



SPACE-BASED POSITIONING
NAVIGATION & TIMING
NATIONAL COORDINATION OFFICE

U.S. Space-Based Positioning, Navigation, and Timing Policy with Program Update

10th ANNUAL BAŠKA GNSS CONFERENCE

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National Coordination Office
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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** <https://www.youtube.com/watch?v=F8fssipuwm4>
- **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** <https://spaceflightnow.com/2016/03/09/new-gps-satellite-begins-transmitting-to-users-around-the-globe/>





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
 - Three improved Rubidium atomic clocks
- **SV07/08 contract awarded 31 Mar 14**
- **SV09/10 planned to be purchased under current Lockheed contract**
- **Navigation payload panel began space environment testing at Lockheed Martin's Colorado facility Sep 14**
- **GPS III Non-Flight Satellite Testbed accomplished launch processing at Cape Canaveral; reduced risk for integration & test and launch processing**
- **On January 8, 2016, the Air Force Space and Missile Systems Center released a solicitation seeking proposals for the GPS III Space Vehicles 11+ Phase 1 Production Readiness Feasibility Assessment contract. Award 3Q 2016?**



Lockheed-Martin (Waterton, CO) - Prime

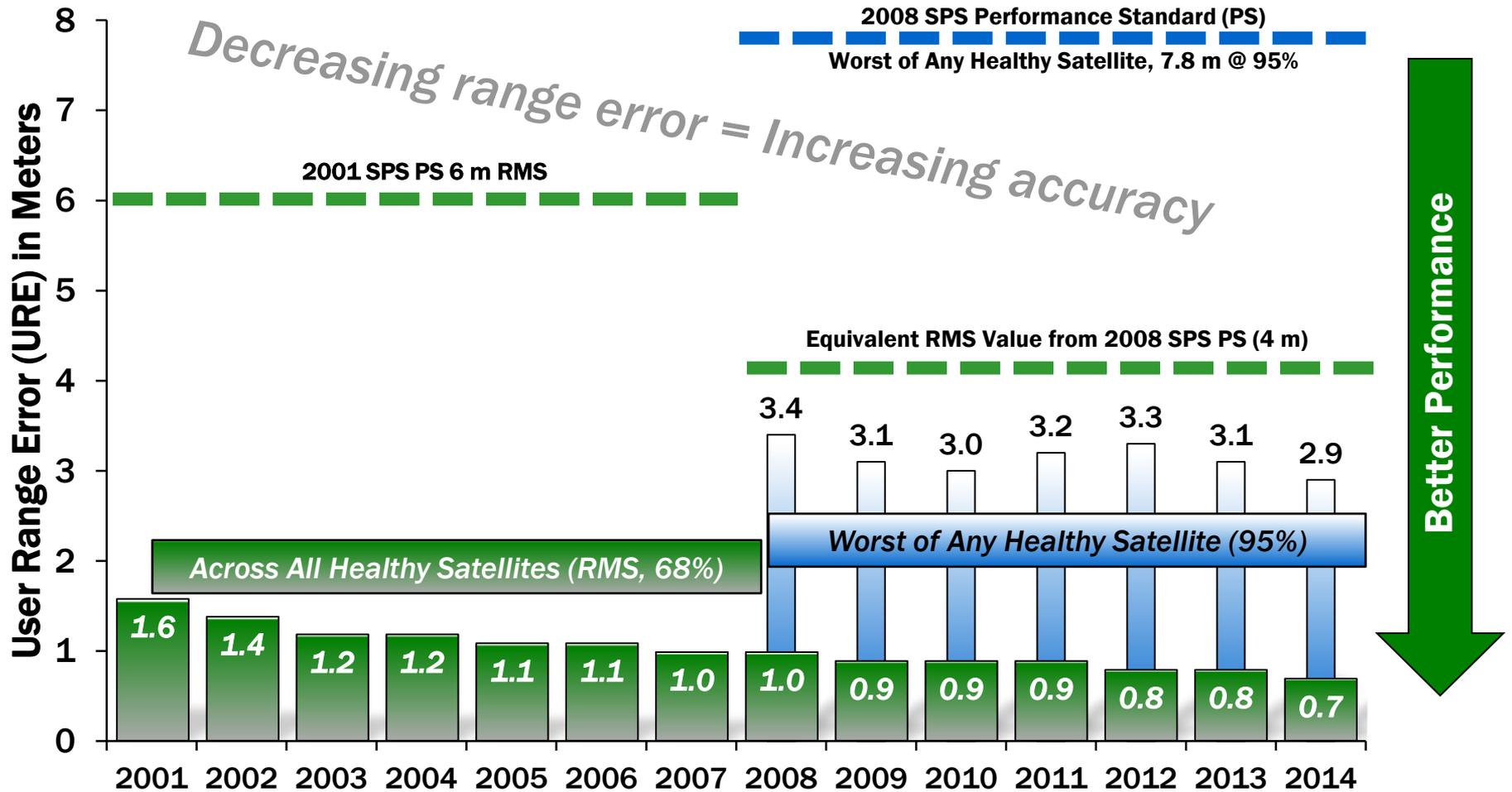


Accuracy: Civil Commitments

Standard Positioning Service Performance Standard



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



System accuracy better than published standard



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 replaces legacy system, adds modern features
 - OCX Block 2 adds advanced Civil Signal Performance Monitoring capabilities; advanced military capabilities



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 ~2019
- **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 ~2024
- **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 (Nationwide Differential GPS System)



- **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
 - Responses have been reviewed
- **Identified and assessed options**
 - Site-by-site analysis
 - Continuation/partial decommission/transfer/hybrid
- **2015 Federal Register Notice sought feedback on deactivation of 62 sites in 2016**
- **Deactivation and decommissioning of sites on hold pending additional analysis of 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**



U.S. National Space Policy

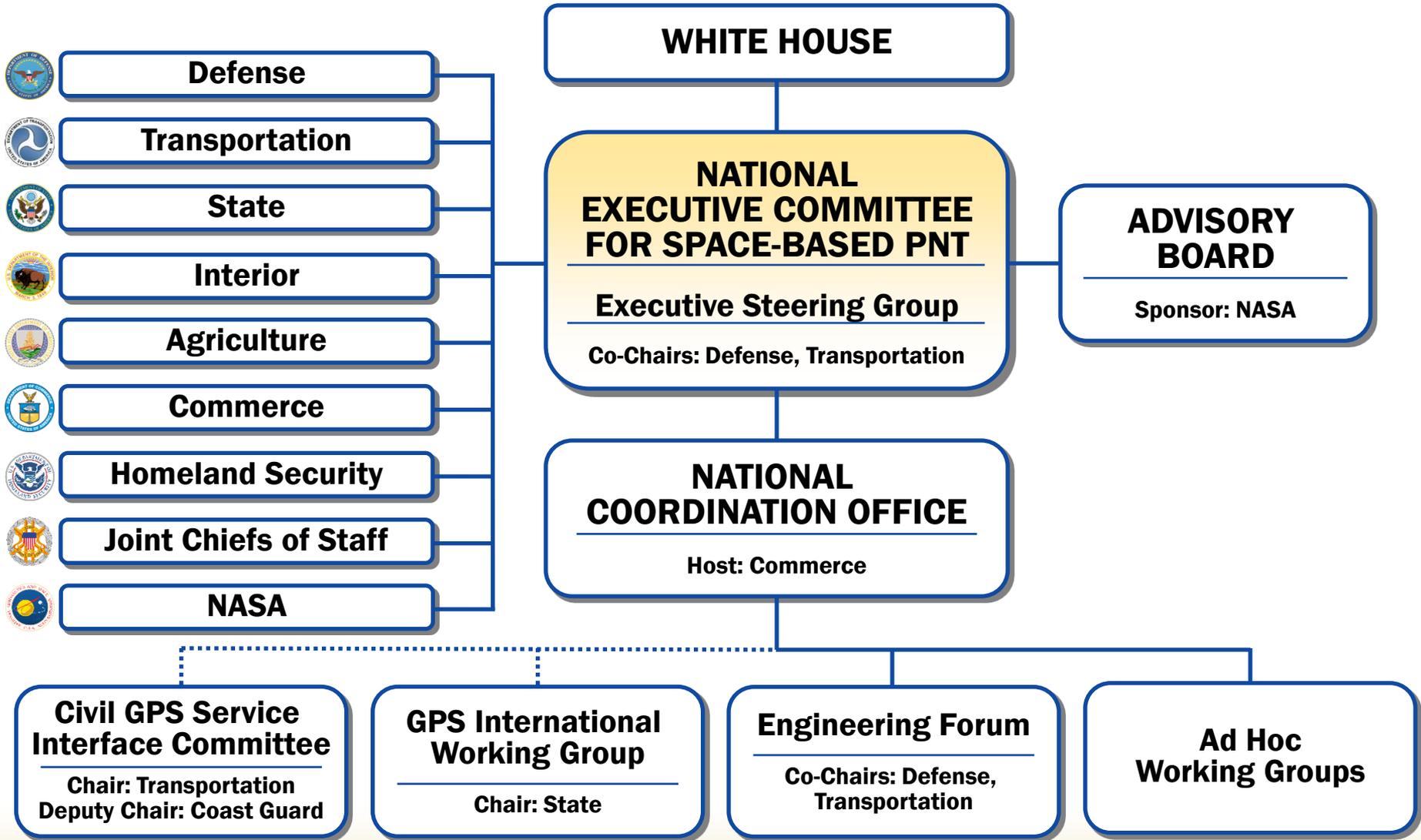


Space-Based PNT Guideline: Maintain leadership in the service, provision, and use of GNSS

- **Provide continuous worldwide access to GPS for peaceful uses, free of direct user charges**
- **Engage with foreign GNSS providers on compatibility, interoperability, transparency, and market access**
- **Operate and maintain GPS 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





Recent Related Developments



- USCG MSA 01-16 issued 19 January 2016 “GPS Disruptions”
[Global Navigation Satellite Systems – Trust, But Verify](#)
- The DHS Press Release (below) of 20 April 2016 RE: NYSE Precision Timing [S&T Press Release: DHS S&T Demonstrates Precision Timing Technology at the New York Stock Exchange](#)
- DOT Announcement of Study for Adjacent Band Testing 3 March 2016 at http://www.rita.dot.gov/pnt/announcement_03032016
- DOT/FAA Study Team Presentation: GNSS Intentional Interference and Spoofing <http://www.gps.gov/multimedia/presentations/2016/04/APEC/alexander-2.pdf>
- GPS Economic Value: Preliminary Assessment: Dr. Irv Leveson’s slides from <http://www.gps.gov/governance/advisory/meetings/2015-06/leveson.pdf>
- The Air Force PR posted on the USCG NAVCEN dated 27 January 2016: <http://www.navcen.uscg.gov/pdf/gps/AirForceOfficialPressRelease.pdf>
- The U.S. Army’s 22 April 2016 RFI: Assured Positioning, Navigation, and Timing; Solicitation Number: W56KGY-16-R-APNT <https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=a1bf08d0e477c5e231319e3669ddab4e>



Summary



- The United States supports free access to civilian GNSS signals and all necessary public domain documentation
- United States policy upholds longstanding commitments to free, continuous, worldwide GPS access to all users
- **GPS is a critical component of the global information infrastructure**
 - Compatible with other satellite navigation systems - interoperable at the user level
 - National level attention - Guided at a national level as multi-use asset
 - Performance continues to improve beyond published commitments
 - Acquired and operated by the Air Force on behalf of the USG
- The United States policy promotes open competition and market growth for commercial GNSS
- Modernization milestones: Multiple launches and new capabilities for user benefits: for instance Civil Navigation messages broadcast and others

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



Thank You!

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www.gps.gov

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

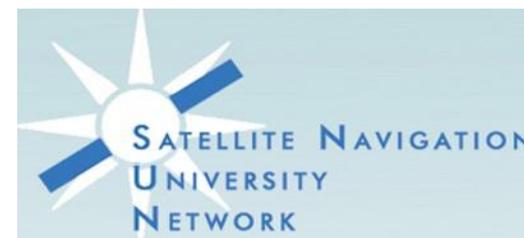
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