



RNT Foundation  
4558 Shetland Green Rd  
Alexandria, VA 22312

3 September 2024

Honorable Jessica Rosenworcel  
Honorable Brendan Carr  
Honorable Geoffrey Starks  
Honorable Nathan Simington  
Honorable Anna M. Gomez

Federal Communications Commission  
445 12<sup>th</sup> Street, SW  
Washington, D.C. 20554

**Re: *Ex parte* presentation in WT Docket No. 24-240**

Dear Chairwoman Rosenworcel, and Commissioners Carr, Starks, Simington, and Gomez:

The Resilient Navigation and Timing Foundation (hereafter RNTF) is a public benefit 501(c)3 scientific and educational charity. We advocate for policies and systems to protect Global Positioning System (GPS) satellites, signals, and users. The chairman of our board is a former Assistant Secretary of Transportation, our president is the former maritime navigation authority for the United States, and one board member is the former Commander, U.S. Air Force Space Command. All three are members of the President's National Space-based Positioning, Navigation, and Timing (PNT) Advisory Board.

Our individual and corporate members, some of whom are referenced below, represent a broad spectrum of expertise in both space-based and terrestrial PNT. This experience and expertise base gives us a unique perspective on issues related to national PNT policy and systems.

As a 501(c)3, we are prohibited from supporting our members' commercial interests and make every effort to provide the government and public with advice that is as impartial and objective as possible.

We are commenting on three aspects of the following statement in the Commission's request:

**"TPNT as a Complement to GPS. NextNav discusses the vulnerabilities of GPS and states that its technology is the only viable solution for a nationwide terrestrial PNT system to complement GPS."**

## 1. GPS Vulnerability

NextNav draws on generally available and accepted information in its statements about GPS vulnerabilities with which we agree.

We also agree that one or more complementary terrestrial PNT (TPNT) systems which operate independently from GPS and other global navigation satellite systems (GNSS) is needed for U.S. critical infrastructures and national security.

RNTF documented this in a keystone October 2020 paper, “A Resilient National Timing Architecture.”<sup>1</sup> In this paper, we identified what some have called “the resilience triad” for national timing and overall PNT – a diverse, continuously cross-checked, independently operating set of time reference signals delivered from space, fiber, and terrestrial broadcast to critical infrastructure, government, military, and other nodes. The United Kingdom, South Korea, China, and other nations are at various stages implementing such national architectures.

While GPS is indeed vulnerable, the value NextNav purports to bring to the current state of PNT resilience in the United States is likely overstated as they do not consider Galileo, Europe’s GNSS. It adds unlimited direct-outdoor<sup>2</sup> coverage plus valuable resilience within the vital space to earth part of the resilience triad.

Multi-constellation GNSS receivers are commonplace and will be used by virtually all resilient nodes. This provides a level of resilience not credited in the petition. We believe this results in NextNav overstating the value they purport to bring to a generalized GPS back up.

## 2. NextNav’s assertion that its version of TPNT is the *only* viable solution

We believe this assertion is incorrect in three ways.

First, it implies a single solution is sufficient. As we stated earlier, that is not the case. Multiple systems in a carefully architected system-of-systems approach are required.

Second, there are numerous existing and emerging technologies that provide or can provide TPNT to complement and backup GPS.

These include:

- Locata and PhasorLab, which, like NextNav, use local beacon-based solutions for infrastructures and users across city-sized or smaller areas.
- The National Association of Broadcasters’ Broadcasting Positioning System (BPS). This technology is based on timing from digital ATSC 3.0 television station broadcast infrastructure. The system can provide timing data to any place served by an ATSC 3.0 television station and PNT to anywhere that can receive three or more stations.
- eLoran, an advanced and modernized low frequency technology built on 80 years of successful Loran-based PNT. Effective transmission range is approximately 1,000 miles

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<sup>1</sup> <https://rntfnd.org/wp-content/uploads/Resilient-National-Timing-Architecture-16-Oct-2020.pdf>

<sup>2</sup> Upcoming systems will also provide indoor coverage and further anti-jam, anti-spoof protection via cloud-assisted GPS, GNSS. Reference iPosi, Inc website, [www.iposi.com](http://www.iposi.com).

over water and 800 miles over land. Receiving one station provides timing, three or more provide PNT.

Existing TPNT use cases include:

Locata systems that are commercially deployed in a variety of localities around the world, in some cases supporting safety of life and critical infrastructure. These provide centimeter, positioning accuracy and picosecond timing accuracy to the network coverage area.

The Broadcasting Positioning System which is being demonstrated at two locations in the United States. This solution requires no additional spectrum or new allocation since the BPS signal is embedded within existing spectrum.

National Loran/eLoran systems that have been serving China, Russia (called “Chayka”), South Korea, Saudi Arabia, and the United Kingdom for decades. China is expanding its eLoran system to serve their entire nation. The U.K. and Russia have also announced plans to expand and upgrade their systems. In the United States at least three eLoran transmission sites are on-air providing TPNT broadcast service to customers.

eLoran/Loran spectrum is allocated and reserved internationally for radionavigation.

In each of these cases, companies have designed, deployed, and provided TPNT without requiring new or changed spectrum allocation rules, or creating incompatibility with current incumbent operations.

In addition to the above examples of non-NextNav TPNT solutions, there are systems that offer timing-only (e.g., fiber-based clocks) or positioning-and-navigation-only (e.g. magnetic navigation). Some of these are appropriate for both indoor and wide area use. In addition to addressing specific needs and use cases, these systems could be combined to provide additional TPNT solutions.

These diverse systems best serve U.S. interests, best use spectrum, avoid costly re-allocation, and could therefore lower end-costs and time to market.

Third, NexNav does not appear to be a viable solution for a nationwide TPNT system to complement GPS.

We understand “nationwide” to mean, at a minimum, service to the entire landmass and immediate contiguous waters of the United States including Hawaii, Alaska, Puerto Rico, and Guam. NextNav will not be able to achieve this, even if the desired access to virtually all high-powered cellular spectrum in the continental United States is granted.

As ubiquitous as terrestrial cellular service has become, we do not believe that it will ever serve “nationwide.” Nor would expanding coverage to achieve “nationwide” service by adding more NextNav transmitters be viable.

Operations in remote mountainous and wild areas, the Alaskan interior and arctic, and America’s maritime Exclusive Economic Zone (generally 200 nautical miles from shore), are important and

will become increasingly so. Maritime commerce accounts for 95% of American international trade. And the Arctic is becoming increasingly important as evidenced by the Department Defense 2024 Arctic Strategy. The strategy even mentions Russian interference with GPS in the region.

At the same time operations in these areas are particularly challenging for both crewed and uncrewed vehicles. This makes reliable and resilient PNT service in these areas especially important.

We do not believe NextNav has made the case that their technology will ever support these increasingly important applications.

### **3. Department of Transportation Technology Demonstration Program**

Finally, we comment regarding NextNav's mentions of their technology's performance in a demonstration program sponsored by the U.S. Department of Transportation (DOT).

We believe their assertions regarding the outcomes of the demonstration program are overstated.

In January 2021 DOT's Volpe National Transportation Systems Center issued DOT-VNTSC-20-07 "Complementary PNT and GPS Backup Technologies Demonstration Report."<sup>3</sup> It documented results from that demonstration program which included 11 companies offering PNT solutions.

The DOT demonstration program was limited in its funding and scope. DOT was not able to fund demos of all technologies offered, nor demonstration of all the features of technologies that were included. This limited scope meant the demonstrations were less than comprehensive.

Department officials have repeatedly described the effort as "vendor demonstrations intended to show their technologies in the best light."

This description was offered during a 5<sup>th</sup> of May 2021 webinar sponsored by George Washington University's Elliot School of International Affairs titled "What Technologies Can Backup GPS?"<sup>4</sup> The webinar was to discuss the DOT-VNTSC-20-70 report. "Demonstration designed to showcase technologies in best light" was included on a slide shown by Dr. Andrew Hansen, the Volpe Center's principal investigator.

That same slide noted "Complimentary PNT technologies were not stress-tested," meaning there was no evaluation of resistance to intentional or unintentional interference.

NextNav correctly asserts that TPNT is needed because of the ease with which signals from GPS and other GNSS can be denied or imitated (spoofed). We are confident the ability to resist such interference will be an essential criterion for acquisition of TPNT systems going forward.

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<sup>3</sup> [https://www.transportation.gov/sites/dot.gov/files/2021-01/FY%2718%20NDAA%20Section%201606%20DOT%20Report%20to%20Congress\\_Combinedv2\\_January%202021.pdf](https://www.transportation.gov/sites/dot.gov/files/2021-01/FY%2718%20NDAA%20Section%201606%20DOT%20Report%20to%20Congress_Combinedv2_January%202021.pdf)

<sup>4</sup> [https://www.youtube.com/watch?v=frY\\_-y2TiBU&list=PLdtBS04eosP91EwRayXzEX3pc-J28g\\_Ql&index=3](https://www.youtube.com/watch?v=frY_-y2TiBU&list=PLdtBS04eosP91EwRayXzEX3pc-J28g_Ql&index=3) beginning at approximately minute 46:00

The DOT demonstration did not provide insight into any of the technologies' ability to resist interference, leaving this important capability unaddressed.

We also note that after the DOT demonstration, NextNav participated in a European Commission project that evaluated seven PNT technologies, three of which were not part of the DOT demonstration project. NextNav did not out-perform all the others in this set of tests.<sup>5</sup>

### **Summary**

Nextnav' s technology is not unique nor universally accepted, and its ability to provide nationwide service has not been proven.

Other solutions or combinations of systems can provide similar capabilities as NextNav proposes. Many of them do not require additional spectrum.

We therefore respectfully urge the FCC to reject NextNav's petition.

Sincerely,

A handwritten signature in blue ink, appearing to read "Dana A. Goward". The signature is fluid and cursive, with a large loop at the end.

Dana A. Goward  
President

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<sup>5</sup> See Table 17 (Timing) & Table 18 (Positioning) on page 76 (Test Conclusions Section) of "European Commission: JRC Science for Policy Report - Assessing Alternative Positioning, Navigation, and Timing Technologies for Potential Deployment in the EU" (<https://tinyurl.com/2fk5u5bf>)