SPACE-BASED POSITIONING NAVIGATION & TIMING

NATIONAL EXECUTIVE COMMITTEE

Global Positioning System Policy and Constellation Update

Col Robert Hessin
Deputy Director
National Space-Based PNT Coordination Office

Overview

- U.S. Space-Based PNT Policy
- GPS Program & Modernization Status
- International Objectives

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

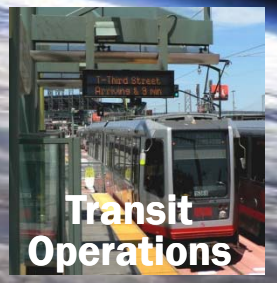
GPS is Essential to Our Economy and National Critical Infrastructures

Satellite Operations

Surveying & Mapping

Power Grids

Precision Agriculture



Transit Operations

NextGen

Trucking & Shipping

IntelliDrive

TeleComm

Disease Control

Personal Navigation

Oil Exploration

Fishing & Boating

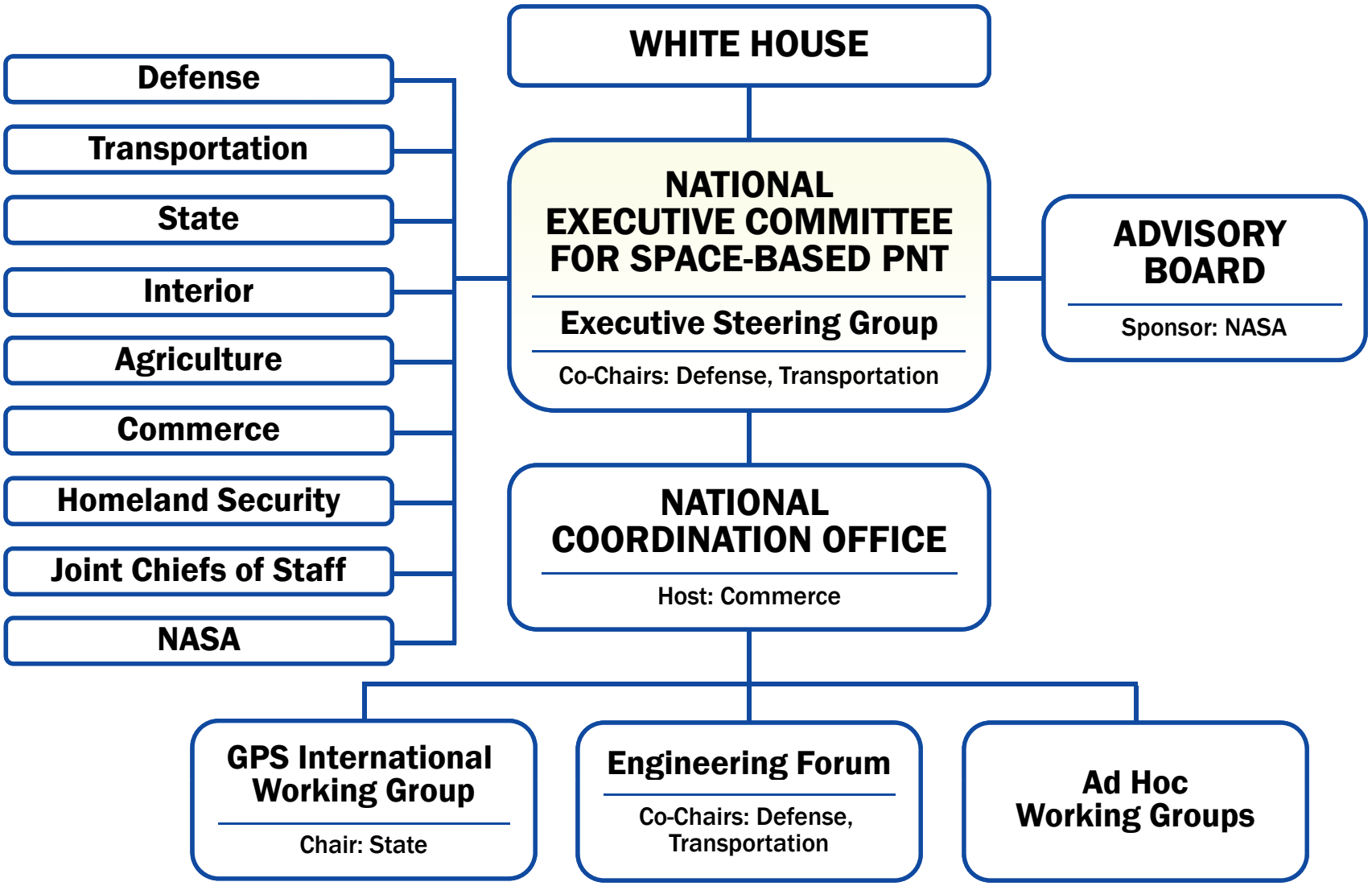
U.S. Space-Based PNT Policy History

- 1978 – First GPS satellite launched
- 1983 – President offered free civilian access to GPS
- 1996 – President established joint civil/military GPS management
- 1997 – Congress passed law providing civil GPS access free of direct user fees
- 2000 – President set Selective Availability to "Zero"
- 2004 – President issued U.S. Policy on Space-Based PNT
- 2007 – President announced elimination of Selective Availability capability from future GPS III satellites

U.S. Space-Based PNT Policy

- Recognizes the changing international scene
  - Other nations are implementing space-based systems that provide PNT services
- Established National Space-Based PNT Executive Committee (EXCOM)
  - 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 (NCO) with staff from each member department/agency

National Space-Based PNT Organization Structure



U.S. Space-Based PNT Policy

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

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

U.S. Policy Promotes Global Use of GPS Technology

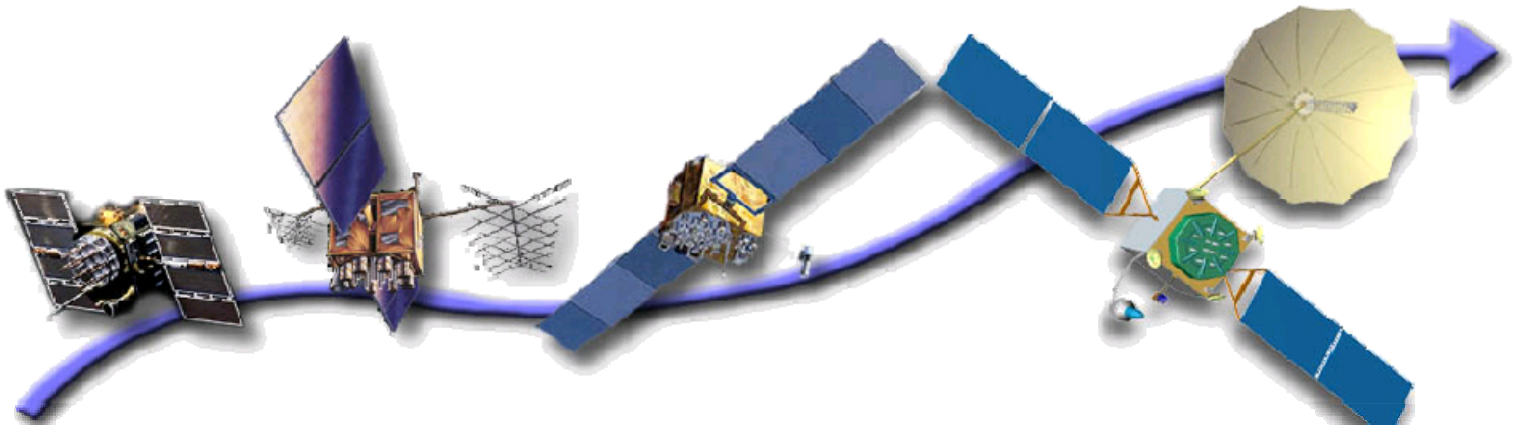
- No direct user fees for civil GPS services
  - Provided on a continuous, worldwide basis
- Open, public signal structures for all civil services
  - Promotes equal access for user equipment manufacturing, applications development, and value-added services
  - Encourages open, market-driven competition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

GPS Constellation Status

30 Operational Satellites (Baseline Constellation: 24)

- 11 Block IIA
- 12 Block IIR
- 7 Block IIR-M
  - Transmitting new second civil signal
  - 1 GPS IIR-M in on-orbit testing
- 3 additional satellites in residual status
- IIF-1 launched May 27th, 2010
  - First of 12 Boeing satellites
- Global GPS civil service performance commitment met continuously since December 1993

GPS Modernization Program



Increasing System Capabilities ◆ Increasing Defense / Civil 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: IIA/IIR capabilities plus

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

IIF: IIR-M capability plus

- **3rd civil signal (L5)**
- Anti-jam flex power

Block III

- Backward compatibility
- **4th civil signal (L1C)**
- Increased accuracy
- Increased anti-jam power
- Assured availability
- Navigation surety
- Controlled integrity
- Increased security
- System survivability

GPS Modernization – New Civil Signals

- Second civil signal "L2C"
  - Designed to meet commercial needs
  - Higher accuracy through ionospheric correction
  - Available since 2005 without data message
    - Currently, 7 IIR-Ms transmitting L2C
  - Full capability: 24 satellites ~2016

- Third civil signal "L5"
  - Designed to meet demanding requirements for transportation safety-of-life
  - Uses highly protected Aeronautical Radio Navigation Service (ARNS) band
  - On orbit broadcast 10 APR 2009 on IIR-20(M) secured ITU frequency filing
    - Included on all IIF satellites
  - Full capability: 24 satellites ~2018

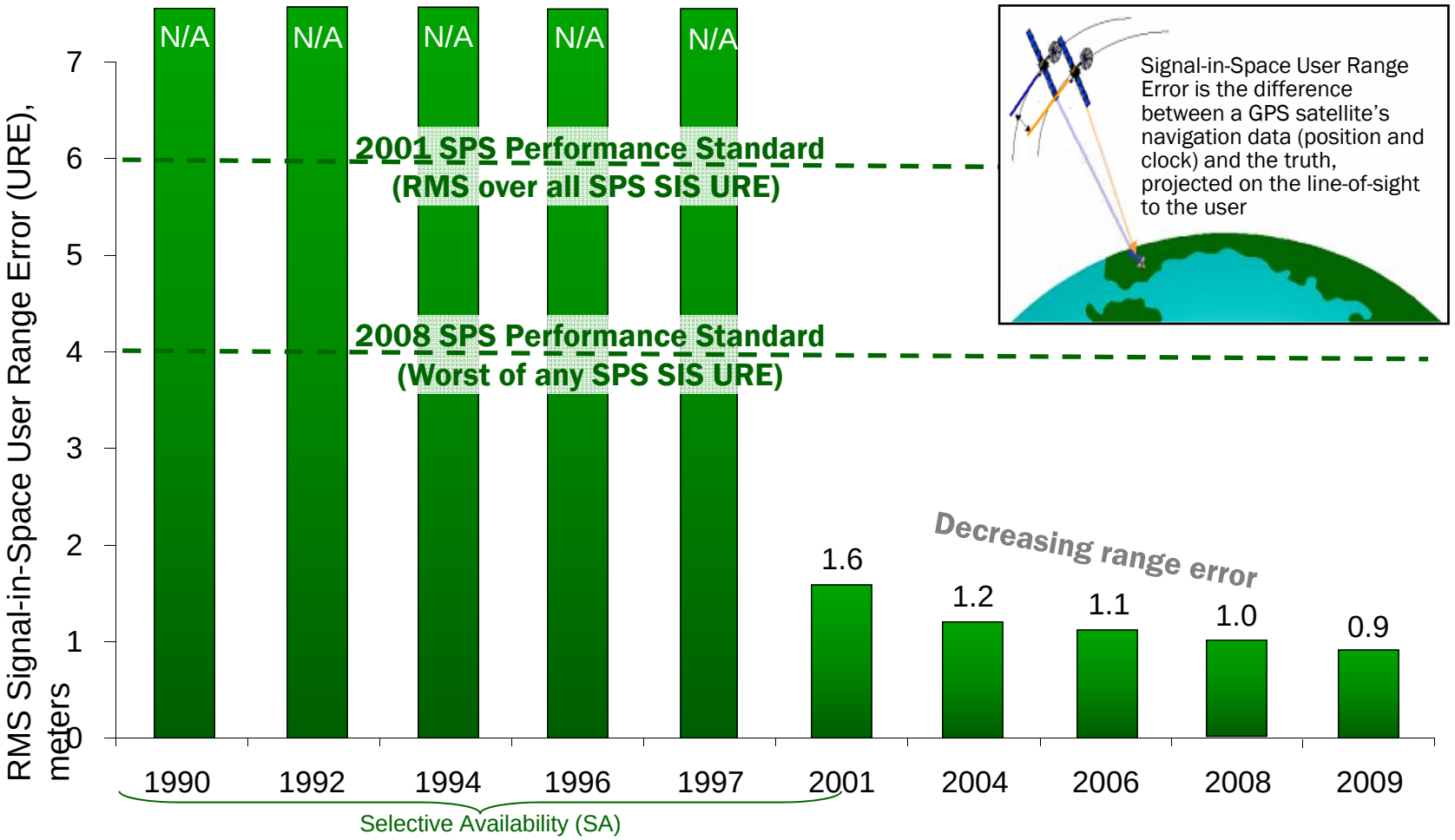
GPS Modernization – Fourth Civil Signal (L1C)

Under Trees

Urban Canyons

- Fourth civil signal "L1C"
  - Designed with international partners for interoperability
  - Modernized civil signal at L1 frequency
    - More robust navigation across a broad range of user applications
    - Improved performance in challenged tracking environments
    - Original signal retained for backward compatibility
  - Specification developed in cooperation with industry recently completed
  - Launches with GPS III in 2014
  - On 24 satellites by ~2021

SPS Signal in Space Performance



System accuracy exceeds published standard

U.S. Objectives 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 same user better capabilities than would be achieved by relying solely on one service or signal
  - Primary focus on the common L1C and L5 signals
- Transparency in "signal and service provision information"

Pursue through Bilateral and Multilateral Cooperation

Summary

- Stable, predictable national policy
  - No direct user fees; open market-driven competition
- New, modernized signals and services
- International cooperation is a priority
  - Compatibility, Interoperability and Transparency

GPS Modernization program is enhancing capabilities for tomorrow

Web Resources

- *PNT.gov* established to provide a source of information about U.S. Space-Based PNT Program including:
  - U.S. Policy; EXCOM membership; Advisory Board; FAQs
  - Announcements about Selective Availability and offer letter to International Civil Aviation Organization (ICAO)
  - Recent public presentations
- *GPS.gov* established for public information about GPS applications
  - Available in English, Spanish, Arabic and Chinese
  - Brochures also available in hardcopy upon request
  - Links to various other Web sites

Contact Information

Col Robert M. Hessin

National Coordination Office for Space-Based PNT
1401 Constitution Ave, NW
Room 6822
Washington, DC 20230

Phone: (202) 482-5812
(202) 482-5809

Robert.Hessin@pnt.gov