



18 July 2024

MEMORANDUM

FROM: Thad Allen, Admiral (USCG, Ret), Chair, National Space-based Positioning, Navigation, and Timing (PNT) Advisory Board

TO: Honorable Kathleen H. Hicks
Deputy Secretary, Department of Defense
Co-Chair, National Space-based PNT Executive Committee

Honorable Polly E. Trottenberg
Deputy Secretary, Department of Transportation
Co-Chair, National Space-based PNT Executive Committee

SUBJECT: Report of the 30th National Space-based PNT Advisory Board Meeting and associated activities

Madam Co-Chairs,

The National Space-based PNT Advisory Board (PNTAB) held its 30th session on April 24-25, 2024, in Colorado Springs. The meeting was held under the provisions of the Federal Advisory Committee Act, with appropriate public notification and documentation for the public record. At this meeting, the Board reaffirmed the recommendations in my January 27, 2023, report and approved three additional recommendations (see Enclosure). The Colorado Springs session was guided by the Board's Protect, Toughen, and Augment (PTA) of the Global Positioning System (GPS) for all users, our longstanding framework to organize our advice. The scope of our work continues to broaden to consider the evolving capabilities of: (1) all Global Navigation Satellite Systems (GNSS), (2) complementary PNT technologies (terrestrial and space-based), and (3) ongoing policy, strategy, and governance challenges presented by global GNSS competition and execution of the GPS program. I delayed this report as further context was provided at the EXCOM's Executive Steering Group (ESG) meeting held on May 29, 2024, and in subsequent classified briefings by the 2nd Space Operations Squadron (2SOPS).

PNTAB Chair's Bottom Line Up Front (BLUF)

- Reliable and resilient PNT (space-based and terrestrial) faces a broad spectrum of risks and challenges. Regarding GPS specifically and U.S. PNT generally, existing policies, resourcing, and governmental program management are fragmented and dispersed across multiple departments and agencies. While GPS is a Dept. of Defense (DoD) program, the well-intentioned framework of an EXCOM to manage the interrelation of military and civil users is ineffective and non-responsive to existing and emerging risks regarding not only GPS, but the larger spectrum of U.S. PNT capabilities. The utility of the EXCOM has been further degraded by the creation of the ESG which adds a layer to an already overly complicated and complex governance structure. Space Policy Directive 7 (SPD-7), U.S. Space-based PNT Policy, must be revisited and the term "space-based" should be removed from its title.
- GPS and associated PNT capabilities are an essential component of America's critical infrastructure, supply chains and everyday life, particularly in the provision of timing services. It has become in effect a public utility, not unlike rural electrification or broadband access, except that the provider is DoD. DoD, through the Army Corps of Engineers, maintains the Nation's commercial ports and waterways infrastructure through a clear and resourced structure. However, GPS and other U.S. PNT capabilities lack a cohesive national governance structure related to the provision and civil use of these services. America's continued over-reliance on GPS for PNT makes critical infrastructure and applications vulnerable to a variety of well documented accidental, natural, and malicious threats.
- At the same time, a broad spectrum of both space and terrestrial based capabilities are emerging that offer potential for greater PNT resiliency and added capability. These numerous technologies are rapidly evolving and, in some cases, competing. But as noted above, there is currently no adequate structure in the federal government to assess, prioritize and acquire capability that improves PNT resiliency and enhances capability. The "default setting" is the GPS program managed by DoD. While the PNTAB is the designated advising entity for the federal government regarding civil users, there are limits in our ability to assess and make recommendations.
- There are significant reasons to be concerned. GPS is now lagging the capabilities found in other GNSSs – notably Galileo

(European Union) and BeiDou (China). In the case of BeiDou, the system's enhanced resiliency and capability should be considered an element of "soft power and an element of great power competition".

- The Administration must revisit SPD-7 to establish a clear strategy, bolstered by a revised governance framework with clear roles and responsibilities extending to the creation of programs of record with resourcing plans to execute agency assigned responsibilities. To achieve this, a revised SPD-7 should include the locus of authority and accountability for PNT decision-making beyond DoD GPS program management and be capable of addressing the spectrum of challenges that have evolved, and continue to evolve, with the ubiquity of these services across technology and society for civil users.

Confronting New Challenges

Our fact-finding activities and deliberations over the past year have primarily focused on the evolving civil space-based and terrestrial PNT capabilities of the U.S. and other nations. There can be no questioning the importance of U.S. leadership in establishing space-based PNT as a global utility. GPS was the world's first truly advanced and precise GNSS. Moreover, the decisions by Presidents Reagan and Clinton to make GPS available free of charge and with full accuracy to all users made GPS one of America's most profoundly important gifts to the world. Those decisions established a precedent that international GNSS providers now follow and made GPS the standard against which other GNSS are compared. Those decisions also democratized navigation and timing.

Our country now faces new challenges. Domestically, we rely almost exclusively on GPS as the principal source of PNT. As noted above, it has also become a public utility. A great many incidents over the past several years have left no doubt that the system is vulnerable to disruption, both inadvertent and intentional. Because so much of our country's critical infrastructure and supply chains rely on GPS, that infrastructure is itself vulnerable to disruption. The Board's most recent meeting was devoted to an exploration of ways to protect, toughen, and augment GPS in the interest of greater reliability for civil users, and produced recommendations for near-term mitigation.

The Board has also been monitoring the capabilities of other GNSSs. We find that there are capabilities in those other systems that GPS does not have, and we worry that a growing gap could call into question America's traditional global standing as the default provider of space-based PNT.

I intend these periodic reports to document what will be a sustained, ongoing effort by the Board to identify how U.S. PNT capabilities continue to compare with or vary from those of other providers, as well as the risks and vulnerabilities to civil users associated with any perceived gaps. This report provides an initial framework we intend to use and to document our progress and guide future efforts to obtain "input from state and local governments, industry, and academia on developments in the application of space-based PNT technologies and advise the EXCOM on policy and service impacts." (SPD-7, section 5(d)(vii)). The framework was presented as a matrix at our Colorado Springs meeting to identify and compare the capabilities and attributes of the leading GNSSs (see Enclosure). It lists some important features of other GNSSs that are not yet available on GPS. The matrix will be populated, revised, updated, and reported to you as our work continues. Although a "work in progress", it is the Board's hope that this framework will be of use to the EXCOM in the preparation of its report to the National Space Council early next year pursuant to SPD-7 (section 5(d)(iii)), "assessing current and planned civil space-based PNT services and whether they are projected to remain competitive with foreign space-based PNT services."

Based on our initial working comparison, we have concluded that our PNT capabilities have fallen behind those of other GNSSs, notably the European Union's Galileo and China's BeiDou. Efforts to date show a troubling shortfall in GPS's greater vulnerability to jamming and spoofing than systems featuring more robust signals. For example,

- GPS's long-planned L5 signal, if made operational, would help to close that gap. Accordingly, the Board recommends setting the L5 signal healthy for non-safety-of-life use and encouraging adoption of multifrequency and dual system receivers, specifically GPS and our allies' Galileo.
- User access to better antennas would reduce further GPS vulnerability to disruption, but the International Traffic in Arms Regulations continue to restrict access to such equipment. In the Board's view, there is no clear justification today for such restrictions.

These are two examples regarding GPS's capabilities in the framework that the Board is bringing to the EXCOM's attention. Let me be clear, while this is a work in progress it is also meant to be a cause for greater involvement by the EXCOM principals.

Policy, Strategy, and Governance

In addition to noting the apparent superiority of some features of other GNSSs and the implications for U.S. leadership, the Board considered possible reasons why GPS has lagged. Briefly stated, our conclusion is that PNT in general and GPS in particular have not been accorded their rightful prominence in the national policy agenda. Existing policies – set forth primarily in Executive Order 13905 and SPD-7 – while properly identifying the general requirements of sound PNT policy – do not attach the appropriate priority or urgency to the sustainment of U.S. leadership. Moreover, decision-making regarding GPS is distributed among many agencies and is, in every case, the subject of coordination and consensus. Despite the way in which some adversaries have used GNSS as a tool in the great power competition that defines today's geopolitics, we have been unable to discern any clear strategy for restoring the U.S. to its long-standing leadership position in this essential sector.

These findings were reinforced just earlier this year by the release of the National Security Memorandum on Critical Infrastructure Security and Resilience (NSM-22, April 30, 2024). We were surprised to discover that GPS is nowhere mentioned in that important document. We fail to understand why, despite its pivotal importance to so many sectors of economic activity and to America's strategic well-being, GPS is not yet recognized as critical infrastructure.

Simply put, the Board believes that the 20-year-old framework for GPS governance and the current policy statements establish neither the priority that the system deserves nor sufficiently clear accountability for its performance.

The Board believes it is time to take a fresh look at our approach to PNT governance and establish a clear strategy for re-establishing an unquestioned position of leadership for the U.S. To be successful, such a strategy requires a governance structure characterized by clearer authority and accountability. Ideally, the administration should propose legislation to Congress that would support this goal with a clear mandate (authorization) and resources (appropriations) adequate to the task.

Conclusion

Your PNT Advisory Board represents GPS's diverse, interconnected, domestic and international PNT user base. Our most compelling mission is to provide to the EXCOM meaningful advice that: (1) is received and considered, (2) results in policy, operational, and funding actions that address risk and reduce capability gaps, and thus (3) ensures the availability to civil and military users reliable PNT in the interest of America's economy, its national security, and its standing in the world.

We look forward to advising you personally at the September 12, 2024, EXCOM meeting.

Respectfully,



Adm (USCG, ret.) Thad Allen, Chair, PNTAB

Enclosure:

- Recommendations Approved at the PNTAB-30 Session
- Table, "Comparing Advanced GNSS Capabilities and Plans"

CC:

- Bill Nelson, Administrator, NASA
- Pamela Melroy, Deputy Administrator, NASA
- Kevin Coggins, Deputy Associate Administrator for Space Communications and Navigation, NASA
- James J. Miller, Executive Director, PNTAB, NASA
- John Sherman, Chief Information Officer, DoD
- Kevin M. Mulvihill, Deputy Chief Information Officer, DoD
- Robert Hampshire, Deputy Assistant Secretary for Research and Technology, DOT
- Karen Van Dyke, Director, PNT/Spectrum Management, Office of Assistant Sec. for Research & Tech., DOT
- Chirag Parikh, Executive Secretary, National Space Council
- Harold Martin, Director, PNT National Coordination Office – for distribution to PNT EXCOM departments & agencies

Enclosure:

Recommendations Approved at the PNTAB-30 Session

- **PNT30-01:** 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. We recommend establishing a deadline of September 2024.
- **PNT30-02:** 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.
- **PNT30-03:** 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.

Comparing Advanced GNSS Capabilities and Plans

PNT Sources & Modernization Efforts			
	United States	China	
Global Navigation Satellite System ¹	GPS	BeiDou	
Low Earth Orbit - based PNT Satellites	RDT&E by govt and industry Satelles timing (fee-based)	Deployment on-going ²	
Terrestrial Broadcast	None deployed	eLoran in east and offshore	eLoran being installed in the west ³
Fiber-based timing	Some major telecoms have deployed	Comprehensive national program w/ 295 timing centers, 20,000km fiber ⁴	
Authentication/ integration of timing*	National Guard NITRO pending cancellation	National system being implemented ⁵	
*China’s terrestrial timing network is designed to integrate space-based, terrestrial broadcast, and fiber-transmitted time in a coherent and consistent architecture.			

Green = Most advanced feature, or national system funded and being completed

Yellow = Less capable, or some efforts in progress but no national system planned

Red = No national capability, none planned

¹ Chairman’s letter Jan 2023 and Board’s preliminary GNSS comparison matrix for GPS, BeiDou, and Galileo

² Numerous announcements, papers. See for example [presentation at UNOOSA](#)

³ Numerous Chinese academic papers, several media announcements see for example: “[The Paper – Accelerate construction, High-precision, Ground-based Timing System](#)”

⁴ [National Time Service Center, Chinese Academy of Sciences](#)

⁵ Ibid 3 & 4. Strategy outlined in [presentation at 2019 Stanford PNT Symposium](#)