

2025 Current Fiscal Year Report: National Space-Based Positioning, Navigation, and Timing Advisory Board

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1. Department or Agency		2. Fiscal Year	
National Aeronautics and Space Administration		2025	
3. Committee or Subcommittee		3b. GSA Committee No.	
National Space-Based Positioning, Navigation, and Timing Advisory Board		29124	
4. Is this New During Fiscal Year?	5. Current Charter	6. Expected Renewal Date	7. Expected Term Date
No	04/25/2023	04/25/2025	09/30/2025
8a. Was Terminated During Fiscal Year?	8b. Specific Termination Authority	8c. Actual Term Date	
Yes	NOTE: the Committee was not addressed in Executive Order 14354 issued September 30, 2025.	09/30/2025	
9. Agency Recommendation for Next Fiscal Year	10a. Legislation Req to Terminate?	10b. Legislation Pending?	
Terminate	Not Applicable	Not Applicable	
11. Establishment Authority	Presidential		
12. Specific Establishment Authority	13. Effective Date	14. Committee Type	14c. Presidential?
Space Policy Directive-7 , "The United States Space-Based Positioning, Navigation, and Timing Policy (January 15, 2021).	12/08/2004	Continuing	Yes

15. Description of Committee Scientific Technical Program

Advisory Board

16a. Total
Number of No Reports for
Reports this Fiscal Year

17a. 1 **17b. Closed** 0 **17c. Partially Closed** 0 **Other Activities** 0 **17d. Total** 1
Open

Meetings and Dates

Purpose	Start	End
Committee meeting	12/04/2024	- 12/05/2024

Number of Committee Meetings Listed: 1

	Current FY	Next FY
18a(1). Personnel Pmts to Non-Federal Members	\$0.00	\$0.00
18a(2). Personnel Pmts to Federal Members	\$0.00	\$0.00
18a(3). Personnel Pmts to Federal Staff	\$28,875.00	\$0.00
18a(4). Personnel Pmts to Non-Member Consultants	\$0.00	\$0.00
18b(1). Travel and Per Diem to Non-Federal Members	\$0.00	\$0.00
18b(2). Travel and Per Diem to Federal Members	\$0.00	\$0.00
18b(3). Travel and Per Diem to Federal Staff	\$0.00	\$0.00
18b(4). Travel and Per Diem to Non-member Consultants	\$0.00	\$0.00
18c. Administrative Costs (FRNs, contractor support, In-person/hybrid/virtual meetings)	\$0.00	\$0.00
18d. Other (all other funds not captured by any other cost category)	\$146,566.34	\$0.00
18e. Total Costs	\$175,441.34	\$0.00
19. Federal Staff Support Years (FTE)	0.15	0.00

20a. How does the Committee accomplish its purpose?

The National Space-Based Positioning, Navigation and Timing (PNT) Advisory Board provides advice, as directed by the PNT Executive Committee (EXCOM) through NASA, on U.S. space-based PNT policy, planning, program management and funding profiles in relation to the current state of national and international space-based PNT services. The PNT Board Chair and Vice-Chair regularly report progress directly to the Deputy Secretaries of the nine Federal Agencies, and White House offices, that convene at the PNT EXCOM and Assistant Secretary level PNT Executive Steering Group (ESG) 2-4 times per year.

20b. How does the Committee balance its membership?

The PNT Advisory Board membership is balanced by sector and expertise to ensure comprehensive representation for diverse points of view to address the complex national issues to be examined and functions to be performed. The actual Board member nominations come from the nine Federal agencies that comprise the PNT EXCOM to ensure this balanced representation and diverse skillset. The Board is comprised of both U.S. and international members, in recognition of the fact that the U.S. Global Positioning System (GPS) is a global navigation satellite system with a worldwide user community. Membership is augmented by rotating on six new members with expertise in different unique sectors at periodic intervals, to ensure new expertise is brought on even as institutional memory is maintained with a core group.

20c. How frequent and relevant are the Committee Meetings?

The PNT Advisory Board usually meets twice each fiscal year. It remains relevant by responding to current issues and taskings as assigned by consensus through active PNT EXCOM discussion topics, as well as independent assessments brought forward by active PNT Board members representing the various sectors.

20d. Why can't the advice or information this committee provides be obtained elsewhere?

A national Presidential policy was announced on December 8, 2004 that establishes guidance and implementation actions for space-based positioning, navigation, and timing programs, augmentations, and activities for U.S. national and homeland security, civil, scientific, and commercial purposes. This policy superseded Presidential Decision Directive/National Science and Technology Council-6, U.S. Global Positioning System Policy, dated March 28, 1996. National Security Presidential Directive-39 (NSPD-39) was most recently continued by Executive Order 14048 on September 30, 2021. On January 15, 2021, Space Policy Directive 7 (SPD-7), "The United States Space-Based Positioning, Navigation, and Timing Policy," superseded NSPD-39. The National Space-Based Positioning Navigation and Timing Advisory Board is a unique Federal advisory committee in that it is Presidential authority, represents the interests of multiple U.S. Government agencies, and has international participation as well. The Charter was last renewed on 04/25/2023, continuing the Committee.

20e. Why is it necessary to close and/or partially closed committee meetings?

N/A. All PNT Advisory Board deliberative meetings were open and accessible to the public.

21. Remarks

NASA is managing the operations of this FACA advisory committee as part of its governmental contribution to the implementation of Space Policy Directive 7 (SPD-7) for Space-Based PNT issued on January 15, 2021. SPD-7 reaffirms the 2004 National Security Presidential Directive (NSPD-39), and expands from 9 to 13 the number of Federal agencies represented in the Deputy-Secretary level PNT Executive Committee (PNT EXCOM): Department of Defense, Department of Transportation, Department of Commerce, Department of State, Department of Homeland Security, Department of Interior, Department of Agriculture, Joint Chiefs of Staff, NASA, Office of the Director of National Intelligence, Department of Treasury, Department of Justice, and Department of Energy. The PNT Advisory Board reports PNT Executive Committee, which is co-chaired by the Deputy Secretary of Defense and Deputy Secretary of Transportation, with the NASA Deputy Administrator or designee as the ranking member. Recommendations and advice are conveyed by the PNT Advisory Board Chair to meetings of the PNT EXCOM, and are formally documented in the PNT Advisory Board meeting minutes. The board is currently chaired by ADM Thad Allen, the 38th Commandant of the U.S. Coast Guard. The board has been sponsored by the NASA Space Communications and Navigation Program (SCaN) since 2007, and its Executive Director is James J. Miller. The National Space-Based Positioning, Navigation and Timing (PNT) Advisory Board met once during the fiscal year on December 4-5, 2024. Executive Order 14109 continued the

National Space-Based Positioning, Navigation, and Timing (PNT) Advisory Board until September 30, 2025. No further continuation has been ordered. NASA awaits further direction from the Administration and looks forward to working with the White House to ensure PNT governance is aligned with Administration priorities and to enhance future PNT capabilities.

Designated Federal Officer

James J. Miller DFO/Executive Director

Committee Members	Start	End	Occupation	Member Designation
Allen (USCG, Ret.), Thad	05/08/2015	09/30/2025	Booz-Allen Hamilton	Special Government Employee (SGE) Member
Axelrad, Penina	05/08/2015	09/30/2025	University of Colorado, Boulder	Special Government Employee (SGE) Member
Betz, John	05/08/2015	09/30/2025	MITRE	Special Government Employee (SGE) Member
Burgett, Scott	05/08/2015	09/30/2025	Consultant	Special Government Employee (SGE) Member
Chan, Bryan	10/06/2023	09/30/2025	Consultant	Special Government Employee (SGE) Member
Diamond, Patrick	06/04/2019	09/30/2025	Consultant	Special Government Employee (SGE) Member
Geringer, James	05/08/2015	09/30/2025	Environmental Systems Research Institute	Special Government Employee (SGE) Member
Goward, Dana	05/08/2015	09/30/2025	Resilient Navigation and Timing Foundation	Representative Member
Greiner-Brzezinska, Dorota	06/04/2019	09/30/2025	Ohio State University	Special Government Employee (SGE) Member

Higgins, Matt	05/08/2015	09/30/2025	International Global Navigation Satellite Systems Society of Australia Nottingham Geospatial Institute, University of Nottingham	Representative Member
Moore, Terry	06/04/2019	09/30/2025	The Boeing Company	Special Government Employee (SGE) Member
Murphy, Timothy	05/08/2015	09/30/2025	Stanford University	Special Government Employee (SGE) Member
Parkinson, Bradford	05/08/2015	09/30/2025	Consultant	Special Government Employee (SGE) Member
Scott, Hugh	10/06/2023	09/30/2025	International Air Transport Association	Representative Member
Shane, Jeffrey	06/04/2019	09/30/2025	Consultant	Special Government Employee (SGE) Member
Shelton, William	10/06/2023	09/30/2025	Ygomi, Founder	Special Government Employee (SGE) Member
Shields, T. Russell	05/08/2015	09/30/2025	North Carolina Department of Public Safety, North Carolina Geodetic Survey	Special Government Employee (SGE) Member
Thompson, Gary	06/04/2019	09/30/2025	Consultant	Special Government Employee (SGE) Member
van Diggelen, Frank	06/04/2019	09/30/2025		Special Government Employee (SGE) Member

Number of Committee Members Listed: 19

Narrative Description

The PNT Advisory Board is NASA's contribution to implementation of the U.S. National PNT Policy, where the NASA Administrator, in

cooperation with the Secretary of Commerce, shall develop and provide to the Secretary of Transportation requirements for the use of the Global Positioning System and its augmentations to support civil space systems. The PNT Board has therefore provided NASA, and the twelve other Federal agencies of the PNT EXCOM, with expert technical and policy advice to ensure that national and international GPS/PNT needs can continue to be met as the constellation is modernized and the spectrum environment becomes more challenged from radio frequency interference. Specific analysis is conducted to develop actionable recommendations for the PNT EXCOM to consider implementing in support of meeting Space Policy Directive (SPD) -7 goals and objectives. The National Space-Based Positioning, Navigation, and Timing Advisory Board held one meeting in fiscal year 2025 on December 4-5, 2024 in Redondo Beach, CA. Executive Order 14109 continued the National Space-Based Positioning, Navigation, and Timing (PNT) Advisory Board until September 30, 2025. No further continuation has been ordered. NASA awaits further direction from the Administration and looks forward to working with the White House to ensure PNT governance is aligned with Administration priorities and to enhance future PNT capabilities. The committee was not listed on the 2025 Continuation Executive Order, therefore the committee was terminated on September 30, 2025.

What are the most significant program outcomes associated with this committee?

	Checked if Applies	
Improvements to health or safety	<input checked="" type="checkbox"/>	
Trust in government	<input checked="" type="checkbox"/>	
Major policy changes	<input checked="" type="checkbox"/>	
Advance in scientific research	<input checked="" type="checkbox"/>	
Effective grant making	<input type="checkbox"/>	
Improved service delivery	<input checked="" type="checkbox"/>	
Increased customer satisfaction	<input checked="" type="checkbox"/>	
Implementation of laws or regulatory requirements	<input checked="" type="checkbox"/>	
Other	<input checked="" type="checkbox"/>	

Outcome Comments

Two FACA meetings were held in FY24. The 29th FACA meeting was held on December 6-7, 2023, in League City, TX, near the NASA Johnson Space Center (JSC), and the 30th FACA meeting was held on April 25-25, 2023, in Colorado Springs, CO. Both meetings were also broadcast on webcast. The first meeting included the following key discussions: (1) Updates from the six subcommittees; (2) U.S. Government and institutional PNT updates, including the National Coordination Office for Space-based PNT, Dept. of Transportation, U.S. Space Force, and United Nations Office for Outer Space Affairs; (3) Briefings on Protecting, Toughing, and Augmenting (PTA) Global Navigation Satellite Systems (GNSS) for all users, including the Critical Infrastructure Augmentation Framework, a comparison of the NASA Global Differential GPS System (GDGPS) & Galileo High Accuracy Service (HAS), and the current Low Earth Orbit (LEO) -based PNT augmentations; (4) PNT Education and science, including space weather effects on GNSS signals, White House space weather survey for GNSS users, and current challenges in hiring geospatial intelligence professionals; and (5) Updates from the PNTAB international members and representatives. Fact-finding meetings were held on December 4-5, including a meeting with Ms. Vanessa Wyche (Director, JSC) to discuss the use of GPS to support human spaceflight throughout Cislunar Space up to near-side lunar surface operations. The presentations and deliberations are described in detail in the Meeting Minutes, which are available at the following link:

<https://www.gps.gov/governance/advisory/meetings/2023-12/>. The second meeting focused on the board's Protect, Toughen, and Augment program for GPS users. This was followed by a discussion comparing the capabilities of the different GNSS constellations, and updates from the board's international members and representatives. Additional activities included: (1) On April 22 the board held a fact-finding meeting at Schriever Space Force Base (SFB) with representatives from the Second Space Operations Squadron (2 SOPS), where key discussions included the status of the development and implementation of the Modernized GPS Operational Control System (OCX); and (2) On April 23 the board held a preparatory meeting to discuss: (1) Dept. of Transportation (DOT) update on complementary PNT, eLoran RFI, GNSS spectrum monitoring; (2) U.S. Space Force (USSF) GPS modernization update; (3) Dept. of State (DOS) update on the ongoing revision of International Traffic in Arms Regulations (ITAR); (4) Use of L5 for improved GNSS resilience. The presentations and deliberations are described in detail in the Meeting Minutes, which are available at the following link:

<https://www.gps.gov/governance/advisory/meetings/2024-04/>. This was followed on July 19, 2024, by the Memorandum, "Report of the 30th National Space-based PNT Advisory Board Meeting and Associated Activities," from ADM Thad Allen (Chair) to the DoD Deputy Secretary (Honorable Kathleen H. Hicks Deputy Secretary, Department of

Defense Co-Chair, National Space-based PNT Executive Committee) and to the DOT Deputy Secretary (Honorable Polly E. Trottenberg Deputy Secretary, Department of Transportation Co-Chair, National Space-based PNT Executive Committee). This Memorandum is available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2024-07-PNTAB-chair-memo.pdf>.

While the PNT Board cannot assume full direct credit for causing the PNT EXCOM and associated Federal agencies to act on specific recommendations, there is most definitely a correlation between what the PNT Board advises and what the PNT EXCOM has actually been implementing and planning to ensure GPS services are protected and made more accessible on a less expensive basis to the world user communities. In this regard the work of the PNT Board has positively assisted NASA and the Federal government in accomplishing its objectives, with some specific examples cited in the comment sections below. Documentation: <https://www.gps.gov/advisory-committee-meetings>

What are the cost savings associated with this committee?

Checked if Applies

- | | |
|----------------------------|-------------------------------------|
| None | <input type="checkbox"/> |
| Unable to Determine | <input type="checkbox"/> |
| Under \$100,000 | <input type="checkbox"/> |
| \$100,000 - \$500,000 | <input type="checkbox"/> |
| \$500,001 - \$1,000,000 | <input type="checkbox"/> |
| \$1,000,001 - \$5,000,000 | <input type="checkbox"/> |
| \$5,000,001 - \$10,000,000 | <input type="checkbox"/> |
| Over \$10,000,000 | <input checked="" type="checkbox"/> |
| Cost Savings Other | <input type="checkbox"/> |

Cost Savings Comments

A key previous recommendation that is still being implemented and has direct value measurable in the tens of millions of dollars is adoption of an enhanced GPS Space Service Volume (SSV) for emerging civil space users (NASA, NOAA, commercial space, etc.). The SSV is a volume of space where GPS broadcasts that ranges from 3,000 Km to 36,000 Km, an altitude where Geosynchronous communications satellites operate. The PNT Board recommended that the Air Force adopt the use of existing GPS signal side lobes to enable more civil space users to access PNT information in the challenging space domain. This capability would enable new missions such as the GOES series of weather satellites, formation flyers, and even satellite servicing missions. However, the Air Force quoted NASA a price of enabling this capability as a new requirement -- for a price range from \$226M to \$1.2B. After much technical debate by PNT Board members, this excessive cost was dramatically reduced by the Air Force in an effort to capture

capabilities already available and measured by NASA, rather than forcing a potentially unneeded hardware modification to new GPS satellite vehicles being built. The end result is that the Air Force is now working with NASA to minimize costs and hardware changes for this enhanced capability, and has allowed for a NASA representative to participate on the GPS IIF procurement team.

What is the approximate Number of recommendations produced by this committee for the life of the committee?

41

Number of Recommendations Comments

The National Space-Based Positioning, Navigation, and Timing (PNTAB) Advisory Board has deliberated and approved 35 key recommendations since its first meeting in 2008.

These recommendations have been grouped into two parts. Part I lists the recommendations (23 in total) submitted by the Chair between 2008 and 2022, and Part II lists the recommendations submitted by the Chair between 2023 and 2024 and in the process of being implemented. Part I: Recommendations FY08-FY22 Between FY08 and FY22 a total of 23 key recommendations, and supporting documentation, were submitted.

Of these, 16 were fully implemented and seven were partially implemented. These 23

recommendations are described below. 2009-June-18 (3 recommendations): Three recommendations were included in the Proceedings, "2007-2008 National Space-Based PNT Advisory Board Proceedings", available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2009-06-finalreport.pdf>. The recommendations are: (1) Ensure GPS policy stability and service guarantees; (2) Expand the nominal GPS constellation to 30 optimally distributed satellites; (3) Maximize the use of the EXCOM. 2010-November-4 (5 recommendations): The board submitted the White Paper, "National PNT Advisory Board comments on Jamming the Global Positioning System - A National Security Threat: Recent Events and Potential Cures," which is available at:

<https://www.gps.gov/governance/advisory/recommendations/2010-11-jammingwhitepaper.pdf>.

It included five recommendations: (1) GPS should be formally declared critical infrastructure by Executive Branch and managed as such by DHS; (2) The National Executive Committee should establish and sponsor a National GPS Interference Locating, Reporting, and Elimination System ; coordinating and expanding on the resources of several Departments; (3) The National Executive Committee should examine whether or not they should sponsor Legislation in Congress that addresses interference to GPS that provides substantial fines and jail time for both possession and use of GPS jammers; (4) Hardening GPS Receivers and Antennas. Government should foster and help to stimulate Manufacturers to speed up the development and offering of interference resistant GPS

receivers, especially for safety-of-life applications such as commercial air and maritime; (5) We strongly recommend that the previously announced decision (to deploy eLoran as the primary Alternate PNT) should be reconfirmed and quickly implemented. We support the FAA's efforts to provide Alternate PNT options that can provide a robust backup to GPS and deter malicious interference. 2011-August-3 (1 recommendation): The board submitted a letter to the FCC Chairman, which is available at:

2011-08-lightsquaredlettertofcc.pdf. It included the following recommendation: The board strongly recommends that the Commission rescind its conditional waiver [to LightSquared Subsidiary LLC) and not allow a change in the structure of the Mobile Satellite Services (MMS) frequency band that abuts GPS to allow transmissions that interference with GPS.

2014-August-29 (4 recommendations): The board submitted a letter to the PNT EXCOM, which is available at: National Space-Based Positioning, Navigation, and Timing Advisory Board -- Fourteenth Meeting, December 10-11, 2014. It included the following four recommendations: (1) Formally designate GPS as a critical infrastructure sector for the United States; (2) Develop a formal National Threat Model for PNT applications in critical infrastructure; (3) Prevent the proliferation of licensed emitters in the GPS frequency bands; (4) Establish a Nationwide CONUS back-up to GPS with existing infrastructure (eLoran).

2016-June-13 (1 recommendation): The board submitted a letter to the PNT EXCOM, "Spectrum Repurposing and Interference with Space-Based Positioning, Navigation, and Timing (PNT) Services," which is available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2016-06-letter-to-excom.pdf>).

The letter included a recommendation to include six criteria for assessing interference to GPS and GNSS applications: (1) Adhere to the 2012 EXCOM letter guidance to ensure that new spectrum proposals "are implemented without affecting existing and evolving uses of space-based PNT services"; (2) Strictly apply the 1 dB degradation Interference Protection Criterion (IPC); (3) Protect all classes of GPS receivers, including precision and timing receivers; (4) Protect GPS receivers in all receiver operating modes, including signal acquisition/reacquisition; (5) Protect all uses of all emerging GNSS signals; (6) Use maximum authorized transmitted interference powers and propagation models that do not underrepresent the maximum power of the interfering signal (particularly consider the impact of multiple transmitters creating additive interference).

2017-July-5 (1 recommendation): The board submitted a letter to the PNT EXCOM, "Adjacent Band Harmful Interference to Global Positioning System (GPS) Users," which is available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2017-07-letter-to-excom.pdf>.

It recommended the USG to protect current and evolving uses of GPS, military and civilian, as a matter of national priority.

2018-August-10 (1 recommendation): The board submitted a letter to the PNT EXCOM, "PNT Advisory Board (PNTAB) Recommendation to PNT Executive Committee (EXCOM) Regarding Latest Ligado Proposal," which is

available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2018-08-letter-to-excom.pdf>.

It included a recommendation for the UGS to oppose the latest proposal from Ligado.

2018-September-28 (7 recommendations): To support U.S. Positioning, Navigation, and Timing (PNT) policy goals, and the economic benefits of the Global Positioning System (GPS), the U.S. National Space-Based PNT Advisory Board has developed topic papers for the following sectors: Agriculture; Aviation and Aerospace; (3) Critical Infrastructure and Timing; Military; Policy and Governance; Science; Spectrum; Transportation (Non-Aviation). This topics paper is available at the following link:

<https://www.gps.gov/governance/advisory/recommendations/2018-09-topic-papers.pdf>. Of

all the recommendations developed for each sector, those summarized below are of the

utmost importance to maintain U.S. leadership in core sectors. The continued and successful execution of the GPS Enterprise will require PNT EXCOM vigilance and

committed governance: (1) Continue the support of on-going GPS modernization, including space, control and user segments. The U.S. must maintain its leading edge

among world satellite-based navigation and timing systems; (2) Ensure that complementary and back-up capabilities for GPS-derived PNT are available and used to

protect the nation's critical infrastructure and public-safety applications. Implement Enhanced Loran (eLoran) as a back-up for GPS timing in the continental U.S., subject to

verification of cost and performance. Further, U.S. agencies should continue the

development of additional capabilities that reinforce PNT resiliency; (3) Protect GPS

signals from interference. The potential for more powerful radio signals in adjacent bands and on-going deliberate disruption by malicious actors remain real and present dangers

that will continue to grow; (4) Encourage the use of toughened GPS receivers which can resist interference such as jamming and spoofing, especially in critical applications. The

technology is available, but it is not being used; (5) Permit users in the U.S. to access other nations' properly vetted GNSS signals. This will increase resilience, receiver

performance, and legitimize many receivers already in service; (6) Demonstrate the utility of backup/augmentation of allied GNSS signals in military receivers: This could allow

improved resilience, assurance, and GPS back-up capabilities to military operations in

increasingly contested environments; (7) The PNT Board recognizes the need for efficient spectrum management. At the same time, it believes it is imperative that we follow the

PNT EXCOM stricture to not adversely affect current and future GPS uses. To pursue this purpose, it strongly supports "no more than 25% (1 dB) noise degradation", which is the

long accepted international standard for evaluating interference to GPS and similar systems. Trimble, Deere, and Garmin have all recently responded with filings that

specifically support use of the 25% degradation standard. The board believes avoiding degradation over at least 90% of the region near terrestrial transmitters is the absolute

minimum protection for GPS receivers in each class. This would be a hypothetical 90%

Protection Evaluation. This is not an endorsement of this level since of course, all users would prefer 100% protection. The Department of Transportation (DOT) Adjacent Band Compatibility (ABC) study is the only validated test to verify degradation at various received power levels. Those results inform that to ensure degradation not exceed 10% of the Region (90% Protection) for High Performance receivers, either: (a) the maximum transmitter power can be no more than .0036 watts at a 400-meter spacing between transmitters; or (b) for a 10 watts transmitter the closest spacing should be 20 km (over 12 miles). Between 2019 and 2022 continued working with the PNT EXCOM departments and agencies to refine and implement these recommendations. For additional information on technical discussions and deliberations by the board see the *extensive* meeting minutes on GPS.gov: <https://www.gps.gov/governance/advisory/meetings/>. Part II: Recommendations FY23-24 At this time there are 12 recommendations from the PNTAB to the PNT EXCOM co-chairs. Nine of these recommendations were initially submitted to the PNT EXCOM co-chairs on January 27, 2023, (see Memorandum, "Summary Report of the 27th National Space-Based PNT Advisory Board Meeting held 16-17 November 2022," available at:

<https://www.gps.gov/governance/advisory/recommendations/2023-01-PNTAB-27-chair-memo.pdf>
Three additional recommendations were submitted on July 19, 2024, (see Memorandum, "Report of the 30th National Space-based PNT Advisory Board Meeting and Associated Activities," available at:

<https://www.gps.gov/governance/advisory/recommendations/2024-07-PNTAB-chair-memo.pdf>)
from ADM Thad Allen (Chair) to the deputy secretaries and three new recommendations were submitted. On January 2, 2024, the National Space-Based PNT Executive Steering Group (ESG) responded to the nine PNT Advisory Board recommendations in the Memorandum dated January 27, 2023 (see Letter, "National Space-Based Positioning, Navigation, and Timing (PNT) Executive Steering Group (ESG) Responses to PNT Advisory Board Recommendations," available at:

<https://www.gps.gov/governance/advisory/recommendations/2024-01-ESG-response-to-PNTAB>

On September 12, 2024, the National Space-Based PNT Executive Committee met and provided a response to one of the three recommendations submitted on July 19, 2024. In summary, of the 12 recommendations submitted in FY23-24, to-date 8 have been fully implemented (67%) and 2 have been partially implemented. These twelve recommendations, and UGS responses, are described below: Recommendation #1: The PNT EXCOM is urged to develop a compelling, quantitative way to accurately express the economic damage to the nation attributable to extended disruptions to GPS services. January 2, 2024, USG Response to Recommendation #1: The ESG will discuss whether to begin a potential follow-on study to the 2019 Department of Commerce (NIST) study, "Economic Benefits of the Global Positioning System (GPS)" [link:

https://www.nist.gov/system/files/documents/2020/02/06/gps_finalreport618.pdf], from

June 2019, which found \$1.4T in U.S. economic benefits from GPS. The study stated that a 30-day widespread outage could erode >\$1 billion in economic value per day. The study also highlighted the impact a GPS outage would have on Agriculture, stating that during planting season, economic damages in the agriculture sector could increase 30-day losses to \$15 billion due to lower yields. The ESG will also review recent studies by our foreign partners, which assessed economic losses to them from GPS/GNSS disruptions. If it is determined that another study is required, also under Commerce leadership, DOT has indicated specific interest in assessing the economic impact on transportation applications due to the disruption, denial, and manipulation of GPS.

Recommendation #2: The Department of Transportation is urged to issue public warnings to GPS users as soon as possible after the beginning of significant disruption events. January 2, 2024, USG Response to Recommendation #2: The ESG notes that warnings of GPS disruptions would align with tasking in Space Policy Directive 7 (SPD-7) for DOT. Part d section (viii) of Space Policy Directive 7 states, "In coordination with the Secretary of Defense, the Secretary of Homeland Security, and the heads of other agencies, as appropriate, implement Federal and facilitate State, local and commercial capabilities to monitor, identify, locate, and attribute space-based PNT service disruption and manipulations within the United States that adversely affect use of space-based PNT for transportation safety, homeland security, civil, commercial, and scientific purposes;" DOT and DHS can cooperate to assess the range of public warnings currently in use and determine whether different or additional methods will benefit civil users of GPS. At present, DOT is working with DOD and DHS to implement the use of the Naval Research Lab (NRL) GPS Operational Awareness Tool (GOAT) to provide a graphical "heat map" that could be used by civil agencies to notify the public when GPS interference is occurring.

Recommendation #3: The USG should rapidly prototype a National GNSS Interference Detection and Reporting system based on mobile wireless technology. Such a system would have been very beneficial in responding to multiple interference events at major U.S. airports in 2022. January 2, 2024, USG Response to Recommendation #3: The ESG recognizes that detection of GPS disruptions is a direct tasking in Space Policy Directive 7 (SPD-7) for DOT "In coordination with the Secretary of Defense and the Secretary of Homeland Security and the heads of other agencies, as appropriate, implement Federal and facilitate State, local and commercial capabilities to monitor, identify, locate, and attribute space-based PNT service disruption and manipulations within the United States that adversely affect use of space-based PNT for transportation safety, homeland security, civil, commercial, and scientific purposes" DOT is working with DOD and DHS and coordinating with other civil agencies with expertise in commercial mobile wireless technology to implement an automated GPS interference detection capability to leverage space, airborne, terrestrial, and cyber domain capabilities and achieve a multilayer GPS interference detection and monitoring (IDM) capability. This GPS IDM enterprise capability

will bring together information from several current and future performance monitoring technology resources. DOT has the resources to advance such an automated GPS IDM capability to an initial operating capability. Further resources are needed to operationalize and maintain that capability fully. Recommendation #4: PNT security should be made a prominent part of the National Cyber Director's responsibilities. Departments and agencies should include PNT security in their cyber portfolios. January 2, 2024, USG Response to Recommendation #4: SPD-7 and EO 13905 highlight that GPS is a crucial component of multiple sectors of the United States critical infrastructure and recognize that national and economic security depends on reliable and efficient functioning. Since 2017, multiple EXCOM Departments and Agencies have included PNT security in their cyber portfolios, and the NCO, on behalf of the EXCOM, has advocated at numerous public events for Government and Private-Sector CIOs to include PNT security in the cybersecurity plans. The ESG will discuss whether to make a recommendation to the Executive Office of the President (EOP) to change the responsibilities of the Office of the National Cyber Director (ONCD). It would be beneficial to bring ONCD into the EXCOM/ESG process to focus on PNT. Recommendation #5: USG to develop and implement a GPS High Accuracy and Robustness Service (HARS) delivered to users via the Internet, with performance initially comparable to that provided by other GNSS such as the European Union's Galileo High Accuracy Service (Galileo HAS). The service would provide corrections to support better than one-meter position accuracy, while providing cryptographically-protected satellite navigation data bits for integrity monitoring and spoofing resistance. January 2, 2024, USG Response to Recommendation #5: Part d section (xiii) of Space Policy Directive 7 states, "In coordination with the Secretary of Defense and the Secretary of Homeland Security, develop and validate requirements and a funding strategy to implement data and signal authentication of civil GPS and wide area augmentations for homeland security and public safety purposes consistent with the Federal Radionavigation Plan or its successor plan." This effort already aligns with the work DOT has underway for out-of-band authentication. The FAA provides WAAS and could disseminate WAAS corrections over the internet like efforts that the Europeans are already doing with EGNOS. October 15, 2024, NOAA Response to Recommendation #5: Following technical discussions between NASA/JPL and the National Oceanic and Atmospheric Administration (NOAA) National Geodetic Survey (NGS), NOAA indicated it would fund the dissemination via the internet of corrections and data provided by NASA's Global Differential GPS Service (GDGPS). GDGPS provides mission-critical, real-time services 24 hours a day, 7 days a week, improving upon the positioning and timing accuracy provided by stand-alone GPS. It calculates real-time corrections within seconds to the GPS broadcast navigation message. GDGPS also estimates the precise orbits and clock states of GPS satellites and monitors GPS system stability, and it offers the same services for most other GNSS constellations. GDGPS uses multiple network sources

relying primarily on the 60+ sites of NASA's Global GNSS Network (GGN), and publicly available International GNSS Service (IGS) data from 100+ sites, and GDGPS owned and operated sites (19 sites fielded, with approximately 12 operating at any one time). This action by NASA and NOAA will effectively fully implement this recommendation. NOAA is scheduled to brief the Board at the December 3, 2024, non-public prep session prior to the PNTAB-31 FACA meetings on December 4-5 in Redondo Beach, CA.

Recommendation #6: USG to invest in the future of U.S. PNT education and training.

There is a definitive shortage of geodesy experts being trained in relation to competitor nations such as China. January 2, 2024, USG Response to Recommendation #6: SPD-7 and EO 13905 highlight that GPS is a crucial component of multiple United States critical infrastructure sectors, stating that national and economic security depends on reliable and efficient functioning. The ESG Departments and Agencies have PNT education and training efforts ongoing now. They will discuss other potential whole-of-government approaches to this shortage, including possible sponsorship of initiatives with nationwide educational institutions in coordination with other Science, Technology, Engineering, and Math (STEM) efforts across the U.S. Government. DOT has established two University Transportation Centers (UTCs) focused on Assured PNT: The Ohio State University and the Illinois Institute of Technology. Workforce development is a vital component of both of these UTCs. Each UTC is funded at \$2M/year for five years (starting in 2023). In coordination with NASA and USGS, the National Geospatial-Intelligence Agency (NGA), and NOAA's National Geodetic Survey (NGS), they established a Geodesy Community of Practice in FY23. Research, workforce, and academic partnerships are part of the COP effort. Additionally, NGS issued \$4M in Geospatial Modeling Grants in FY23 to academic partners. The NCO has worked with teachers across the U.S. for over five years promoting STEM in schools with free GPS-themed STEM educational products, such as the "How GPS Works" poster. NCO is developing a proposal for a phase 2 GPS-themed STEM curriculum that would align with upgrades to the GPS.gov website. The U.S. has supported workshops through ICG funding provided to the U.N. Office for Outer Space Affairs. Recommendation #7: There currently are wildly diverse opinions concerning the likelihood and extent that the GPS infrastructure could fail to provide useful signals in different time frames. Those making risk management decisions, and those investing in Protect, Toughen, and Augment, lack the information needed to select the appropriate approaches, and how urgent it is to implement them. Therefore, the USG should establish, publish, and maintain estimates of the likelihood that GPS would not provide sufficient useful civil signals, due to failures of the GPS infrastructure (GPS Ground Segment, GPS Space Segment, and GPS user equipment) from any cause. January 2, 2024, USG Response to Recommendation #7: SPD-7 and EO 13905 highlight that GPS is a crucial component of multiple sectors of the United States critical infrastructure, stating that national and economic security depends on the reliable and efficient

functioning. The ESG notes that conducting risk assessments to support risk management is essential. However, determining the likelihood that GPS infrastructure (GPS Ground Segment, GPS Space Segment, and GPS user equipment) could fail for any reason is very challenging. The possibility of threats could change more quickly than the ability to react to them. DOT supports risk assessments by applying the NIST PNT profile in support of the implementation of EO 13905 and released a DOT Complementary PNT Action Plan in September 2023. DoD and ODNI-related risk assessments are also routinely conducted across the Intelligence Community and reported to the ESG and EXCOM. To address GPS vulnerabilities in critical infrastructure, the DHS Science and Technology Directorate (S&T) PNT program has a multi-pronged approach of conducting vulnerability and impact assessments, developing mitigations, exploring complementary timing technologies, and engaging with industry through outreach events and meetings. Through these sustained efforts, the program's goal is to increase the resiliency of critical infrastructure to GPS vulnerabilities in the future.

Recommendation #8: Convene a White House summit to recognize and celebrate U.S. achievements with GPS and to launch an initiative to regain U.S. PNT leadership and ensure resilient, reliable PNT for critical infrastructure and the larger economy. GPS's capabilities are now substantially inferior to those of China's BeiDou. January 2, 2024, USG Response to Recommendation #8: This year marks the 50th anniversary of the Global Positioning System program. In December 1973, the Defense Systems Acquisition Review Council (DSARC) approved the U.S. Air Force to develop the Navstar Global Positioning System (GPS). GPS has provided America and the world with innumerable and valuable benefits. It has also symbolized America's strength and global leadership for decades. Recommitting U.S. positioning, navigation, and timing (PNT) leadership must be a key public policy objective in an era of great power competition. The EXCOM/ESG has worked to promote the 50th Anniversary of GPS through speeches, presentations, interviews, and events.

Recommendation #9: The Executive Office of the President should undertake an Administration-wide review of domestic radio spectrum regulation processes. January 2, 2024, USG Response to Recommendation #9: The State Department, as the owner of the International Traffic in Arms Regulations (ITAR) process, has been working with the interagency on a Targeted Revisions Notice of Proposed Rulemaking for Categories XI(c)(10) and XII(d)(3) on the U.S. Munitions List 9(USML). State PM/DTCP is currently drafting the Notice and will take into consideration input collected through the interagency coordination process. State is also coordinating closely with the Department of Commerce on the final Notice since DOC controls the Export Administration Regulations (EAR), which goes hand-in-hand with the ITAR process.

Recommendation #10: PNT EXCOM direct the U.S. Space Force to establish a way for "good enough" monitoring of GPS L5 signals using existing capabilities and set L5 signals healthy subject to a "use at your own risk" caveat, just as is done with L2C today. September 18, 2024, USG Response to Recommendation #10: At the Sep.

12, 2024, the National Space-based PNT EXCOM agreed to an action to establish a working group to look into the way forward to establish a way to set L5 signals as healthy subject to a “use at your own risk” caveat. Recommendation #11: PNT EXCOM direct Federal Chief Information Officers to acquire and install multifrequency dual-system (GPS-Galileo) receivers to complement GPS use. The Department of Transportation and the Department of Homeland Security should actively encourage critical infrastructure users to adopt multifrequency dual-system (GPS-Galileo) receivers. USG Response to Recommendation #11: Pending Recommendation #12: PNT EXCOM assign a lead agency and single individual with clear responsibility and authority for the end-to-end prompt detection, characterization, and removal of significant sources of interference to GNSS in the U.S. USG Response to Recommendation #12: Pending Part III: Recommendations FY 25 Four recommendations were developed as a result of the one meeting in fiscal year 2025. - A presidential transition paper with one recommendation to the administration (“ . . . ensure America has the resilient PNT we need. . . “); paper was approved for signature and submission - A recommendation to support the NOAA/NGS High Accuracy Robustness Service (HARS) they proposed. This has been implemented. - A recommendation for ESG to partner with NASEM on a formal study evaluating national PNT workforce needs. - A recommendation for governance reform (evaluate SPD-7 / EXCOM). One of the four has been implemented.

What is the approximate Percentage of these recommendations that have been or will be Fully implemented by the agency?

74%

% of Recommendations Fully Implemented Comments

USG dept /agency responses to each recommendations are described above.

What is the approximate Percentage of these recommendations that have been or will be Partially implemented by the agency?

19%

% of Recommendations Partially Implemented Comments

USG dept /agency responses to each recommendations are described above. The remaining 7 % have not been implemented.

Does the agency provide the committee with feedback regarding actions taken to implement recommendations or advice offered?

Yes No Not Applicable

Agency Feedback Comments

The recommendations from the PNT Advisory Board are presented by the Chair, ADM Thad Allen, to the Deputy Secretary level PNT Executive Committee, which consists of 13 Federal departments. NASA is one of these agencies at the Deputy Administrator level, and provides real-time feedback during discussions that address Recommendation adoption & implementation.

What other actions has the agency taken as a result of the committee's advice or recommendation?

Checked if Applies

- | | |
|-----------------------------------|-------------------------------------|
| Reorganized Priorities | <input checked="" type="checkbox"/> |
| Reallocated resources | <input checked="" type="checkbox"/> |
| Issued new regulation | <input checked="" type="checkbox"/> |
| Proposed legislation | <input checked="" type="checkbox"/> |
| Approved grants or other payments | <input type="checkbox"/> |
| Other | <input checked="" type="checkbox"/> |

Action Comments

Is the Committee engaged in the review of applications for grants?

No

Grant Review Comments

Not Applicable

How is access provided to the information for the Committee's documentation?

Checked if Applies

- | | |
|---------------------------|-------------------------------------|
| Contact DFO | <input checked="" type="checkbox"/> |
| Online Agency Web Site | <input checked="" type="checkbox"/> |
| Online Committee Web Site | <input checked="" type="checkbox"/> |
| Online GSA FACA Web Site | <input checked="" type="checkbox"/> |
| Publications | <input checked="" type="checkbox"/> |
| Other | <input checked="" type="checkbox"/> |

Access Comments

All PNT EXCOM agencies assist with getting information out to the general public on the

PNT Advisory Board's activities to maximize the usefulness of the information that is generated. More information can be found at: <https://www.gps.gov/node/77>