SPACE-BASED POSITIONING NAVIGATION & TIMING

NATIONAL EXECUTIVE COMMITTEE

The U.S. Space-Based PNT Current Program and Future Trends

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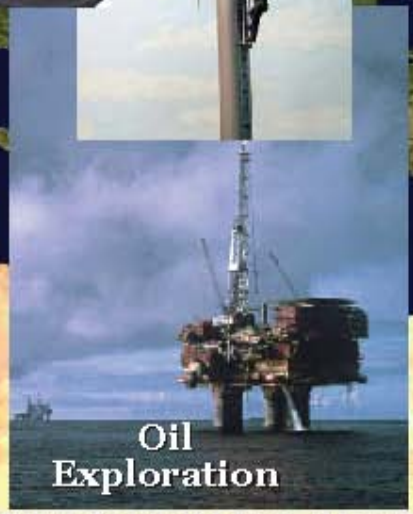
Introduction

- During the past decade, GPS has grown into a global utility providing space-based positioning, navigation and timing (PNT)
  - Consistent, predictable, dependable policy and performance
  - Augmentations improve performance

- Like the Internet, GPS is a critical component of the global information infrastructure
  - Scalable applications enabling broad new capabilities
  - Innovations in efficiency, safety, environmental protection, public security and science

GNSS Applications Support A Wide Range of Economic Activities

Communications Network Synchronization



GNSS is Key to Scientific Monitoring of the Earth

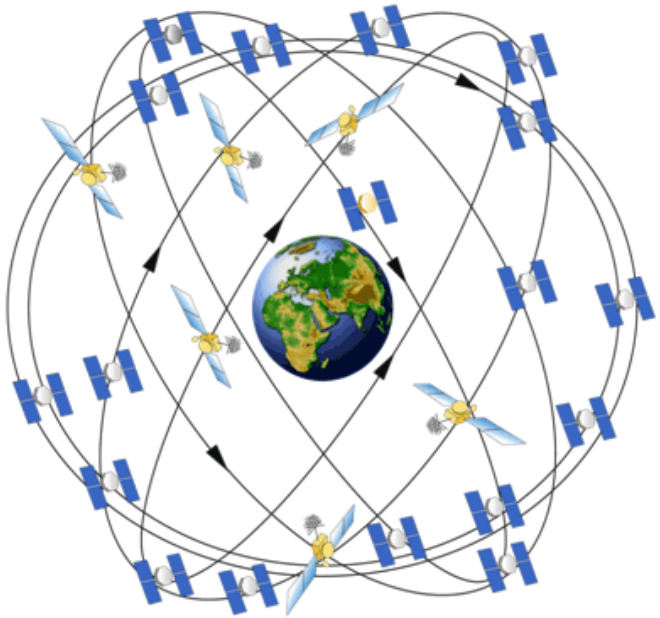





To better understand the changes and complex dynamic processes of our home planet

Global Positioning System (GPS)

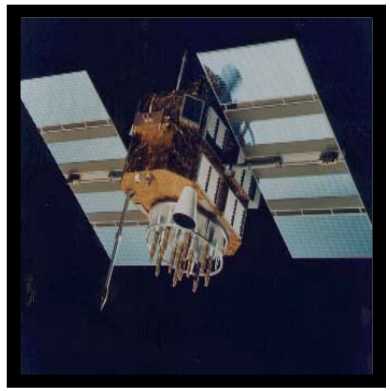
- Baseline 24 satellite constellation in Medium Earth Orbit
- Global coverage, 24 hours a day, all weather conditions
- Satellites broadcast precise time and orbit information on L-band radio frequencies
- Two types of signals:
  - Standard (free of direct user fees)
  - Precise (U.S. and allied military)
- Three segments:
  - Space
  - Ground control
  - User equipment

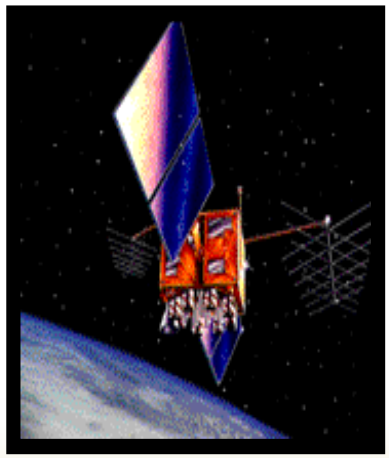


GPS Constellation

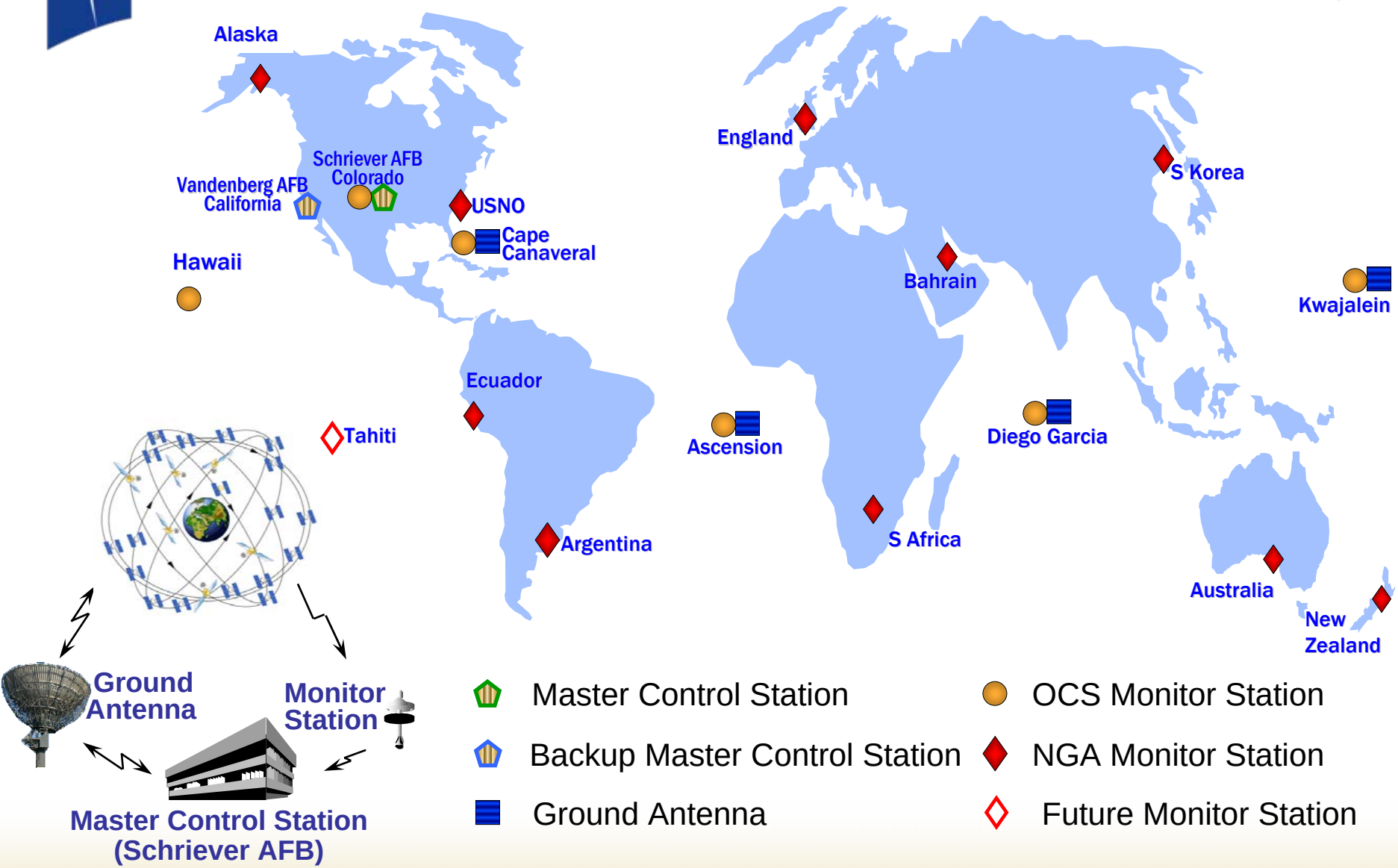
31 Operational Satellites
As of 1 Apr 2008 (Baseline Constellation: 24)

- 13 Block IIA satellites
- 12 Block IIR satellites
- 6 Block IIR-M satellite
  - Transmitting new second civil signal (L2C)
- Continuously assessing constellation health to determine launch need
  - 2 Block IIR(M) satellites remaining
  - Next launch: June 2008
- Global GPS civil service performance commitment met continuously since December 1993





GPS Operational Control Segment (OCS)



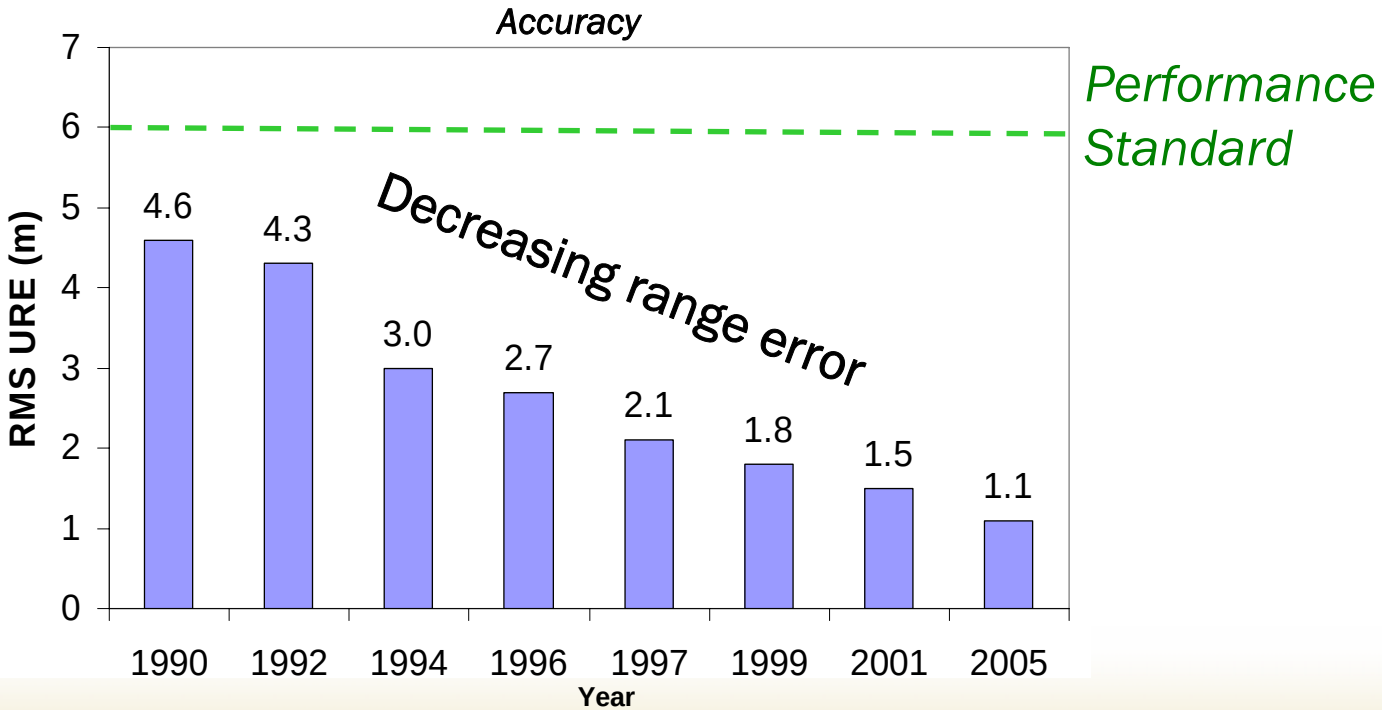
GPS Modernization – the Future

- Second civil signal "L2C"
  - Designed to meet commercial needs
    - Higher accuracy through ionospheric correction
  - Began with GPS Block IIR-M in Sep 2005; 24 satellites: ~2014
- Third civil signal "L5"
  - Designed to meet demanding requirements for transportation safety-of-life
    - Uses highly protected Aeronautical Radio Navigation Service (ARNS) band
  - Begins with GPS Block IIF
  - 1st launch: ~2008 (GPS IIR-M Demo); ~2009 (GPS IIF); 24 satellites: ~2016
- Fourth civil signal "L1C"
  - Designed with international partners for GNSS interoperability
  - Begins with GPS Block III
  - First launch: ~2014; 24 satellites: ~2021

Continuous Performance Improvement

Key **measures of effectiveness** to evaluate GPS services

- *Accuracy*
- *Bounded inaccuracy*
- *Assured availability*
- *Integrity*
- *Resistance to RF interference/jamming*



U.S. Policy History

- 1978: First GPS satellite launched
- 1983: President offered free civilian GPS access to GPS
- 1996: Established joint civil/military GPS management
- 1997: Congress passes law providing civil GPS access free of direct user fees
- 2000: President set Selective Availability to “Zero”
- 2004: President issues U.S. Policy on Space-Based PNT
- 2007: President announces Selective Availability eliminated from future GPS III satellites

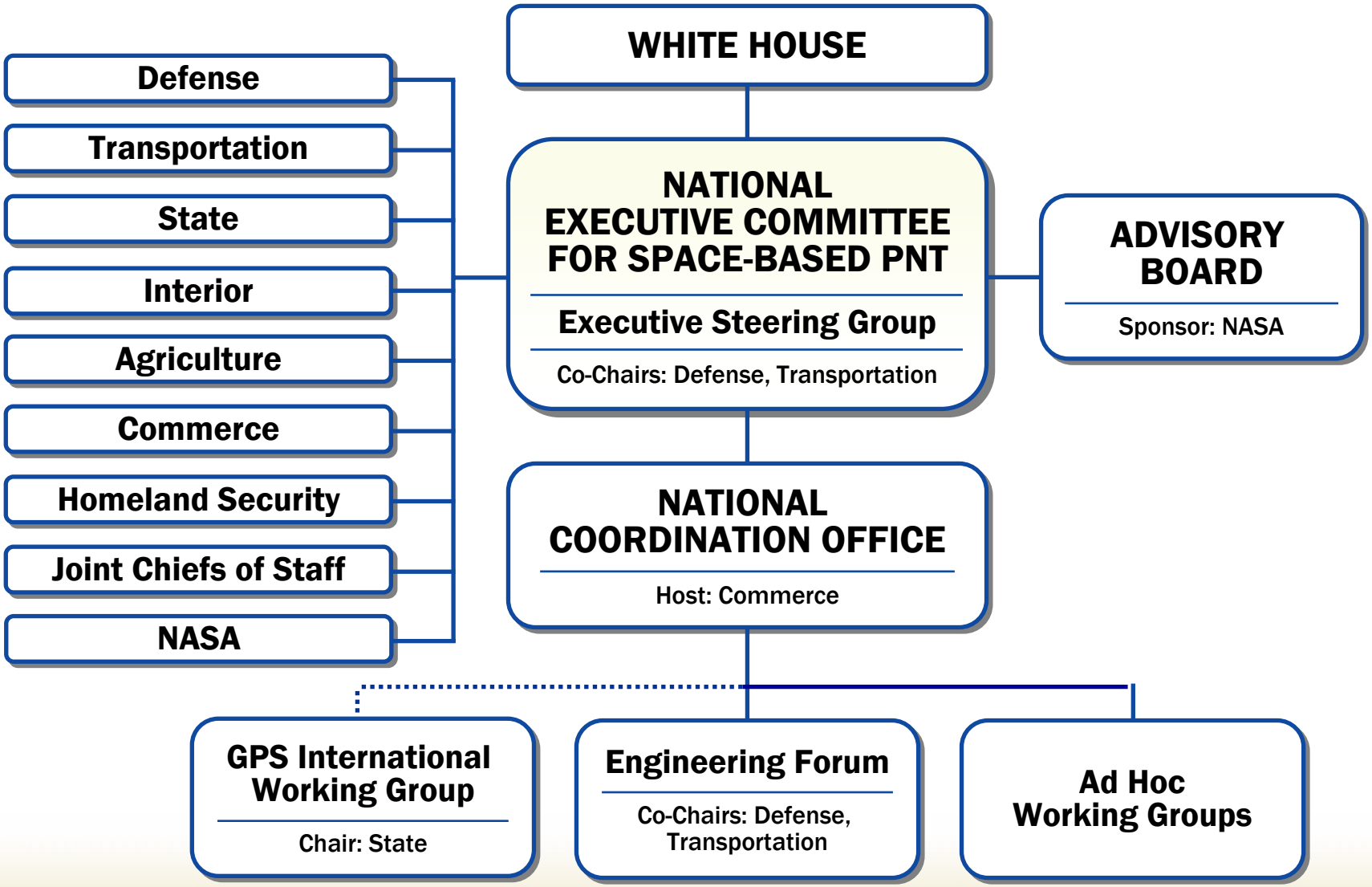
U.S. Space-Based PNT Policy

- No direct user fees for civil GPS services
- Open public signal structures for all civil services
  - Promotes equal access for user equipment manufacture, applications development and value-added services
  - Encourages open market-driven competition
- Encourage use of GPS time, geodesy and signal standards
- Promote global compatibility and interoperability of GNSS systems with GPS
- Protect the radionavigation spectrum from disruption and interference
- Recognition of national and international security issues and protect against misuse

U.S. Space-Based PNT Policy

- Recognizes the changing international scene
  - Other nations are implementing space-based systems that provide PNT services
- National Executive Committee for Space-Based PNT
  - Chaired by Deputy Secretaries of Defense and Transportation
  - Membership includes: State, Interior, Agriculture, Commerce, Homeland Security, Joint Chiefs of Staff and NASA
- Established National Coordination Office with staff from each member agency

U.S. Space-Based PNT Structure



U.S. Space-based PNT Advisory Board

- Conducts assessments; makes recommendations to the Executive Committee in support of national policy goals and objectives for space-based PNT
- Twenty-four members; 6 international members
- Met twice in 2007
- Last meeting: 27-28 March 2008

Key Executive Committee Activities

Eight meetings since 2006

- **Five-Year National Space-Based PNT Plan**
  - Summarizes EXCOM agency planning for development, acquisition, sustainment and modernization of U.S. space-based PNT systems
- **Interference Detection and Mitigation Plan**
  - Department of Homeland Security coordinating U.S. capabilities to detect and mitigate sources of interference to GPS and its augmentations
- **National PNT Architecture**
  - Provides national PNT framework/investment strategy to help guide future PNT system-of-systems investment – 2025 timeframe
- **International Cooperation and Consultation**
  - Compatibility and interoperability with other foreign systems

U.S. Space-Based PNT Policy
International Relations

Goals:

- U.S. space-based PNT systems and services remain essential components of internationally accepted services
- Promote U.S. technological leadership in applications involving space-based PNT services

To achieve these goals, the U.S. shall:

- Encourage foreign development of PNT services/systems based on GPS
  - Seek to ensure foreign space-based PNT systems are interoperable with civil GPS and augmentations
  - At a minimum ensure compatibility
- Promote use of GPS and its augmentations, civil services and standards with foreign gov'ts and other int'l organizations

Summary

U.S. Space-based PNT effort progressing well in policy, programs and international outreach

- Implementation of U.S. Policy proceeding well
- U.S. space-based PNT system performance continue to improve into the future
- International cooperation is a top U.S. priority
  - Actively engaged in multi-lateral/bi-lateral consultations
- New GNSS applications emerging

As new space-based GNSSs emerge, compatibility and interoperability is the key to "success for all"

Web-based Information

- **PNT.gov** established to provide a source for information about U.S. Space Based PNT Program including:
  - U.S. policy, Executive Committee membership, Advisory Board and frequently asked questions
  - Announcements about Selective Availability and offer letter to International Civil Aviation Organization
  - Recent public presentations
- **GPS.gov** established for public information about GPS applications
  - Available in English, French, Spanish, Arabic and Chinese
  - Brochures also available in hardcopy upon request
  - Links to various other Web sites

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