United States Department of Transportation
Office of the Assistant Secretary for Research and Technology (OST-R)

GeoGov Summit: The Imperative for Resilient/Precise PNT

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Future of Transportation
What Goals Are We Trying to Achieve?

- **Zero Fatalities**
  - Advance a future without transportation-related serious injuries or fatalities

- **Resilient Supply Chains**
  - Create a multi-modal freight system that can withstand and rapidly recover from severe disruptions

- **Equitable Mobility for All**
  - Create an equitable transportation system that provides safe, affordable, accessible, and convenient mobility options for all users

- **Net-Zero Emissions**
  - Create a transportation system that supports an economy with net-zero greenhouse gas emissions

- **Transformation**
  - Develop connected intelligent infrastructure that provides people-centered mobility

PNT Challenges for Safe and Reliable Transportation

Jamming/Spoofing/Cybersecurity
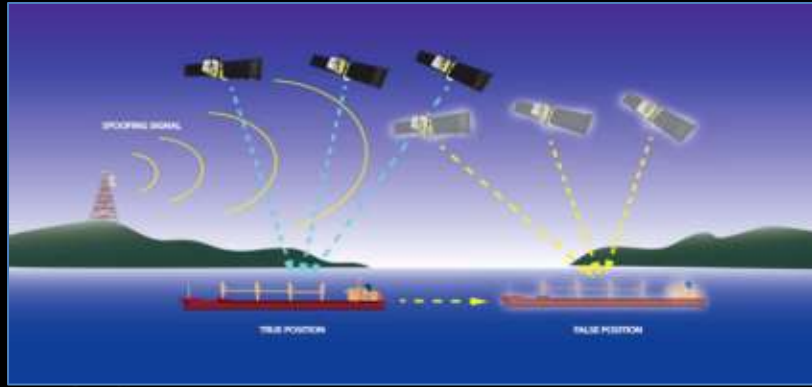
High Accuracy with Integrity

Timely Notification of Misleading Information

Urban Canyons

Underground/Indoors

Reliable and Secure Connectivity

High-Definition Maps

US DOT PNT Research Priorities

- **GNSS Civil Signal Performance Monitoring**
  - Full Civil Monitoring Performance Specification on Civil GPS Signals (L1C, L2C, L5, and L1 C/A)
  - GPS Integrity Support Message (ISM) for Advanced Receiver Autonomous Integrity Monitoring (ARAIM)
  - Monitoring and Assessment of GNSS L-band Broadcasts

- **GNSS Interference Detection and Mitigation**
  - Monitoring, Localization, and Attribution of Interference
  - Establishing Key Government Partnerships to develop a joint automated IDM capability
  - Create a Nationwide IDM Common Operating Picture for All GNSS Stakeholders

- **GPS Signal and Data Authentication**
 - Out of Band and In Band Authentication

- **Implementation of Complementary PNT Demonstration Recommendations**
  - Facilitate Adoption of CPNT Technologies
  - Establish PNT Standards, Requirements & Conduct Vulnerability Testing and Analysis
  - Engagement with PNT Technology Vendors and Critical Infrastructure Sectors

- **EO 13905 Implementation**

Executive Order 13905: Key Actions for DOT (In Conjunction with DHS)

- Vulnerability Assessment / Testing – Aviation, Maritime, Rail, Automated Vehicles
- PNT Profile Development – NISTIR 8323
- Maritime and Rail Pilot Programs
- National R&D Plan on PNT Resilience
- Resilient PNT Conformance Framework Working Group
  - IEEE standards development
- Development of PNT Resilience Contract Language
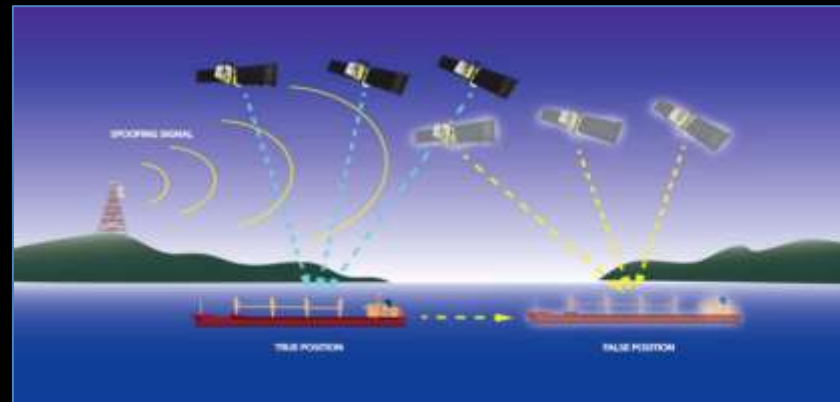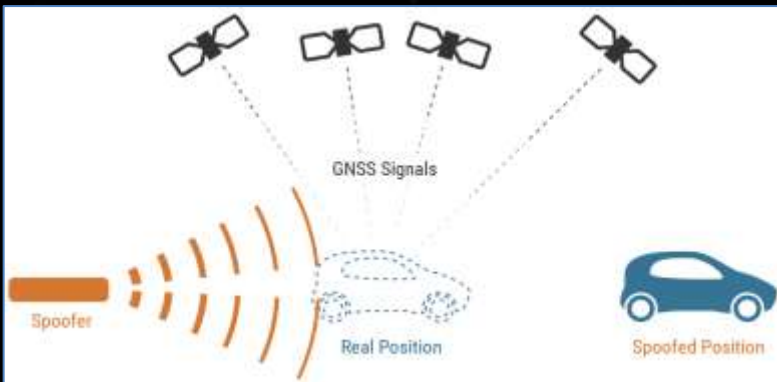
"Responsible use of PNT services" means the deliberate, risk-informed use of PNT services

US DOT Complementary PNT Industry Roundtable
Aug. 4, 2022

Complementary PNT vendors voiced their vision for paths forward to resilience:

- GPS has had excellent reliability and is a market anomaly created by the impression that it is a free service/utility; cost is a concern for adoption of other PNT technologies
- CPNT technologies must provide increased capability, not viewed only a backup to GPS
- "Sandbox" facilities, test ranges, and pilot programs for soft entry to mature operations
- CPNT technologies need to have a mature threat posture against capable actors
- CPNT must be viewed as a system-of-systems approach with layered/overlapping service
- Need Federal PNT contract language / USG to lead as an investor/subscriber of services
- Standards and requirements serve a role to promote innovation and adoption

Critical infrastructure owners and operators reflected views:

- USG must demonstrate commitment to resilience through procurement of these services
- Cost and technology risk are decision factors for CPNT vs. GPS in fixed infrastructure

PNT Industry Roundtable – Bottom Line and Next Steps

Bottom Line:

- It will take a combination of the awareness of PNT vulnerabilities, use of Pilot Programs, Grants (Critical Infrastructure Sector Users), and other programs put in place to ensure the transition from experimentation to actual adoption of Complementary PNT services and products

Next Steps:

- DOT has developed an action plan that leads to adoption of CPNT capabilities

  - Participate in Resiliency Standards Bodies to Develop Stringent Performance Specifications

  - Develop PNT Performance Assessment and Vulnerability Test Ranges

  - Make the U.S. Government a Lead Adopter of Complementary PNT Services

  - Establish a Federal PNT Services Clearinghouse

  - Develop Application Domain Acquisition Support for Complementary PNT Services Procurement

CPNT Sandbox capabilities leverage products and outcomes from the standards, vulnerability testing, and performance assessment