



SPACE-BASED POSITIONING  
NAVIGATION & TIMING  
NATIONAL COORDINATION OFFICE

# *GPS Modernization and Interoperability*

*Munich Satellite Navigation Summit 2016*

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# GPS Constellation Status



## **31 Operational Satellites (Baseline Constellation: 24)**

- **Robust operational constellation**
  - 12 Block IIR: L1 C/A, L1 P(Y), L2 P(Y) signals
  - 7 Block IIR-M: adds L2C, L1M, L2M signals
  - 12 Block IIF: adds L5 signal
- **9 additional satellites in residual/test status**
- **Modified Battery Change Control has extended GPS IIR and IIR-M life by 1-2 years per SV**
- **Global GPS civil service performance commitment met continuously since Dec 1993 (IOC)**
  - **Best performance 43.8 cm User Range Error (URE) on 1 Jan 15, best weekly average 52.7 cm URE 23 Nov 14**
  - **Performance improving as new satellites replace older satellites**



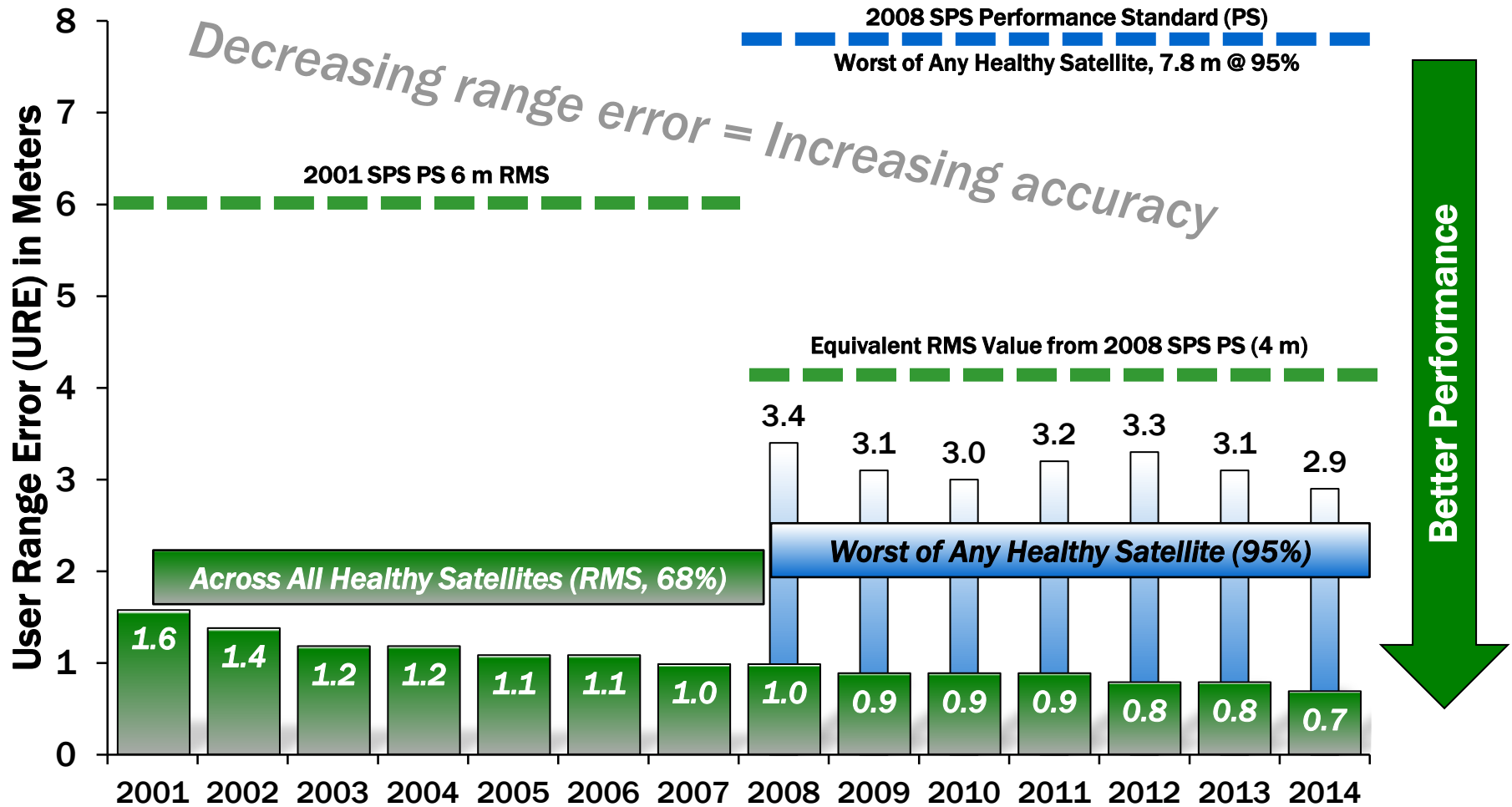


# Accuracy: Civil Commitments

## Standard Positioning Service Performance Standard



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



**System accuracy better than published standard**



# GPS III Status



- **Newest block of GPS satellites**
  - 4 civil signals: L1 C/A, L1C, L2C, L5
    - First satellites to broadcast common L1C signal
  - 4 military signals: L1/L2 P(Y), L1/L2M
  - 3 improved Rubidium atomic clocks
- **SV07/08 contract awarded 31 Mar 14**
- **SV09/10 planned to be purchased under current Lockheed contract**
- **SV1 successfully completed thermal vacuum testing in Dec 2015**
- **GPS III Non-Flight Satellite Testbed accomplished launch processing at Cape Canaveral; reduced risk for integration and test and launch processing**



Lockheed-Martin (Waterton, CO) - Prime



# Ground Segment Status



- **Current system Operational Control Segment (OCS)**
  - Flying GPS constellation on Architecture Evolution Plan and Launch and Early Orbit, Anomaly, and Disposal Operations software systems
  - Cyber security enhancements in progress
- **Next Generation Operational Control System (OCX)**
  - Modernized command and control system with M-Code
  - Modern civil, signal monitoring, info assurance infrastructure and improved PNT performance
  - OCX Block 0 supports launch and checkout for GPS III
  - Currently in integration and test
  - OCX Block 1 supports transition from OCS
  - Civil Signal Performance Monitoring capability scheduled for OCX Block 2



Monitor Station



Ground Antenna





# Now on the Air: New Civil Signals



- **Second civil signal “L2C”**
  - Designed to meet commercial needs
  - Higher accuracy through ionospheric correction
  - Full capability: 24 satellites
- **Third civil signal “L5”**
  - Designed to meet demanding requirements for transportation safety-of-life
  - Uses highly protected Aeronautical Radio Navigation Service (ARNS) band
  - Full capability: 24 satellites
- **Continuous broadcasts began 28 Apr 2014**
  - Position accuracy not guaranteed
  - L2C message currently set “healthy”
  - L5 message currently set “unhealthy”





# Assessment of Future of NDGPS



- **Joint U.S. Coast Guard & Department of Transportation *Federal Register* Notice in 2013**
  - Targeted outreach to user community
  - Asked how NDGPS is used, impact/alternatives if discontinued
  - Assessment driven by many factors: from policy to technology
- **2015 *Federal Register* Notice sought feedback on deactivation of 62 of 84 sites in January 2016**
  - Numerous responses received, 1/3 maritime related
- **Deactivation and decommissioning of sites temporarily on hold pending review and consideration user inputs**



# Complementary PNT (CPNT)

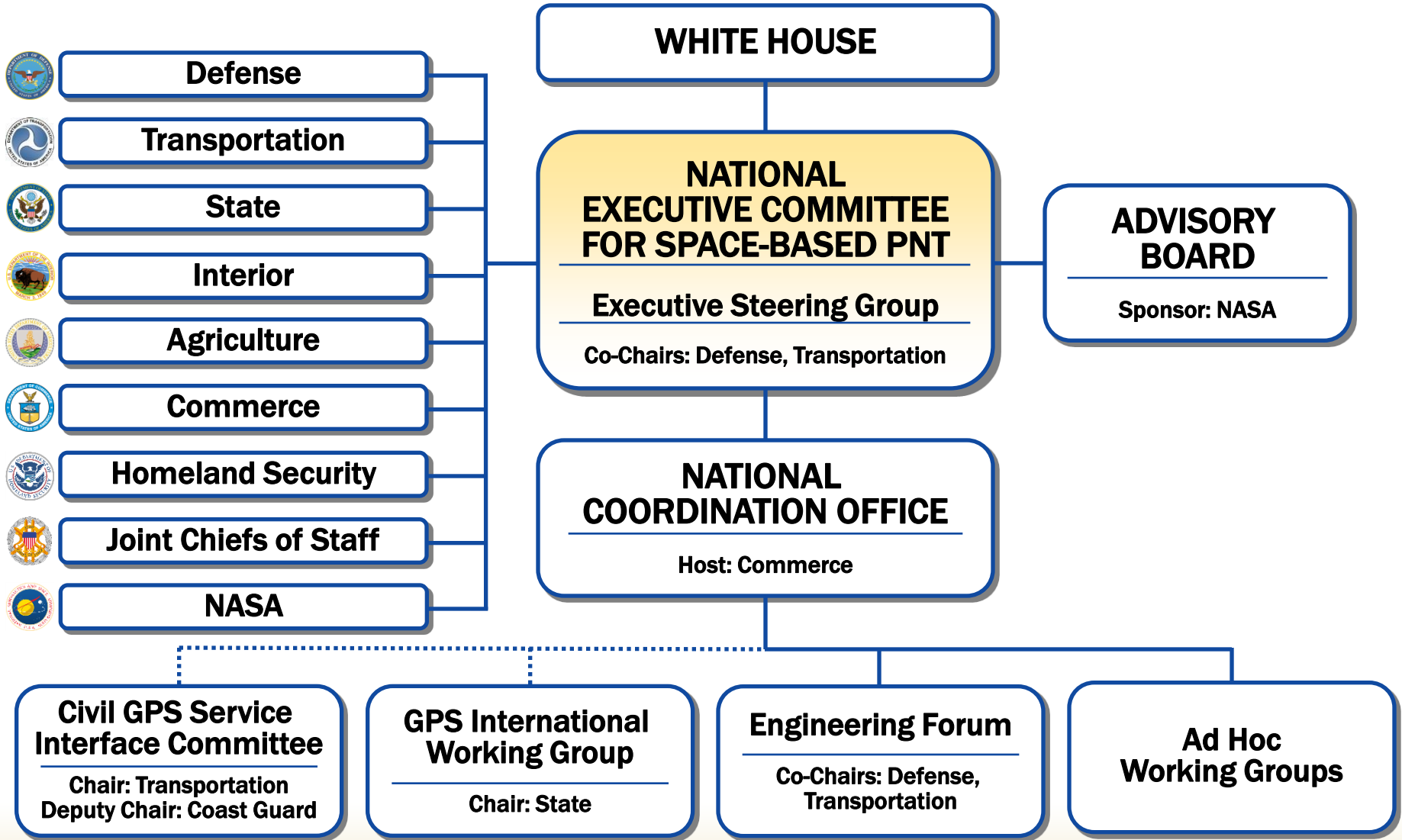


- **EXCOM looked at need for complement to GPS**
  - Assessment driven by many factors: from policy to technology
  - U.S. coverage for GPS outage from natural or man-made events
- **Current Activity: Identify and develop requirements**
  - Assesses a wide range of user requirements
- **Decisions support FY18 investment actions**
- ***Federal Register* Notice in development for public stakeholder engagement**





# National Space-Based PNT Organization





# Summary



- **The U.S. supports free access to civilian GNSS signals and all necessary public domain documentation**
- **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 the Air Force on behalf of the USG**
- **The U.S. policy promotes open competition and market growth for commercial GNSS**
- **Modernization milestones: Multiple launches and new Civil Navigation messages broadcast**

***GPS: Continuous improvement,  
predictable, dependable positioning performance***



# Thank You!



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

**Official public resource for U.S. Government  
Information about GPS and related topics**

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