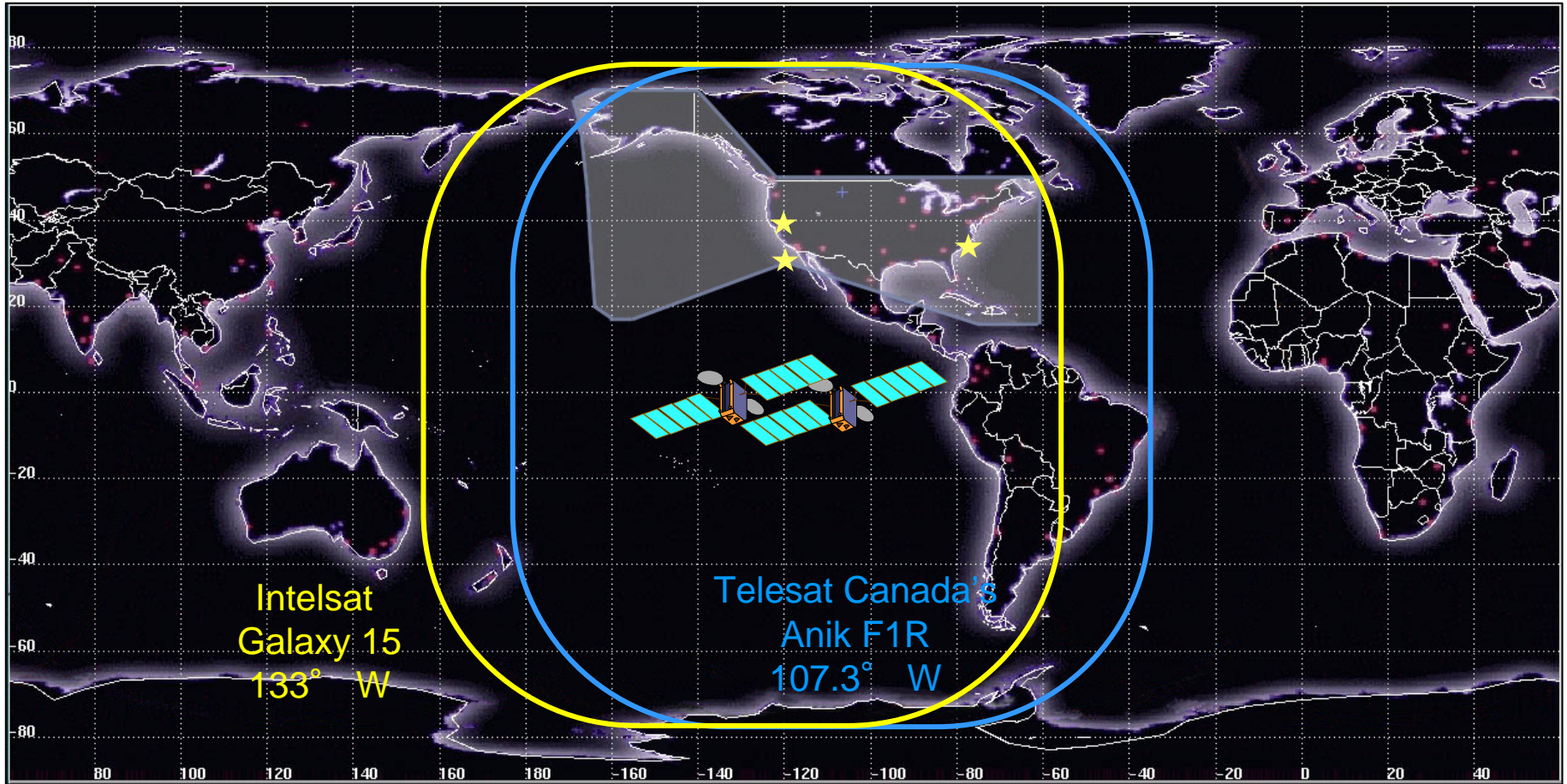
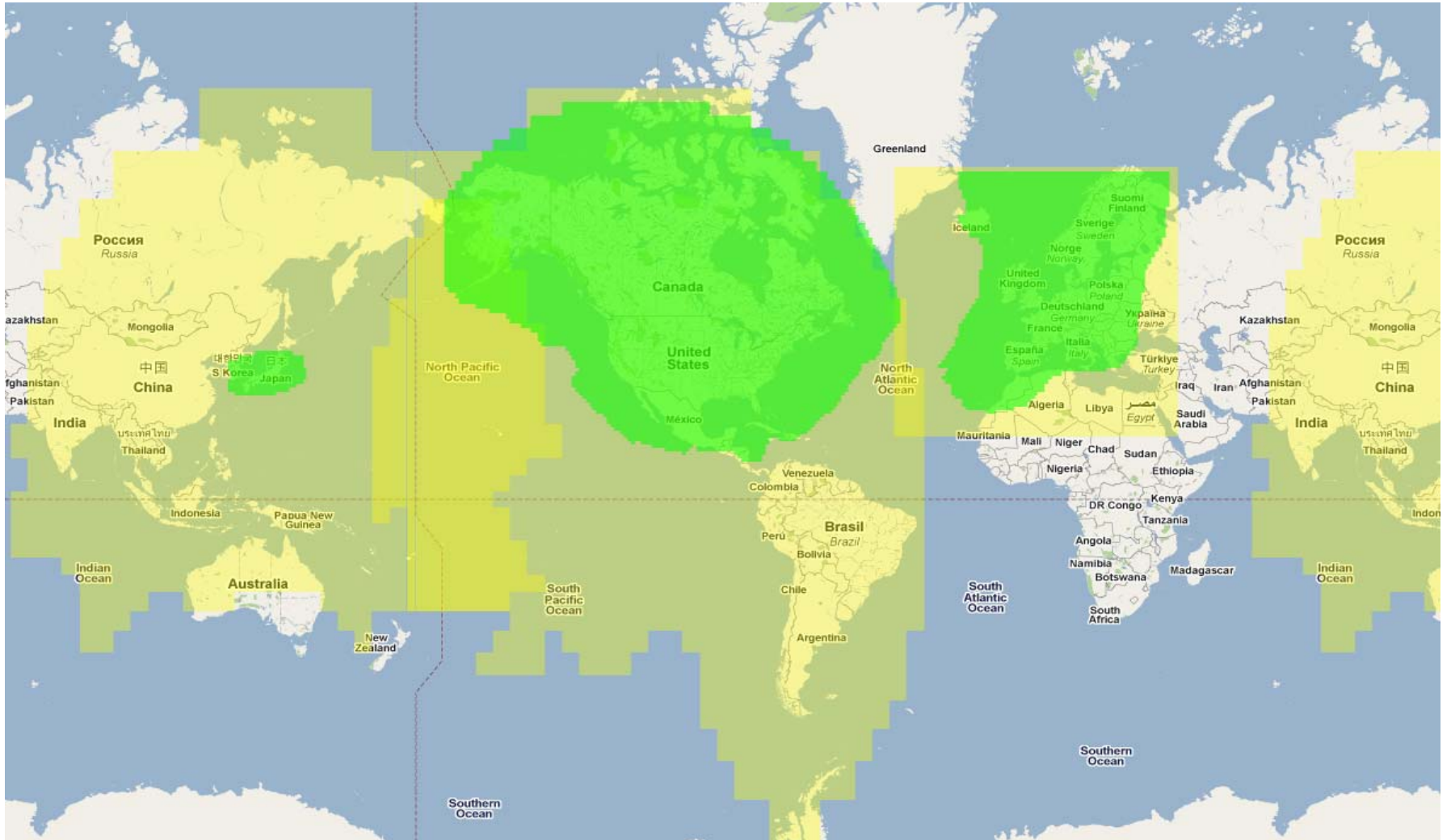2 Geostationary Satellite Links

2 Operational Control Centers
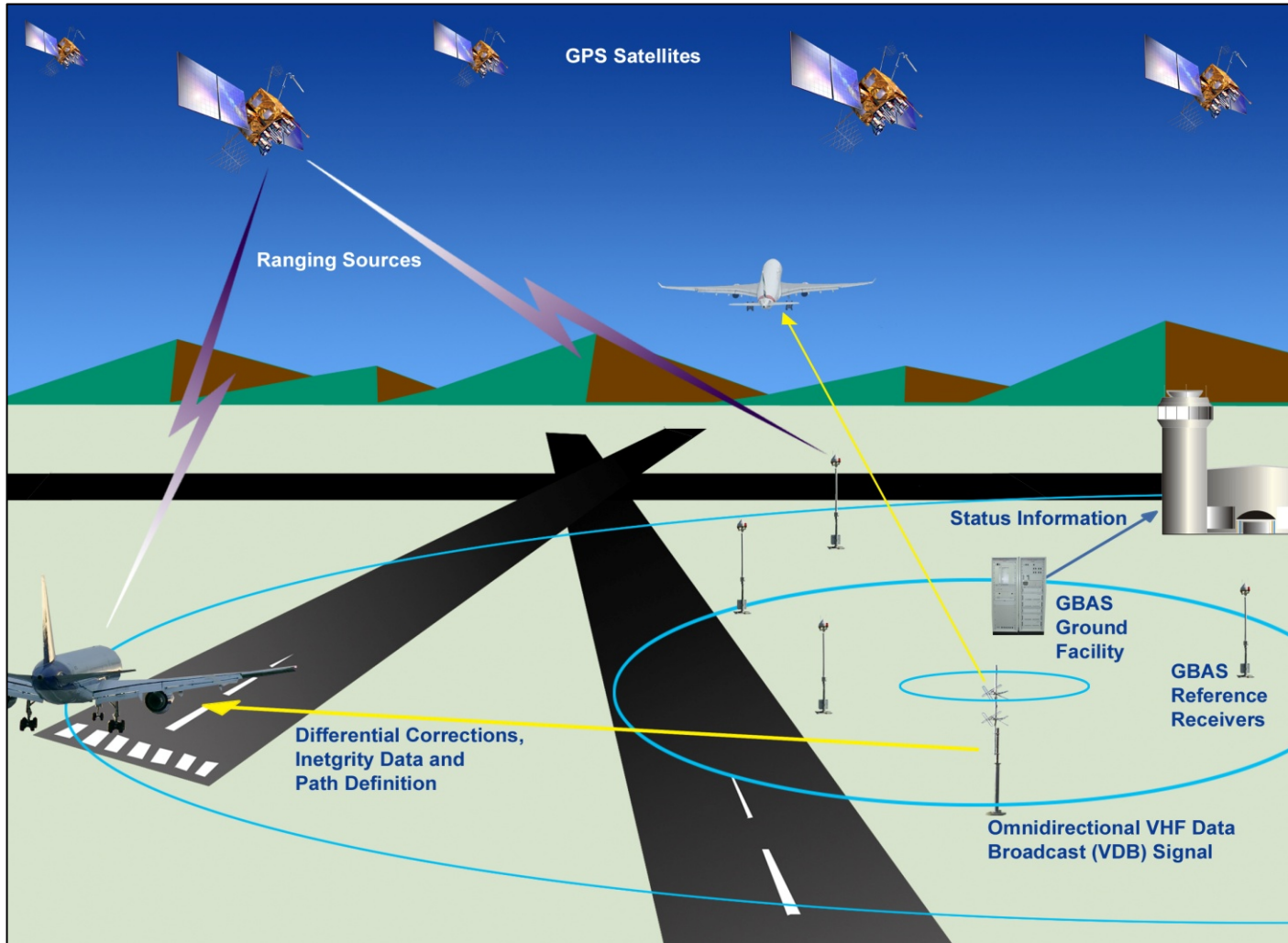
GEO Satellite Coverage Plot

Intelsat
Galaxy 15
133° W

Telesat Canada's
Anik F1R
107.3° W

Global SBAS Coverage

Local Area Augmentation System (LAAS)

National Differential GPS (NDGPS)

Alaska

Hawaii

May 2009

Legend
▲ Site
Single Coverage
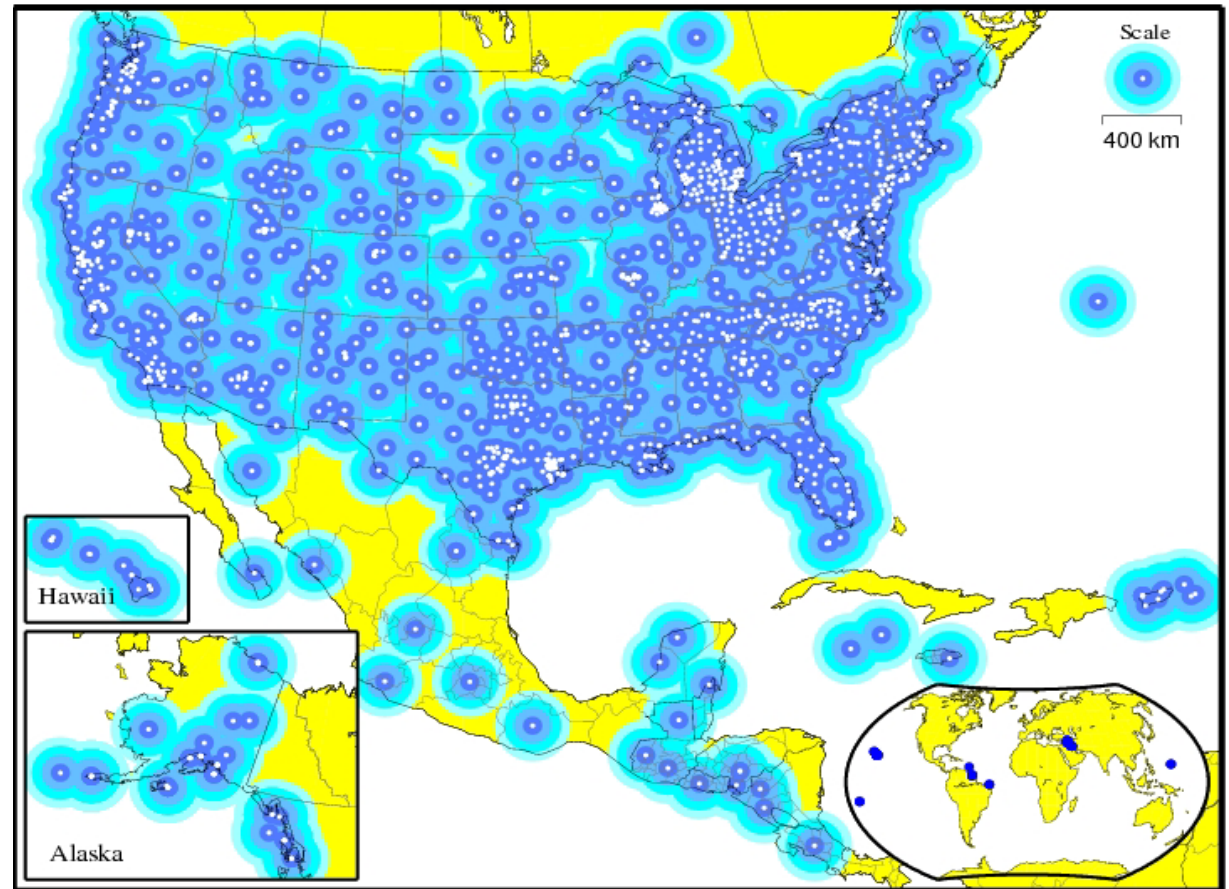Multiple Coverage

Puerto Rico
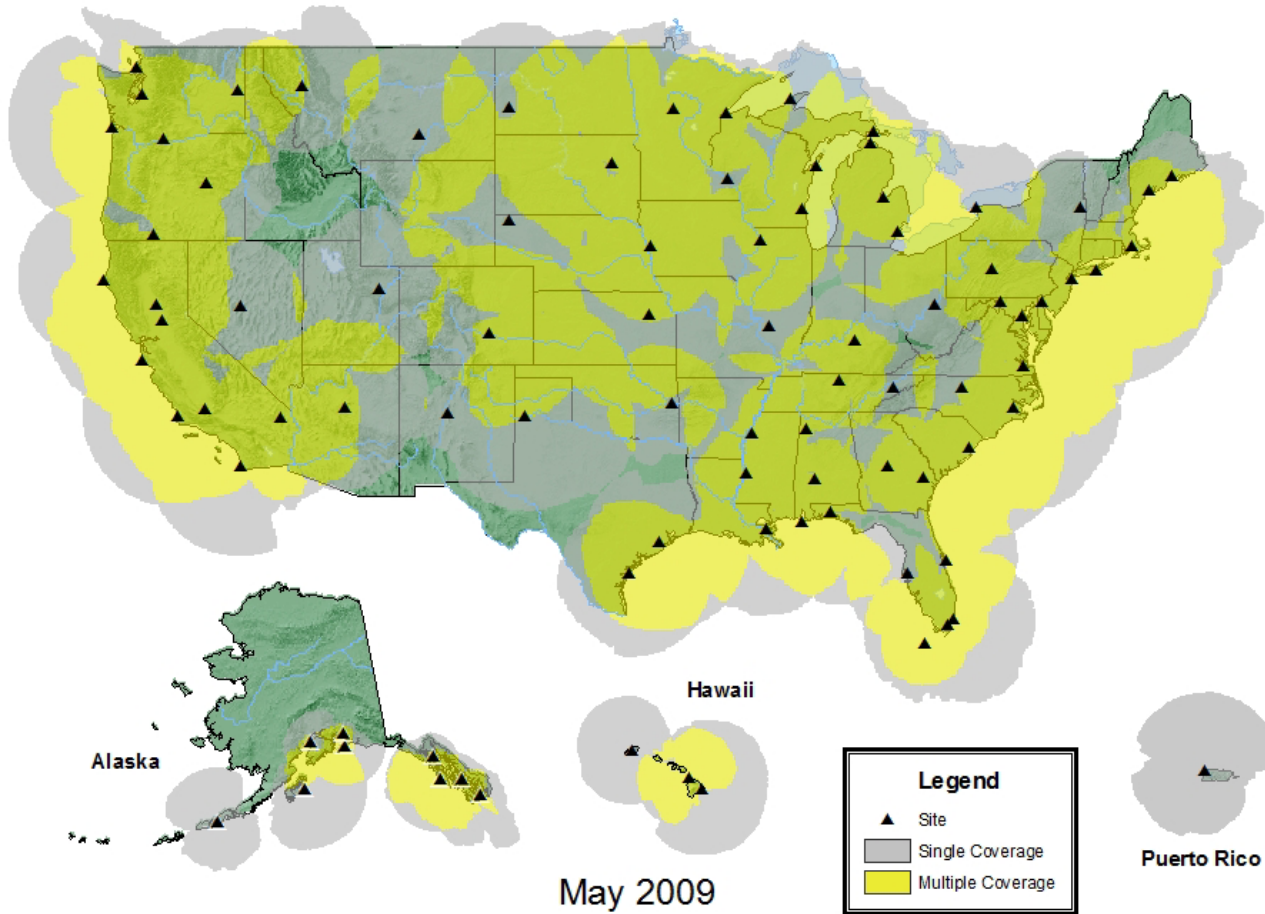
National Continuously Operating Reference Stations (CORS)

Sponsor: NOAA

- 1,300+ sites

- Operated by 200+ academic organizations

- Enables highly accurate, 3-D positioning

Global Differential GPS (GDGPS) and TDRSS Augmentation Service for Satellites (TASS)

Sponsor: NASA

GDGPS: More than 100 real-time tracking sites
  - Real-Time Positioning, Timing, and Orbit-Determination

TASS: Future plans to disseminate GDGPS corrections to satellites
for autonomous orbit determination and science missions

Epoch Wed Jun 9 23:51:00 2004 (UTC) (local time at JPL: Wed Jun 9 16:51:00 2004)
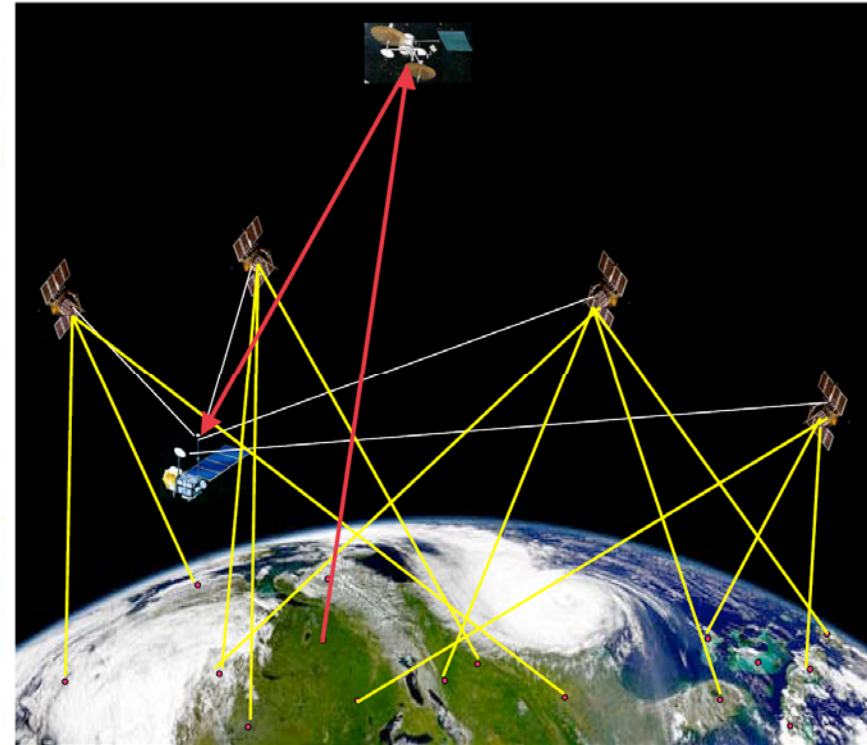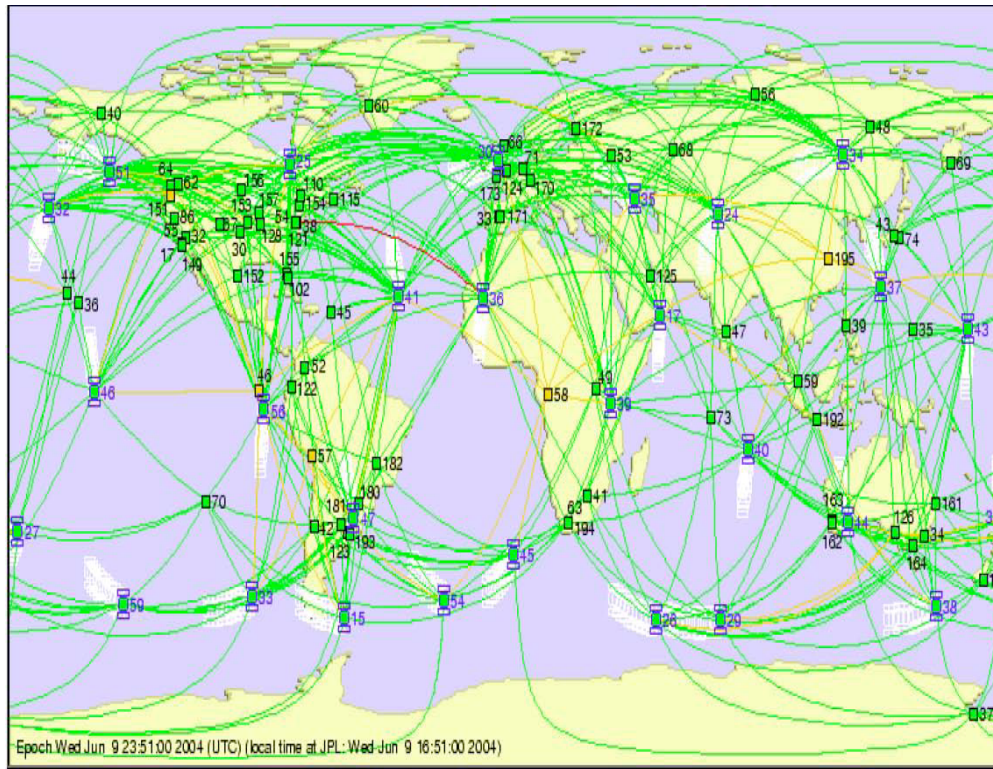
Summary

- The U.S. supports free access to civilian GNSS signals with public domain documentation necessary to develop user equipment and achieve service certification by international regulatory bodies

- GPS is a critical component of the global information infrastructure
  - Compatible with other satellite navigation systems and interoperable at the user level
  - Guided at a national level as multi-use asset
  - Acquired and operated by Air Force on behalf of the USG

- The U.S. policy promotes open competition and market growth for commercial GNSS

GPS continues to provide consistent, predictable, dependable performance