

# Positioning, Navigation, and Timing Systems for Critical Infrastructure

## GNSS Test Vector Suite & Distribution Methodology



Science and Technology

### IMPROVED RESILIENCE FOR CRITICAL INFRASTRUCTURE

Positioning, Navigation, and Timing (PNT) services are used in several sectors of the nation's critical infrastructure. Essential services such as financial systems, emergency response, utilities, and transportation heavily rely on PNT data to deliver services globally. Natural disasters, accidents, or attacks can disrupt PNT services, leading to adverse consequences for individuals, businesses, and nations alike. To counteract these threats, the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) is researching ways to strengthen PNT resilience, including safeguarding existing services and developing alternative PNT systems.

### RELIABLE COMMERCIAL GNSS SIMULATORS FOUND LACKING

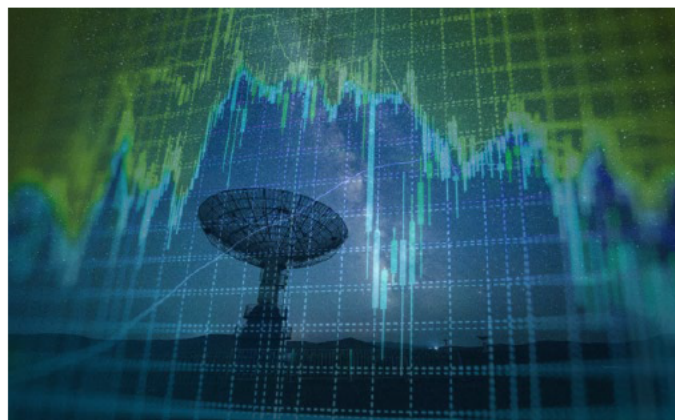
The lack of reliable commercial Global Navigation Satellite Systems (GNSS) simulators and test vector generation for PNT vulnerability and equipment testing makes reliable testing challenging, with non-existent software tools generating the need for Radio Frequency (RF) inputs into GNSS receivers.

### DISTRIBUTION METHODOLOGY AND EXEMPLAR EVALUATIONS

S&T previously developed an enhanced test vector generator and approaches to validate commercial test vector generators, utilizing JavaScript Object Notation format, with associated text files to describe scenarios. Building upon these efforts, the latest test vector suite aims to develop a set of publicly releasable software tools for generating RF inputs to GNSS receivers from a set of input test vectors. This effort will also develop a set of exemplary GNSS receiver test vectors, which will be useful for evaluating GNSS receiver responses to specific signal spoofing attacks and will also serve as a proof-of-concept for the distribution methodology.

### DISTRIBUTION, METHODS, AND SIGNALS

Ensuring a robust standard for resilient PNT user equipment involves incorporating a conformity assessment program, which creates a demand for a common set of vectors for GNSS-based PNT source components and the means to distribute them efficiently to developers, integrators, and independent test facilities that may emerge to certify user equipment compliance.



This effort will identify and define appropriate test scenarios that support standards conformity assessments and GNSS test vectors based on these test scenarios; and provide these test vectors in a compact representation that can be hosted by existing share sites, forming a proof-of-concept for the distribution methodology. This effort will provide a test vector suite, which will be publicly released through the GitHub platform, allowing end-users to conduct their own testing.

### MILESTONES

#### Completed:

- Test Vector Distribution Methodology
- Test Vector Generator Development and Support
- Test Vector and Scenario Design Review
- Development of Test Vector Suite

#### Upcoming:

- Public Release of Test Vector Suite – To be released on GitHub.

### PROJECT PERFORMERS & PARTNERS

**Performer:** Homeland Security Systems Engineering and Development Institute™ Federally Funded Research and Development Centers, MITRE Corp.

**Partner(s):** DHS Cybersecurity and Infrastructure Security Agency, DHS Enterprise, and other federal agencies

**Stakeholders:** GPS equipment manufacturers, PNT technology providers, critical infrastructure owners and operators, industry groups, and federal civilian agencies.

