SPACE-BASED POSITIONING
NAVIGATION & TIMING
NATIONAL COORDINATION OFFICE

GPS Constellation, Modernization Plans and Policy

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USTTI Seminar

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Overview

- Introduction
- Global Positioning System
- Modernization Plans
- U.S. Policy

GPS enables a diverse array of applications

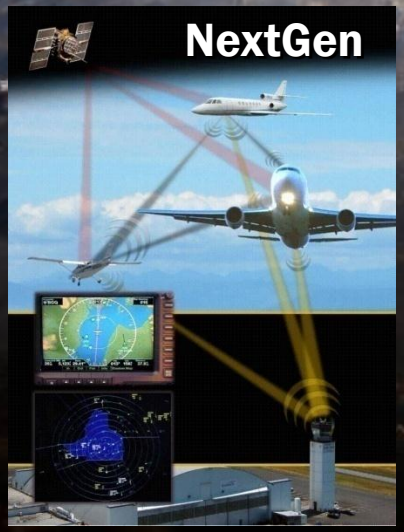
Satellite Operation

Surveying & Mapping

Power Grids

Precision Agriculture

Transit Operations



NextGen

Disease Control

Intelligent Vehicles

TeleComm

Trucking & Shipping

Personal Navigation

Oil Exploration

Fishing & Boating

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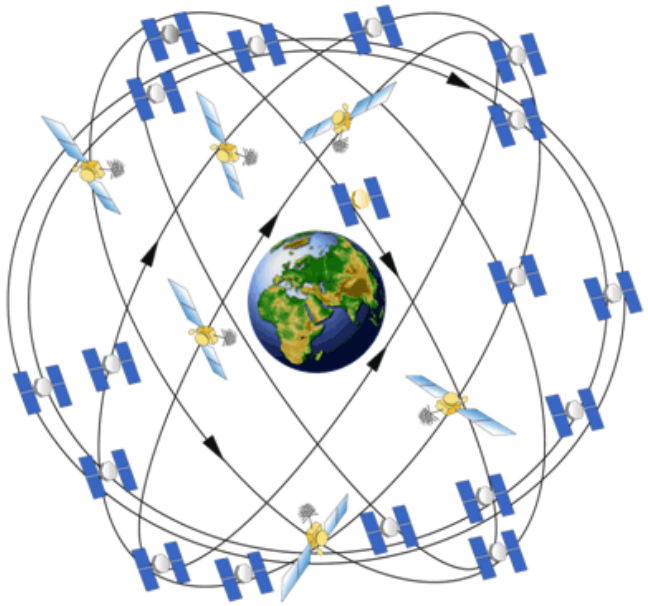
GPS IIF-3 Launch

SVN–65 , October 4, 2012

The Global Positioning System

- Baseline 24+3 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

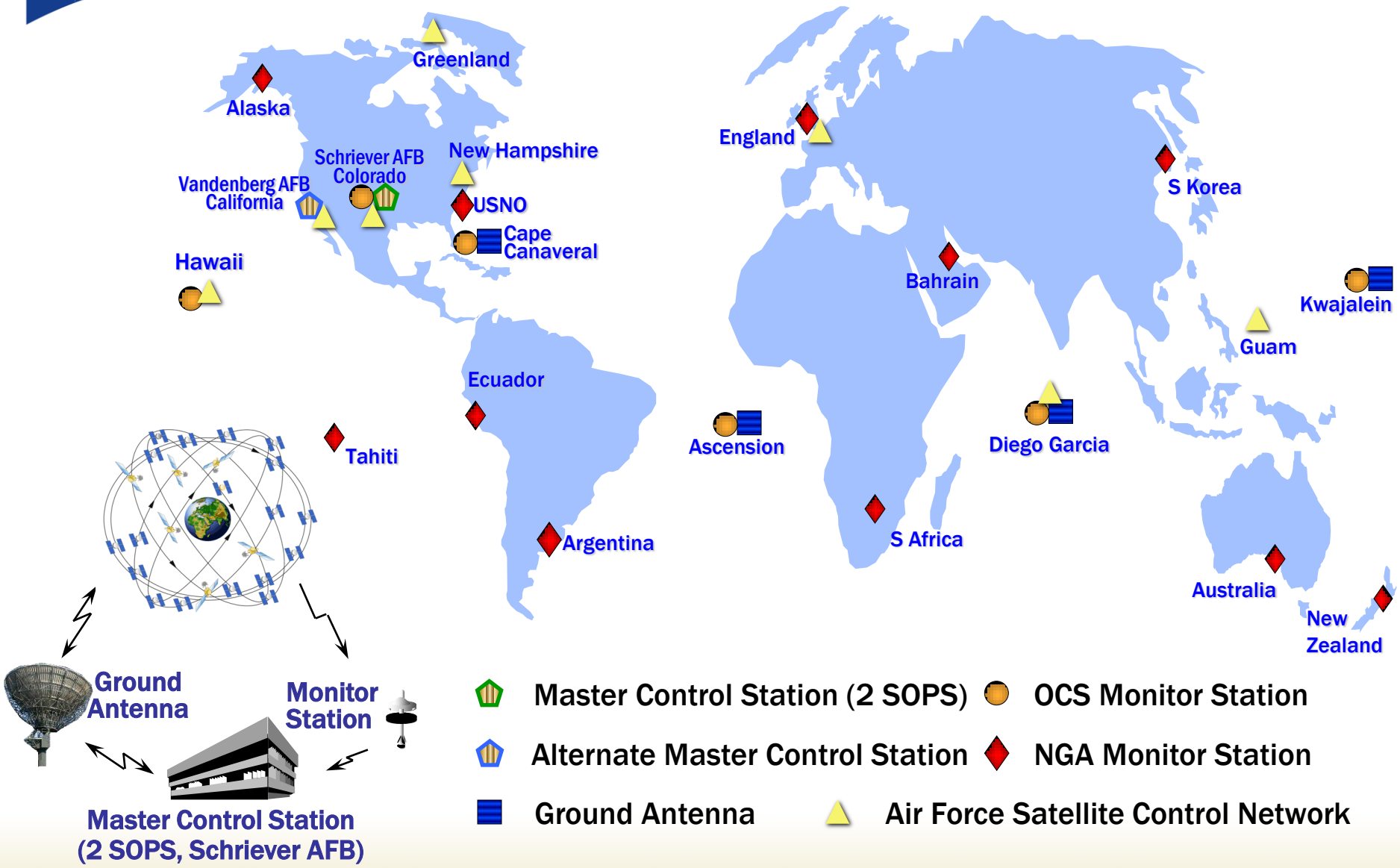


GPS Constellation Status

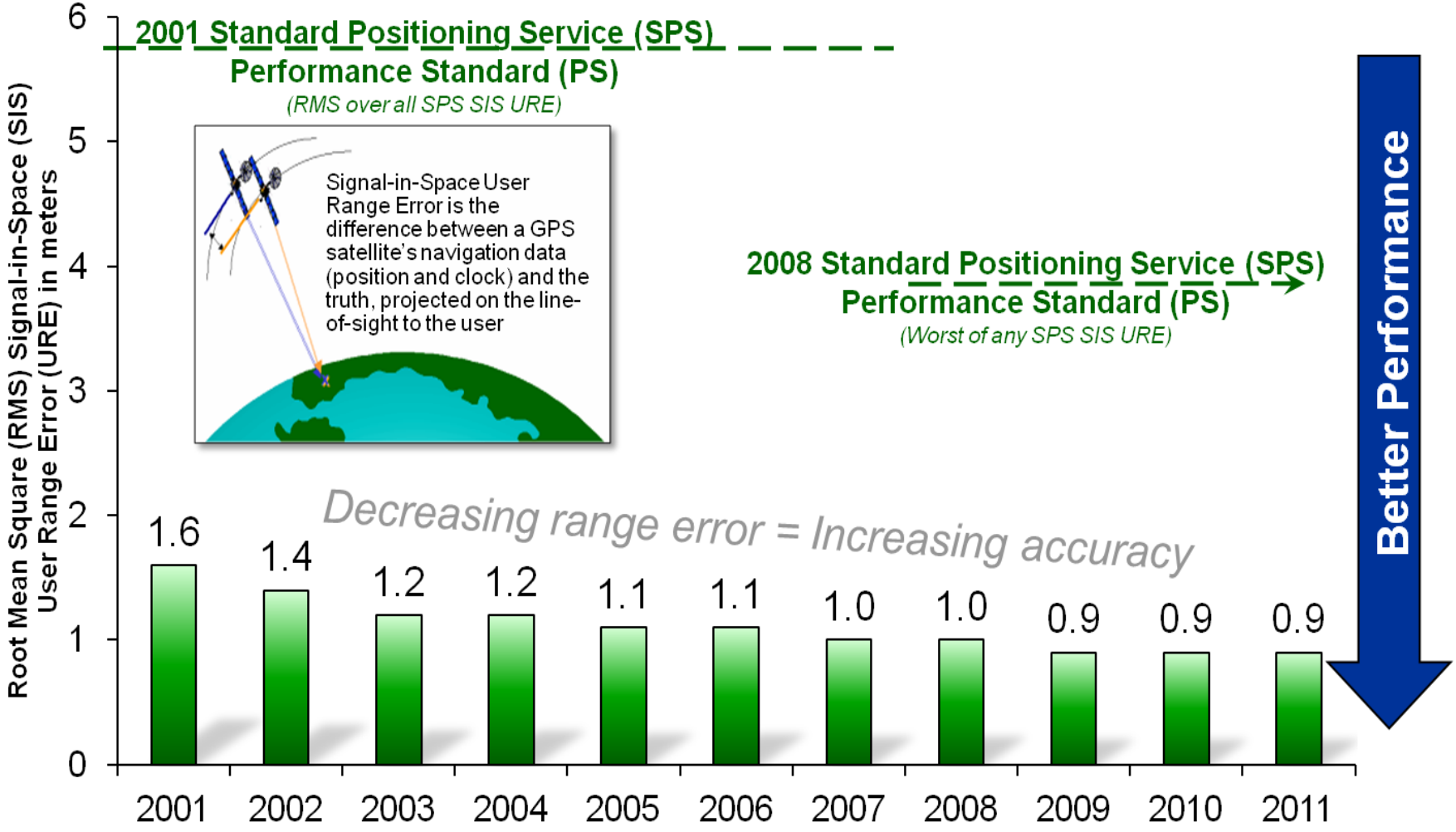
35 Satellites (30 Operational)
(Baseline Constellation: 24+3)

- 12 Block IIA
  - 3 on-orbit in residual status
- 12 Block IIR
- 8 Block IIR-M
  - Transmitting new second civil signal
  - 1 GPS IIR-M in on-orbit testing
- 3 Block IIF
  - SVN-65 operational late 2012
- Global GPS civil service performance commitment met continuously since December 1993

GPS Operational Control Segment (OCS)



Standard Positioning Service (SPS) Signal-in-Space Performance



System accuracy exceeds published standard

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GPS Modernization Program

Increasing System Capabilities ◆ Increasing User Benefit

Block IIA/IIR

Basic GPS

- Standard Service
  - Single frequency (L1)
  - Coarse acquisition (C/A) code navigation
- Precise Service
  - Y-Code (L1Y & L2Y)
  - Y-Code navigation

Block IIR-M, IIF

IIR-M – Basic GPS capability plus

- 2nd civil signal (L2C)
- M-Code (L1M & L2M)

IIF – IIR-M capability plus

- 3rd civil signal (L5)
- 2 Rb + 1 Cs Clocks
- 12 year design life

Block III

- Backward compatibility
- 4th civil signal (L1C)
- 4x better User Range Error than IIF
- Increased availability
- Increased integrity
- 15 year design life

GPS Modernization – New Civil Signals

- Second civil signal "L2C"
  - Designed to meet commercial needs
  - Available since 2005 without data message
  - Currently broadcasts from 9 satellites
  - Full capability: 24 satellites and full CNAV approximately 2018

- Third civil signal "L5"
  - Designed to meet transportation safety-of-life requirements
  - Currently broadcasts from 2 satellites
  - 24 satellites and full CNAV approximately 2021

- Fourth civil signal "L1C"
  - Designed for GNSS interoperability
  - Specification developed in cooperation with industry
  - Fully designed and in testing
  - Will be broadcast by GPS III
  - Available on 24 satellites approximately 2026

Improved performance in challenged environments

Ground Segment Status

Monitor Station

Master Control Stations at Schriever AFB, Colorado

Ground Antenna

- Current system Operational Control Segment (OCS)
  - Currently flying expanded 24+3 constellation of GPS Block II satellites
  - Provides worldwide ground antenna and monitor station with redundant coverage
- Next Generation Operational Control System (OCX) development continues
  - Will provide ability to fly GPS III and operate modernized GPS signals
  - OCX Block I deployment planned for 2016

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U.S. Policy History

- 1978: First GPS satellite launches
- 1983: President announces civilian access to GPS following KAL 007
- 1991: U.S. offers free civil GPS service to the International Community
- 1996: First U.S. GPS Policy establishes joint civil/military management
- 1997: U.S. law provides civil GPS access free of direct user fees
- 2000: President ends use of Selective Availability
- 2004: President issues U.S. Policy on Space-Based PNT
- 2004: Agreement signed on GPS-Galileo Cooperation
- 2007: Selective Availability eliminated from GPS III satellites
- 2010: National Space Policy provides high-level PNT guidance

National Space Policy, 2010

The U.S. must maintain its leadership in the service, provision and use of Global Navigation Satellite Systems (GNSS)

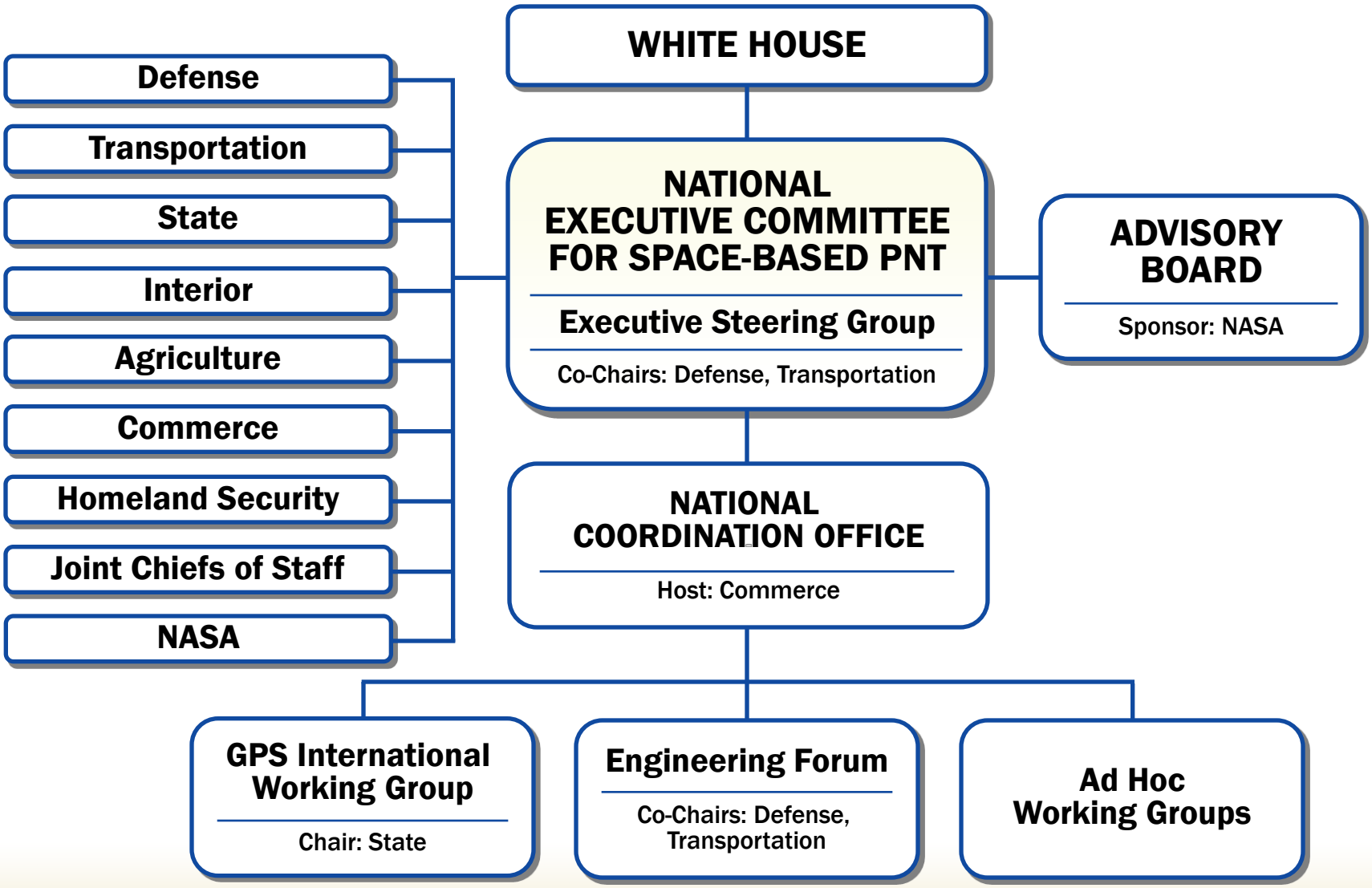
- Provide continuous worldwide access to GPS for peaceful uses, free of direct user charges
- Encourage compatibility and interoperability with foreign GNSS services
- Operate and maintain constellation to satisfy civil and national security needs
  - Foreign PNT may be used to strengthen resiliency
- Invest in domestic capabilities and support international activities to detect, mitigate and increase resiliency to harmful interference

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

Pursue through Bilateral and Multilateral Cooperation

National Space-Based PNT Organization

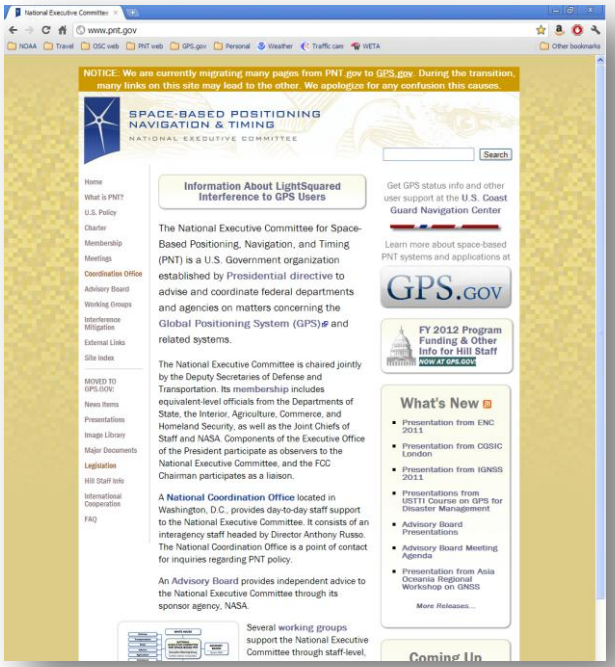


Summary

- GPS continues to meet or exceed our performance commitments to worldwide users
- Modernization of all GPS segments on track
- Striving to continually improve navigation and timing services while maintaining backward compatibility with legacy equipment.
- GPS is committed to open and transparent cooperation with the international GNSS community

For Additional Information

- NCO maintains GPS.gov as a central public resource for official USG information about GPS and related topics



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This presentation and other GPS information:
www.gps.gov

Thank You!