STATEMENT OF OBJECTIVES (SOO)
Complementary PNT (CPNT) Technology Testing and Evaluation Rapid Phase II

I. Purpose:

This is a multiple award solicitation. The U.S. Department of Transportation (DOT) is planning to expand the number of Complementary Positioning, Navigation, and Timing (CPNT) technologies for test, evaluation, and performance monitoring of positioning, navigation, and/or timing (PNT)-dependent systems for critical infrastructure sectors. Taken together with efforts of other Federal partners through the executive branch interagency process, this initiative will enhance the resilience of the Nation's PNT-dependent systems by stimulating the implementation and adoption of technologically mature CPNT services to achieve safer, more secure critical infrastructure for the Nation.

The U.S. DOT Volpe National Transportation Systems Center (Volpe Center) located in Cambridge, MA, is soliciting proposals from vendors with operationally ready CPNT services and who are interested in fielding those services for test and evaluation in the Rapid Phase of U.S. DOT's CPNT Action Plan.[1] This Request for Quotation (RFQ) is a solicitation for proposals that meet the high-level requirements listed in Sections II-VI. Proposals received by the RFQ submission deadline will be evaluated for selection and subsequent award. The U.S. Government will not pay for any effort expended in responding to this solicitation.

The Volpe Center seeks proposals from industry to deploy very high Technical Readiness Level (TRL ≥ 8) PNT services at operational or operationally equivalent field ranges.[2] Performance of proposed PNT functions should meet levels needed by one or more national critical infrastructure sectors as outlined in the Federal Radionavigation Plan (FRP).[3] The primary objective of the Rapid Phase II execution is to evaluate the performance of deployed CPNT technology under nominal and adverse conditions and an expansion of the diversity of technologies currently being tested during the initial Rapid Phase[4,5]. To achieve this goal, proposals from current vendors undergoing technology testing under the Initial Rapid Phase will only be considered if a different technology is proposed by the vendor and a partnership is identified for Rapid Phase II testing.

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[1] U.S. Department of Transportation, Complementary PNT Action Plan, September 2023 (updated March 2024), https://www.transportation.gov/pnt/complementary-pnt-action-plan.
[2] Federal Highway Administration Exploratory Advanced Research Program, Technology Readiness Level Guidebook, FHWA-HRT-17-047, September 2017, https://rosap.ntl.bts.gov/view/dot/37824.
[3] U.S. Department of Transportation, "Radionavigation Systems Planning," updated October 30, 2023, https://www.transportation.gov/pnt/radionavigation-systems-planning.
[4] U.S. Department of Transportation. "Call for Proposals Operationally Ready Complementary PNT Services." Press Release, March 21, 2024. https://www.transportation.gov/pnt/call-proposals-operationally-ready-complementary-pnt-services.
[5] U.S. Department of Transportation. "Department of Transportation Awards $7 Million for Complementary Positioning, Navigation, and Timing Technologies." Press Release, July 3, 2024. https://www.transportation.gov/briefing-room/department-transportation-awards-7-million-complementary-positioning-navigation-and.

Evaluation conditions will include situations in which Global Positioning System (GPS)/Global Navigation Satellite System (GNSS) service is disrupted or manipulated, and CPNT-specific threat vectors are introduced. Proposals should be tailored to include at least one critical infrastructure PNT user/partner and that Rapid Phase II evaluation results will be shared with Sector Risk Management Agencies (SRMAs) through the Federal interagency process to drive CPNT adoption.

A successful Rapid Phase II outcome is the earliest possible provisioning of the following three elements necessary for characterizing CPNT service performance:

1. Vendor installation of an operational CPNT service;
2. Government data collection and ground truth reference system, methodologies, and algorithms to evaluate performance and resilience of the CPNT service under nominal and adverse conditions; and,
3. Suitable proving ground(s) that are at, or representative of, operational critical infrastructure.

The Volpe Center is prepared to make multiple awards should multiple qualified bidder proposals meet the solicitation requirements. Responses to the RFQ are required to include the bidder's preferred test range where the proposed CPNT service is or can expediently become operationally ready to meet the Rapid Phase II timeline objectives (no later than six [6] months after award).

The test range capabilities and location being proposed by the offeror shall include the capacity to evaluate CPNT services with quantitative performance metrics. The CPNT service user equipment (UE) output signals should be provided over standard interfaces. UE output information should be saved into standard or otherwise well documented and readable formats. Additionally, the offeror should provide recommendations on, and support for, threat testing implementation (e.g., provide information about the type of jamming and spoofing the CPNT service is most vulnerable to and a recommendation on how to inject such threats via wireless or wired coupling into the input signal to the user equipment to test resiliency). The offeror should also describe the available fault monitoring capabilities of the service in general and of the UE in particular and how fault monitoring alarms are reported or otherwise accessed by the user.

CPNT technology vendors should demonstrate through a proposal—specifically its narrative—that it can meet the Government objectives (see section V) to participate. Failure to do so could disqualify the offeror from participation in the Government’s Rapid Phase II.

II. Scope:

The Volpe Center is looking to procure CPNT services that are mature and commercially available that can be deployed, tested, and evaluated at a vendor provided test range for the purpose of supporting PNT functions for critical infrastructure owners and operators with an emphasis on Federal applications.

For this solicitation, a CPNT service refers to a technology capable of providing critical infrastructure users and operators positioning, navigation and/or timing information that is derived independently

from GPS/GNSS.

The proposed test range(s) will be used to test and evaluate CPNT technologies. The CPNT technologies will be evaluated under a wide range of conditions and scenarios. The test range capabilities shall include the capacity to evaluate CPNT services with quantitative performance metrics, particularly regarding resilience, performance, vulnerability to threat vectors, adherence to use case-specific standards, and fault monitoring. Proposals with identified partnerships including test ranges not currently in use will be prioritized. Current test ranges include: Joint Base Cape Cod, White Sands Missile Range, Port of Los Angeles, and Santa Clara, CA.

A partnership with a critical infrastructure owner/user is a requirement to be selected for award. Partnerships should be included in the proposal and the narrative should clearly identify each organization's role. Ideally, the CPNT technology would be setup at a critical infrastructure facility and tested alongside but independent of critical infrastructure to ensure no disruption to nominal operations.

Field campaigns to provision, operate, and evaluate the proposed CPNT service(s) will begin promptly upon successful award. Field campaigns may range in duration from several months up to a year. Adversity testing will be conducted to assess the resilience of the system.

III. Period and Place of Performance:

The period of performance (PoP) will extend one year from the award and work will be performed at the proposed field test range.

IV. Background:

U.S. critical infrastructure depends on resilient PNT services for safety, national security, and economic strength. That dependence is increasingly recognized by U.S. Federal, State, and local government agencies as well as by industry, academia, and, broadly, the public through increased media attention and economic indicators. PNT functions are now acknowledged as an information source in economic and national security activities on par with other critical information sources and with many of the same vulnerabilities to natural and human threats. With the active support and engagement of Congress, the U.S. Federal Executive Branch has been promulgating significant policy that pertains to performance, dependence, and resilience of PNT services. Current National Space Policy, Space Policy Directive 7, and Executive Order 13905 on strengthening national resilience through responsible use of PNT services form the core Federal guidance on PNT services.

The focal point of this specific initiative on PNT resilience is documented in the U.S. DOT CPNT Action Plan, which formulates a strategy to drive adoption of PNT technologies that are complementary to the cornerstone PNT capability of GPS. The CPNT Action Plan calls for specific activities based on the recommendations from prior work documented in U.S. DOT's 2020 Complementary PNT and GPS Backup Technologies Demonstration Report to Congress and stakeholder engagement in a series of industry and critical infrastructure roundtables, the most recent of which was held August 4, 2022.

This solicitation builds on an initial Rapid Phase RFQ with a goal to increase the quantity and diversity of CPNT technologies being tested, as well as increase the diversity of test range locations and CI engagement/collaboration through identified partnerships.

Note: The government hosted Joint Base Cape Cod test range is not in consideration for the Rapid Phase II due to it being dedicated to the Vendors testing under the initial Rapid Phase.

V. Objectives:

The following is a set of requirements the proposal must include to be deemed technically acceptable.

1) Proposals must describe the CPNT service and its underlying technology, to include at least the following:
    a. Nature of service, i.e., positioning, navigation (or velocity), and/or timing.
    b. Usage of GNSS (GPS and/or foreign), e.g.,
        i. None;
        ii. Once, e.g., during initialization or infrequently but not required to function; or
        iii. Routinely but capable of holdover (specify duration) combined with robust ability to sense GNSS disruption and switch to holdover (describe).
    c. Radio frequency (RF) transmissions, to include band(s), power levels, and license (if applicable).
2) Proposals must describe how the CPNT technology achieves the required minimum TRL of eight (8), as described in the Federal Highway Administration Technology Readiness Level Guidebook. The TRL requirement applies to the full end-to-end solution including the PNT service infrastructure and user equipment (UE).
3) Proposals must identify and include a partnership with a critical infrastructure owner/users and specify a field test range location. Proposal must also provide a description of the setup and how the CPNT technology will function in parallel but independently from the critical infrastructure operation.
4) Proposals must provide a schedule covering the period from award to nominal operation of the end-to-end CPNT service at the indicated field test range preference and location. In the spirit of the Rapid Phase II described herein, nominal operation (e.g. setup and ready to operate) should be achieved as early as possible and no later than six (6) months after award.
5) Proposals must include a description of how the CPNT technology is capable of being tested, including any diagrams and information for system installation and setup under nominal and stressed operating conditions, as well as the adversities applied to the UE input signals, that includes denial and/or manipulation of:
    a. GNSS UE input signals,
    b. CPNT UE input signals, or
    c. Both GNSS and CPNT UE input signals, or
    d. Power to UE or critical system components, or
    e. Power and GNSS or CPNT UE input signals.
6) Proposals must contain a statement that:
    a. The operation of the solution meets regulatory compliance and be without any proprietary licensing agreement restrictions.
    b. The solution will not produce information requiring protections against disclosure in the interest of national defense of the U.S.

7) Proposals must provide additional contextual information:
    a. The intended operating environment, which includes both the solution infrastructure (if applicable) and user environment. User environment includes, but is not limited to, urbanization level, terrain, weather conditions, sky visibility, outdoor/indoor/below grade conditions, and size, weight, and power (SWAP) constraints.
    b. Potential users beyond the identified partnership (industry/market sectors and/or infrastructure type), example use-cases, potential safety and economic benefits, service provisioning availability and cost.
    c. All technology specifications and/or standards that the CPNT technology adheres and designed to.
    d. Interface description and protocols (e.g., supported reporting output rate, power, data communication protocols, service, and alert signal output specifications/standards). A description of any logging capabilities and its format.
    e. Previously performed tests under nominal or adverse conditions for GNSS (if used) and CPNT technology challenged environments.

Note: proposals will be given priority in the order of GNSS independence as described in item 1) b. above.

VI. Operating Constraints:

The identified test range site operator and CPNT vendor will be responsible for providing support to deploy and test the CPNT technology.

Proposals should include the critical infrastructure sector/application that the CPNT technology supports (e.g., Energy, Communications, and Transportation, including Aviation, Maritime, Rail, and other surface transportation). The responses should also consider the context of PNT risk profiles from Executive Order (EO) 13905 (i.e., National Institute of Standards and Technology Internal or Interagency Reports (NISTIR) 8323 Foundational PNT Profile: Applying the Cybersecurity Framework for the Responsible Use of Positioning, Navigation, and Timing (PNT) Services). The CPNT technology(ies) will be tested against normal operations and threat vectors developed from the critical infrastructure risk profile(s).

Based on the normal operations and critical infrastructure risk profiles, U.S. DOT will provide scenario development and support and a U.S. DOT data collection and reference system at the test range. Vendors will be required to integrate into the Government's reference and data collection system(s). If the vendor is unable to integrate, a description of how the vendor intends to be referenced to "truth" and how data will be provided to the U.S. DOT is required in its proposal.

Vendors proposing CPNT services utilizing RF transmissions must have authority to operate in all proposed spectrum bands.