National PNT Architecture

National Space-Based PNT Advisory Board

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PNT Challenges and Capability Gaps

1. Physically Impeded Environments
2. Electromagnetically Impeded Environments
3. High Accuracy with Integrity
4. Timely Notification of Misleading Information
5. Accurate Geospatial Information
6. PNT Modeling and Simulation Capabilities
PNT GAP: OPERATIONS IN PHYSICALLY IMPEDED ENVIRONMENTS

**Description:** Physically impeded environments reduce users ability to obtain accurate and reliable GPS service

**Importance:** PNT use is increasing in ever-growing urban areas with many more indoor applications. GPS frequency radio signal is sometimes unavailable in these environments.

**Problem Areas:** Indoors, underground, underwater, areas under dense foliage as well as urban canyons

**Affected Applications:** Cell Phones, PDAs, personal navigation, and surface transportation applications
Description: Electromagnetically impeded environments reduce users' ability to obtain accurate and reliable PNT service.

Importance: Radionavigation signals, such as GPS, can be intentionally and unintentionally interfered with, resulting in a loss of PNT service.

Problem Areas: Could occur anywhere, although urban areas present a particular challenge for interference.

Affected Applications: Any device or application that receives updates through GPS radio signals.
Description: High accuracy with integrity is needed by many applications in order to function safely and properly

Importance: Improving the accuracy of current PNT technology will allow for higher rail and road capacity, increased efficiency, and improved safety.

Problem Areas: Advanced driver assistance systems (road departure and lane change collision avoidance) which need 10cm accuracy; railroads which need 1 m accuracy; safety of life drive integrity requirements

Affected Applications: Roads/Rails traveling at surface speeds, urban canyons, tunnels, valleys, and under canopies
PNT GAP: TIMELY NOTIFICATION of Degraded or Misleading Information

**Description:** Safety-of-life applications require timely notification (some as short as 1 sec) when PNT information is degraded or misleading.

**Importance:** Degraded or misleading PNT information that is not detected in time could possibly lead to adverse situations.

**Problem Areas:** Transportation including road and harbor navigation, as well as aviation approach and landing.

**Affected Applications:** All safety-of-life applications, especially, air, surface, and maritime transportation.
**PNT GAP: GEOSPATIAL INFORMATION**

**Description:** Users require access to accurate geospatial(map) information for successful navigation.

**Importance:** Geospatial (map) information is needed, in addition to GPS signals, to provide accurate navigation information to all PNT users. More reliable and accurate geospatial information will result in users having greater knowledge about their intended path of travel.

**Problem Areas:** Changing conditions due to road construction or areas that are not well mapped.

**Affected Applications:** Air, surface, and subsurface navigation users, personal navigation devices.
PNT GAP: MODELING CAPABILITIES

**Description:** Modeling capabilities and simulations of integrated PNT technologies are needed to determine the accuracy, availability, and reliability of PNT services in impeded conditions.

**Importance:** The ability to better model and simulate integrated PNT capabilities will lead to the ability to develop those capabilities to close the PNT capability gaps.

**Problem Areas:** Modeling the use of integrated PNT

**Affected Technologies:** Integrated PNT technologies (GPS, INS, foreign GNSS, chip-scale atomic clocks, etc.)
National PNT Architecture

- Eighteen month effort:
  - 31 civil and military Federal agencies
  - 200+ people
- Provide more effective and efficient PNT capabilities to USG
- Vision, Strategy, Vectors and Recommendations approved June 2008
National PNT Architecture Recommendation Tree

**Vision**
- Protect Strategic Advantage
- High Accuracy with Integrity
- Augmentation Transition Opportunities
- PNT Signal Monitoring & Dissemination
- GPS – An Architecture Cornerstone

**Strategy**
- US Leadership in Global PNT
- The US can Best Achieve Efficiency and Effectiveness through a Greater Common Denominator Approach

**Vectors**
- Multiple Phenomenologies
- Integrated User Equipment
- Civil Use of Foreign PNT
- US Military Use of Non-Military Signals
- PNT Pseudolites & Beacons
- Evolution of PNT Capabilities
- Critical Infrastructure & Time
- Interchangeable Solutions
- Interchangeability with Foreign PNT Sources
- Standards & Reference Frames
- Info Exchange, Assurance & Protection
- Grids & Coordinate Systems
- Synergy of PNT & Communications
- Synergy of PNT & Communications
- Synergy of PNT & Communications
- Cooperative Organizational Structures
- National PNT Coordination Process
- Phenomenology & Application Champions
- Modeling & Simulation Framework
National PNT Architecture Implementation Plan

- National Architecture Implementation Memorandum
  - Signed by Assistant Secretary of Defense for NII and Undersecretary of Transportation
  - Released July 28, 2010
  - Approves the Implementation Plan
  - Close the National PNT Architecture Terms of Reference
National PNT Architecture – Next Steps

• Identify and take credit for work across the interagency that supports the National PNT Architecture Implementation Plan
  - Examine areas that are being worked by industry and universities

• Map future planned activities against PNT Architecture Implementation Plan

• Perform assessment of how well we are moving toward “Should Be” Architecture

• Perform gap analysis of tasks not being implemented

• Refine and update architecture based on data and analysis
Perform an independent assessment of the way ahead for the National PNT Architecture Implementation Plan.

- What can the Departments and Agencies do to ensure the successful implementation of the Plan?
- What sort of organizational, functional, or technical issues does the Board believe may impede successful implementation of the Plan?
- How can the Departments and Agencies reduce the likelihood that these impediments occur?
- How can the Departments and Agencies reduce the effect these impediments may have?