Positioning, Navigation, and Timing (PNT) for Critical Infrastructure

Science and Technology

CRITICAL INFRASTRUCTURE

Accurate Positioning, Navigation, and Timing (PNT) is a necessity for many critical infrastructure (CI) sectors. Precision timing is one aspect that is particularly important, with one microsecond level or better synchronization often being required by infrastructure systems such as electric grids, communication networks, and financial institutions. Currently, the primary source of distributed, accurate timing information is through the Global Positioning System (GPS). In an ever-evolving landscape where multi-PNT ecosystem attack surfaces are larger, the incorporation of PNT dependencies into future technologies are increasingly interdependent, and the scale of impacts more widespread and longer-lasting.

VULNERABILITY AND IMPACT ASSESSMENT

Understanding, validating, and characterizing how current and future critical infrastructure operations degrade and fail in response to progressively challenging disruption threat scenarios is essential to better understanding vulnerabilities at the end-user equipment level. The Department of Homeland Security Science and Technology Directorate (S&T) will work with CI owners and operators to plan and conduct testing scenarios that will help characterize their behavior under various scenarios and identify key vulnerabilities.

An interdependent, multi-PNT ecosystem poses both unique and complex problems for PNT. S&T will work with experts throughout PNT-related subsectors to develop a set of standards frameworks, and assessment processes to create scalable, secure, and resilient PNT services for industry.

MITIGATION TECHNIQUES

Mitigations range from implementing best practices to developing improved, more secure hardware. Examples include improving situational awareness by developing the capability to detect and automatically alert users of jamming or spoofing events, working with equipment manufacturers to ensure newer product lines are more robust against existing threats; and developing new antenna designs optimized to minimize jamming and spoofing effects on GPS receivers.

OUTREACH AND ENGAGEMENT

This program will conduct outreach to stakeholders, such as equipment manufacturers and CI owners and operators, vendors, and end users, to educate them on threats, vulnerabilities, impacts, and mitigations—a crucial part of this effort. This will allow S&T to lead an effort to develop a conformance framework and resilience standards for a complex world of threats.

DIVERSIFYING TECHNOLOGIES

S&T is assessing complementary timing technologies to reduce reliance on a single system (e.g., GPS). This effort is driven by Space Policy Directive 7 (SPD-7), U.S. Space-Based Positioning, Navigation, and Timing Policy (2021) and in line with prior National Security Presidential Directives and policies. This effort will aid in the development of alternative timing technologies, which will not only provide new sources of robust timing data but will also hamper jamming and spoofing attempts.

PROJECT IMPACT

- Advance the state of PNT research and development efforts to promote adoption of standards and techniques to develop more resilient PNT-related environments

- Promote outreach to stakeholders to educate them on threats, vulnerabilities, impacts, and mitigations preparing them to meet the demands of this constantly changing threat landscape

ACCOMPLISHMENTS AND UPCOMING MILESTONES

- PNT Best Practices; Financial Services PNT Best Practices; PNT Trust Inference Engine (PNTTING) Application Report (Q4 FY23)

- GPS Equipment Testing for Critical Infrastructure (GET-CI) live-sky event (Q1 FY25)

PARTNERS

- Cybersecurity and Infrastructure Security Agency

- Homeland Security Systems Engineering and Development Institute™, MITRE Corp

- University of New Hampshire InterOperability Laboratory

- Institute of Electrical and Electronics Engineers