



SPACE-BASED POSITIONING
NAVIGATION & TIMING
NATIONAL COORDINATION OFFICE

GPS Constellation, Modernization Plans and Policy

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United States of America**



Overview



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

GPS enables a diverse array of applications



Satellite Operation



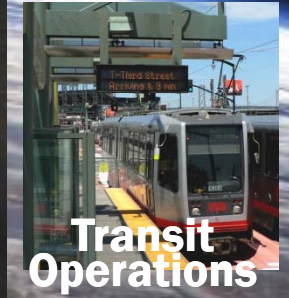
Surveying & Mapping



Power Grids



Precision Agriculture



Transit Operations



NextGen



Disease Control



IntelliDrive



TeleComm



Personal Navigation



Trucking & Shipping



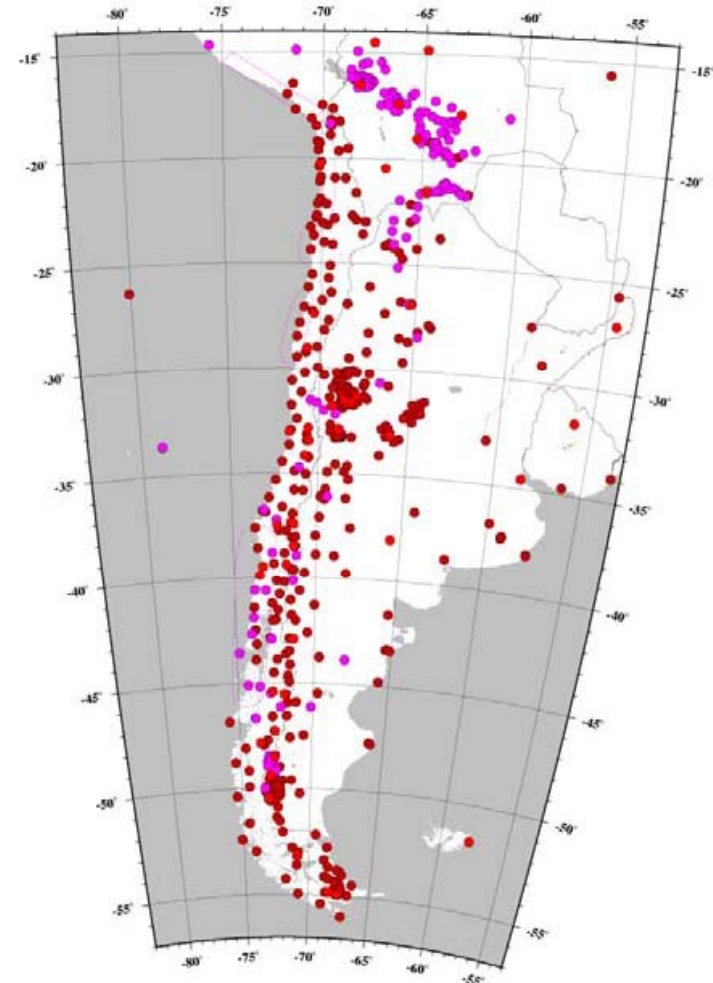
Oil Exploration



Fishing & Boating



GPS in Disaster Relief





Restoring Infrastructure





Overview



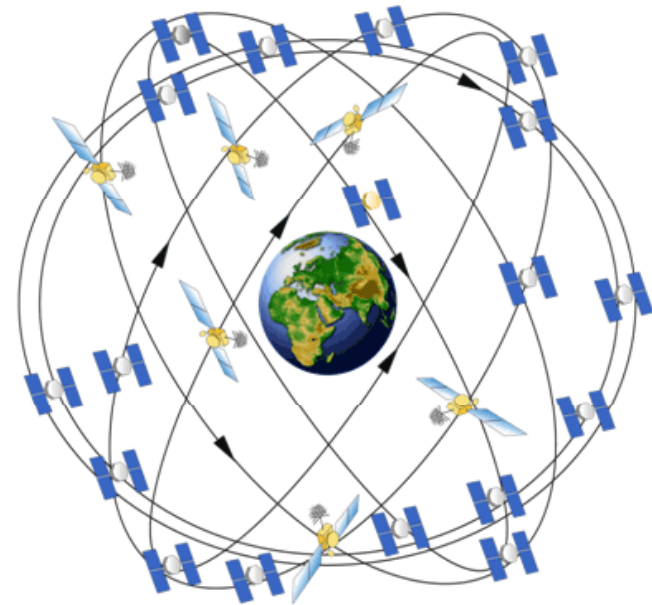
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The Global Positioning System



- **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



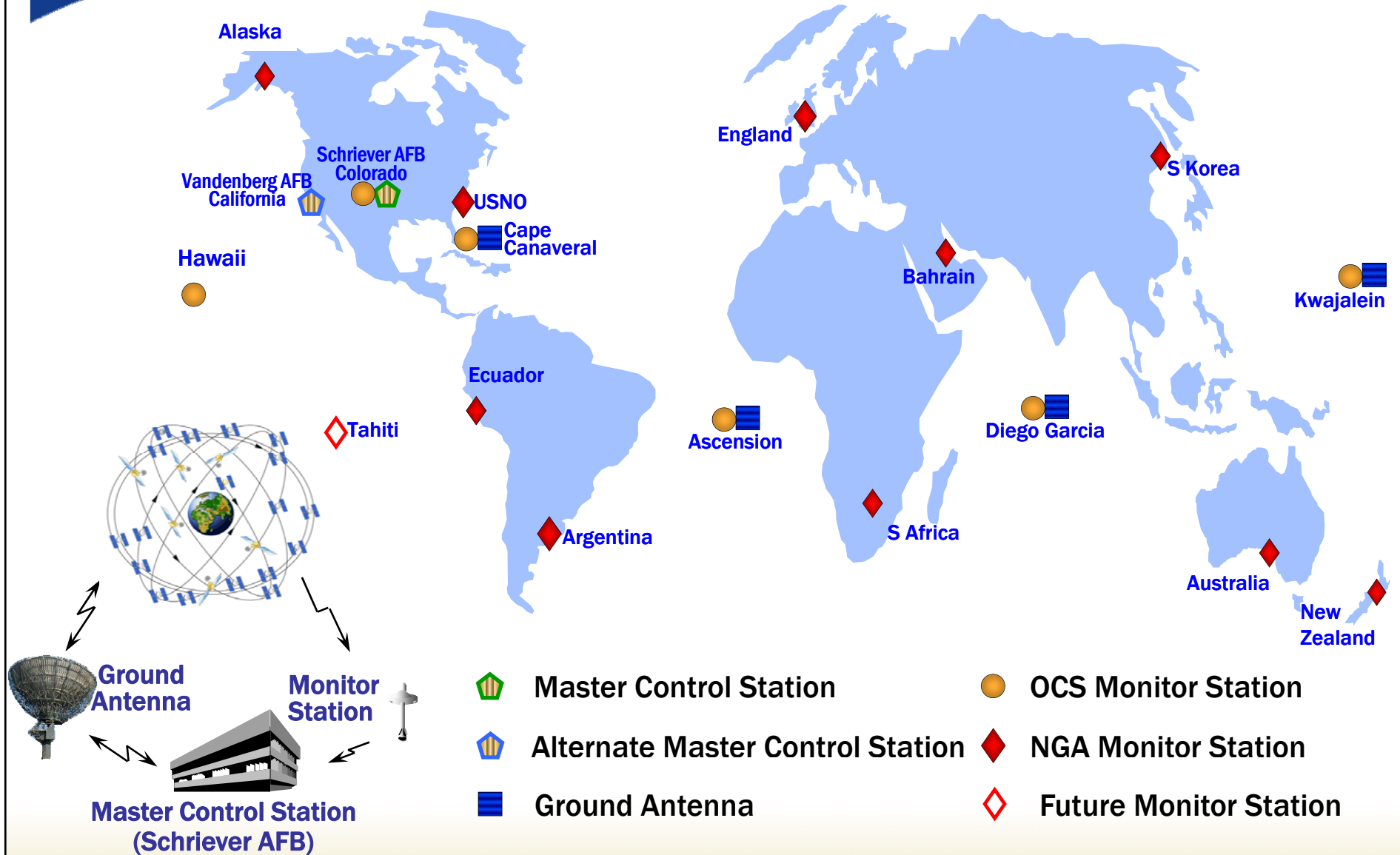
32 Operational Satellites **(Baseline Constellation: 24+3)**

- **11 Block IIA**
- **12 Block IIR**
- **8 Block IIR-M**
 - Transmitting new second civil signal
 - 1 GPS IIR-M in on-orbit testing
- **1 Block IIF**
 - In Test and Checkout
 - First of 12 Boeing satellites
- **3 additional satellites in residual status**
- **Global GPS civil service performance commitment met continuously since December 1993**



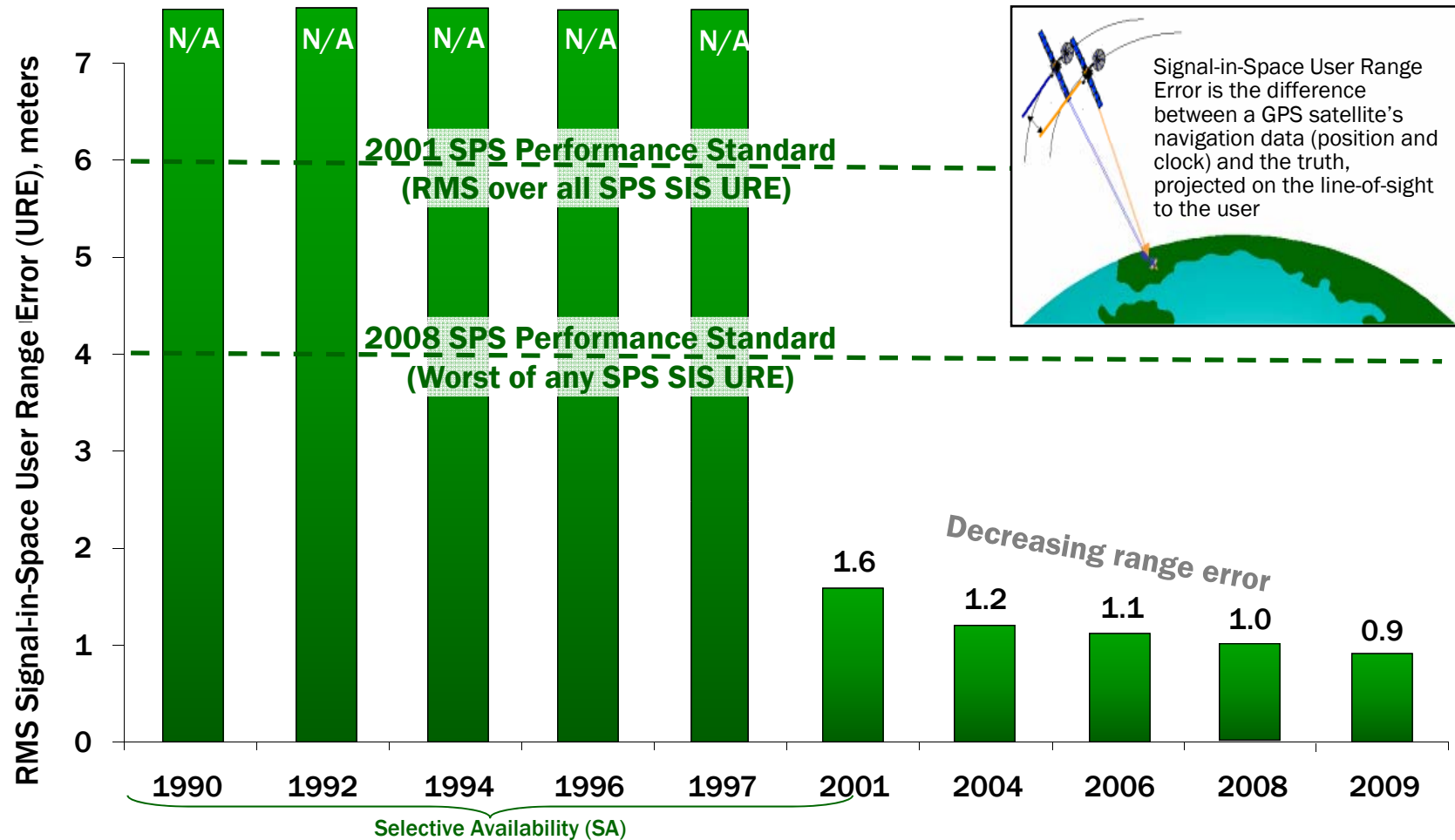


GPS Operational Control Segment (OCS)





Current GPS Accuracy



System accuracy exceeds published standard



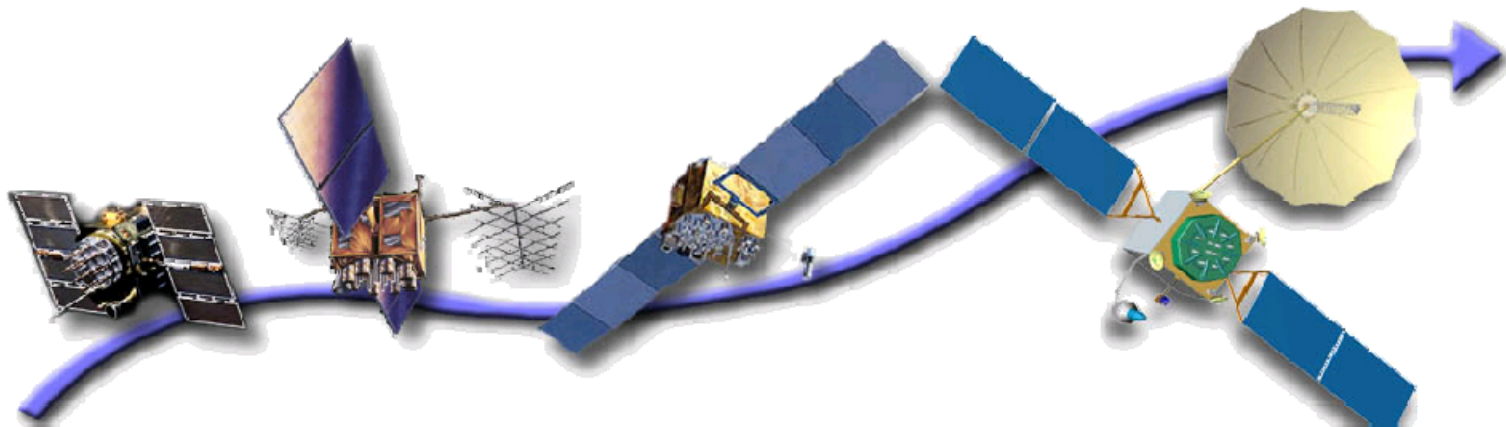
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GPS Modernization Program



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



Second Civil Signal (L2C)



- **Designed to meet commercial needs**
 - Higher accuracy via ionospheric correction
 - Expected to generate over \$5 billion in user productivity benefits
- **Available since 2005**
- **On 24 satellites by 2016**



Benefits existing professional receivers



Increases accuracy for consumers



Supports miniaturization, possible indoor use



Third Civil Signal (L5)



- **Designed to meet demanding requirements for transport safety**
 - Uses highly protected Aeronautical Radionavigation Service (ARNS) band
- **May also enable global, centimeter-level accuracy using new techniques**
- **Opportunity for international interoperability**
- **Demonstration signal launched in 2008**
- **24 satellites by 2018**





Fourth Civil Signal (L1C)



Under trees



Inside cities

- 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
- Launches with GPS III in 2014
- On 24 satellites by ~2021



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U.S. Policy History



- **1978: First GPS satellite launched**
- **1983: U.S. President offers free civilian access to GPS**
- **1996: U.S. policy establishes joint civil/military GPS management**
- **1997: U.S. Congress passes law that civil GPS shall be provided free of direct user fees**
- **2000: U.S. President set Selective Availability to “Zero”**
- **2004: U.S. President issues Space-Based PNT Policy**
- **2007: Selective Availability removed from GPS III satellites**
- **2010: U.S. President issues new National Space Policy**



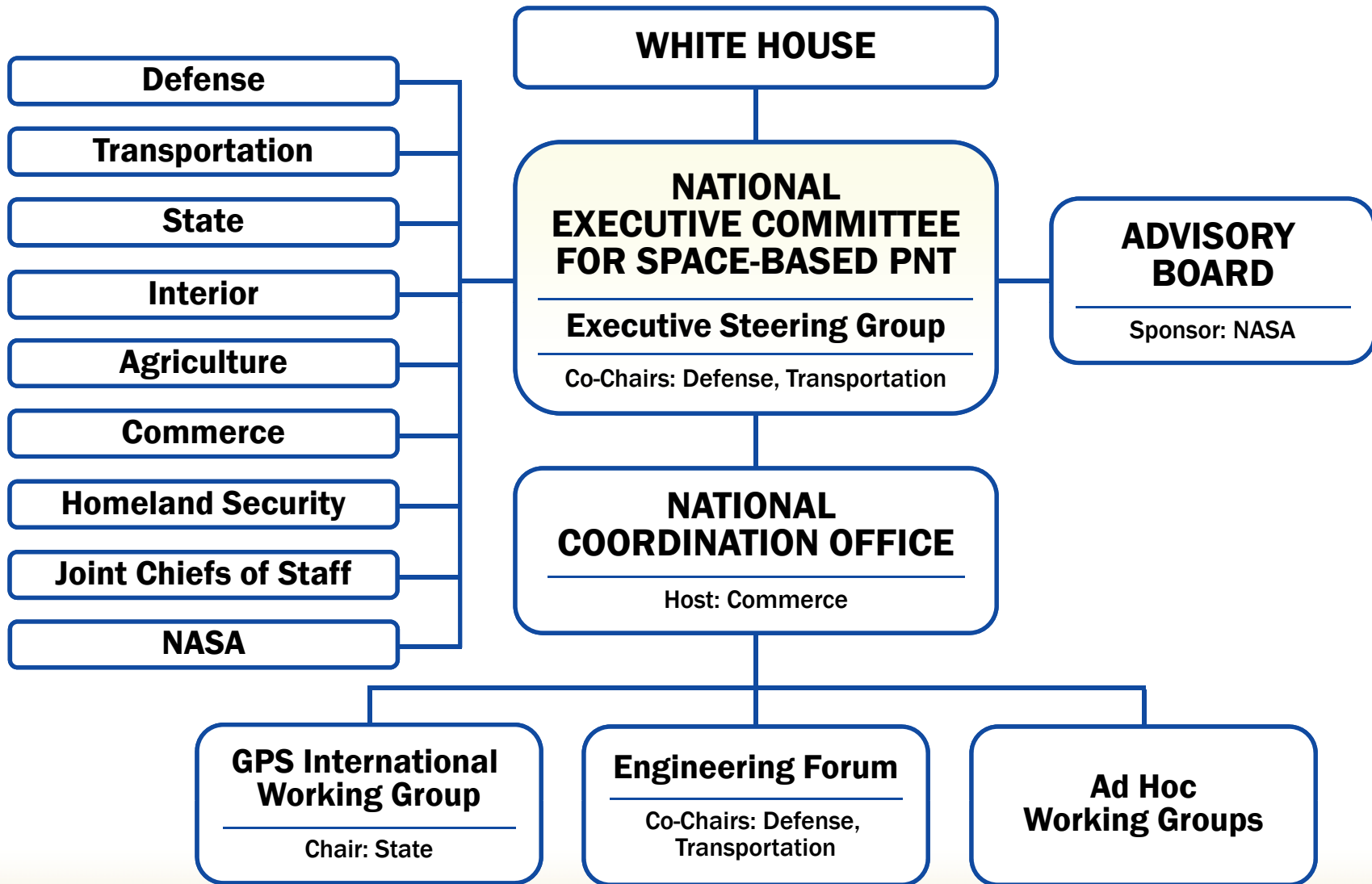
Latest U.S. Policy



- Provide continuous worldwide access 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



National Space-Based PNT Organization





Summary



- **GPS performance is better than ever and will continue to improve**
 - Augmentations enable even higher performance
 - New civil GPS signal available now
 - Many additional upgrades scheduled
- **U.S. policy encourages worldwide use of civil GPS and augmentations**
- **International cooperation is a priority**
 - **Compatibility and interoperability are critical**



For Additional Information...



[GPS.gov](http://www.gps.gov)

[PNT.gov](http://www.pnt.gov)



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