

National PNT Architecture

National Space-Based PNT Advisory Board

November 9, 2011

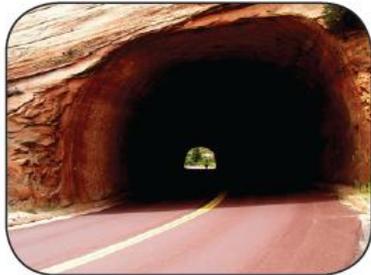
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National PNT Architecture Background

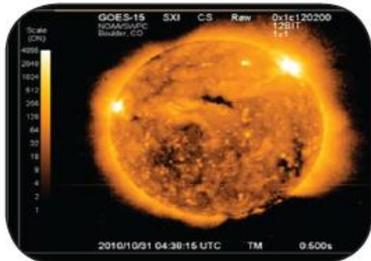
- PNT Strategic Landscape is Changing
 - Missions & Applications
 - Greater need for PNT Services
 - Affects civil, military, and commercial communities
 - Technology
 - Rapid Change affecting PNT Services
 - PNT Services
 - More providers - increased competition and/or integration

- Strategic Vision Needed
 - Sustain and advance global PNT capabilities
 - Meet long term user needs affordably and effectively

PNT Capability Gaps



1. Physically Impeded Environments



2. Electromagnetically Impeded Environments



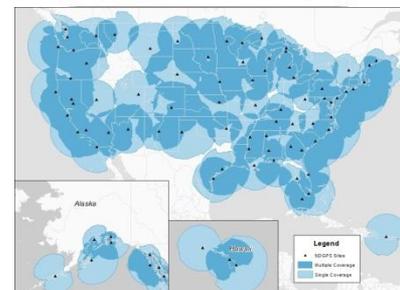
3. High Accuracy with Integrity



4. Timely Notification of Misleading Information



5. Accurate Geospatial Information



6. PNT Modeling and Simulation Capabilities

- ❖ Promote efficiency and effectiveness
 - Avoid duplication of activity

Easy to Purchase GPS Jamming Devices

- Growing market for low-cost GPS jammers
 - Concern over being tracked using GPS, particularly among those driving a company or fleet vehicle
- Many devices are battery-operated or can be plugged into a cigarette lighter
- Sold as “privacy protectors”
- Examples: gpsjammers.net, jammer-store.com, chinavision.com, others
 - Manufactured in China and Europe



\$99



\$99



\$320



\$129



\$145



\$30



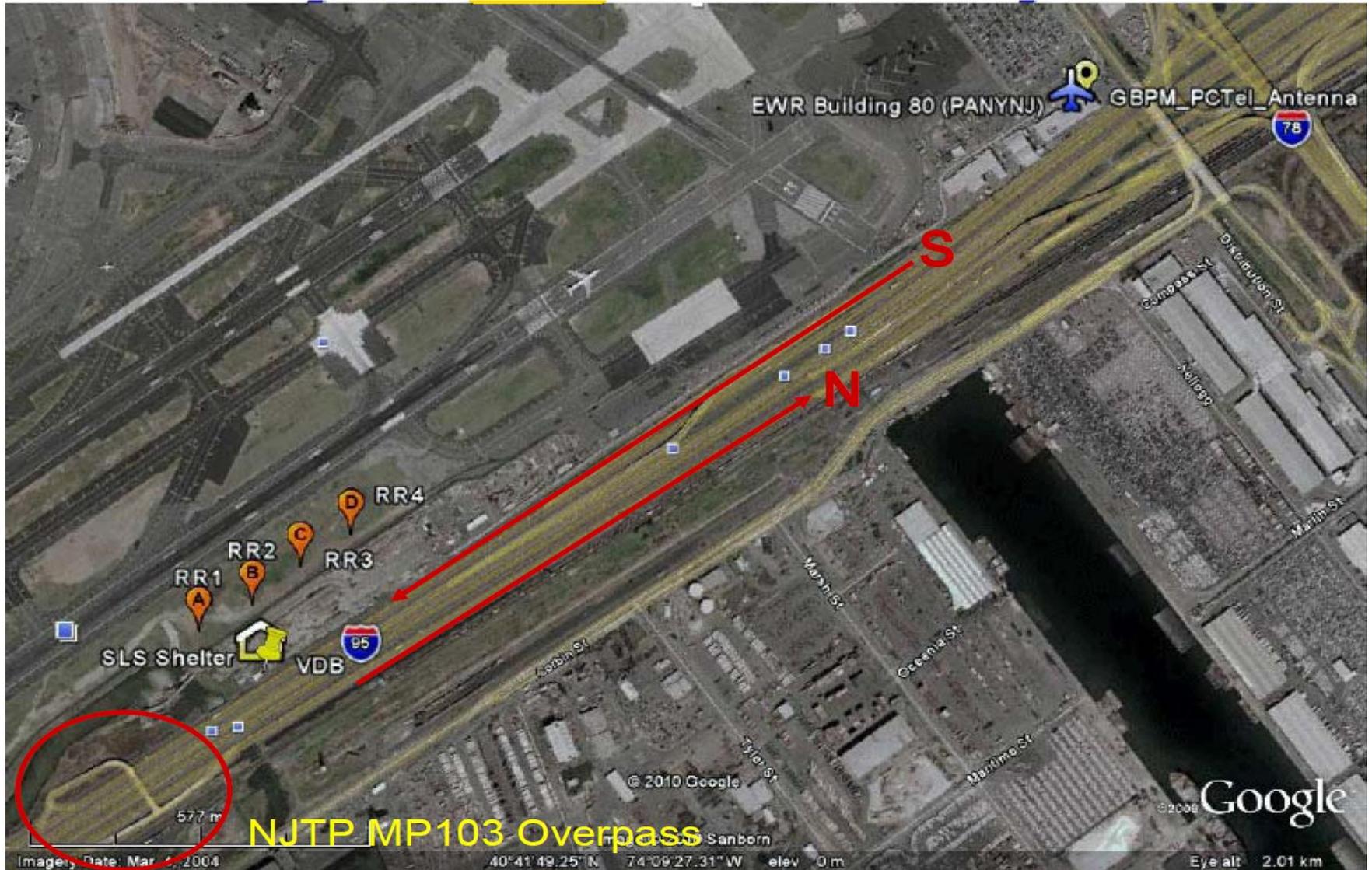
\$430



\$79



NJ Turnpike Adjacent to GPS Reference Receivers at EWR



National PNT Architecture Recommendation Tree



National PNT Architecture Implementation Plan

- Approved By DoD and DOT in July 2010 after interagency review
 - Disseminated to agencies to inform subsequent programming, planning, budgeting, and execution activities

- Tasks place the PNT community on a path to achieve the 2025 “Should-Be” Architecture
 - Eliminate capability gaps
 - Introduce efficiencies in acquisition and operations

Goal:

- Identify current and planned efforts across the interagency that support National PNT Architecture recommendations and Implementation Plan tasks
- Assist agencies in a budget-constrained environment to demonstrate why work is of national importance

- ❖ Need interagency assistance to accomplish



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

BACKUP SLIDES

PNT GAP: OPERATIONS IN PHYSICALLY IMPEDED ENVIRONMENTS



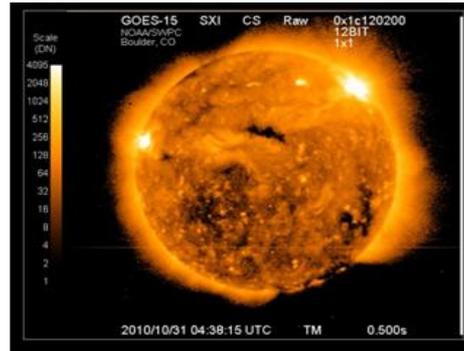
Description: Physically impeded environments reduce users ability to obtain accurate and reliable GPS service

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

PNT GAP: ELECTROMAGNETICALLY IMPEDED ENVIRONMENTS



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

PNT GAP: HIGH ACCURACY WITH INTEGRITY



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

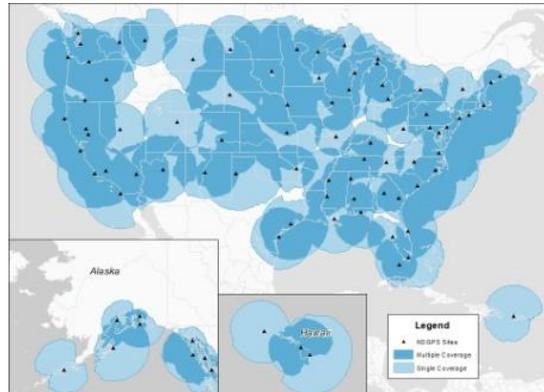
Importance: Geospatial (map) information is needed, in addition to GPS signals, to provide accurate navigation information to all PNT users. More reliable and accurate geospatial information will result in users having greater knowledge about their intended path of travel.

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.

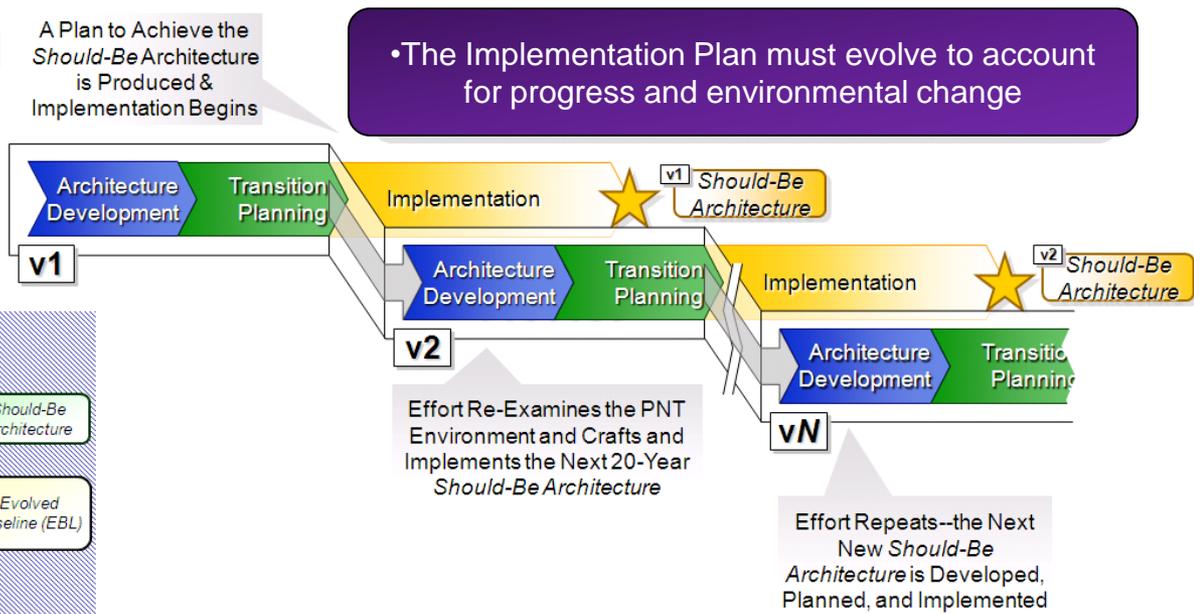
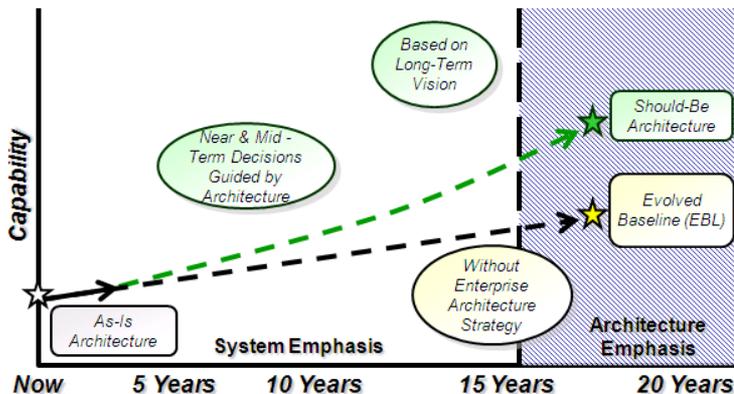
Problem Areas: Modeling the use of integrated PNT

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

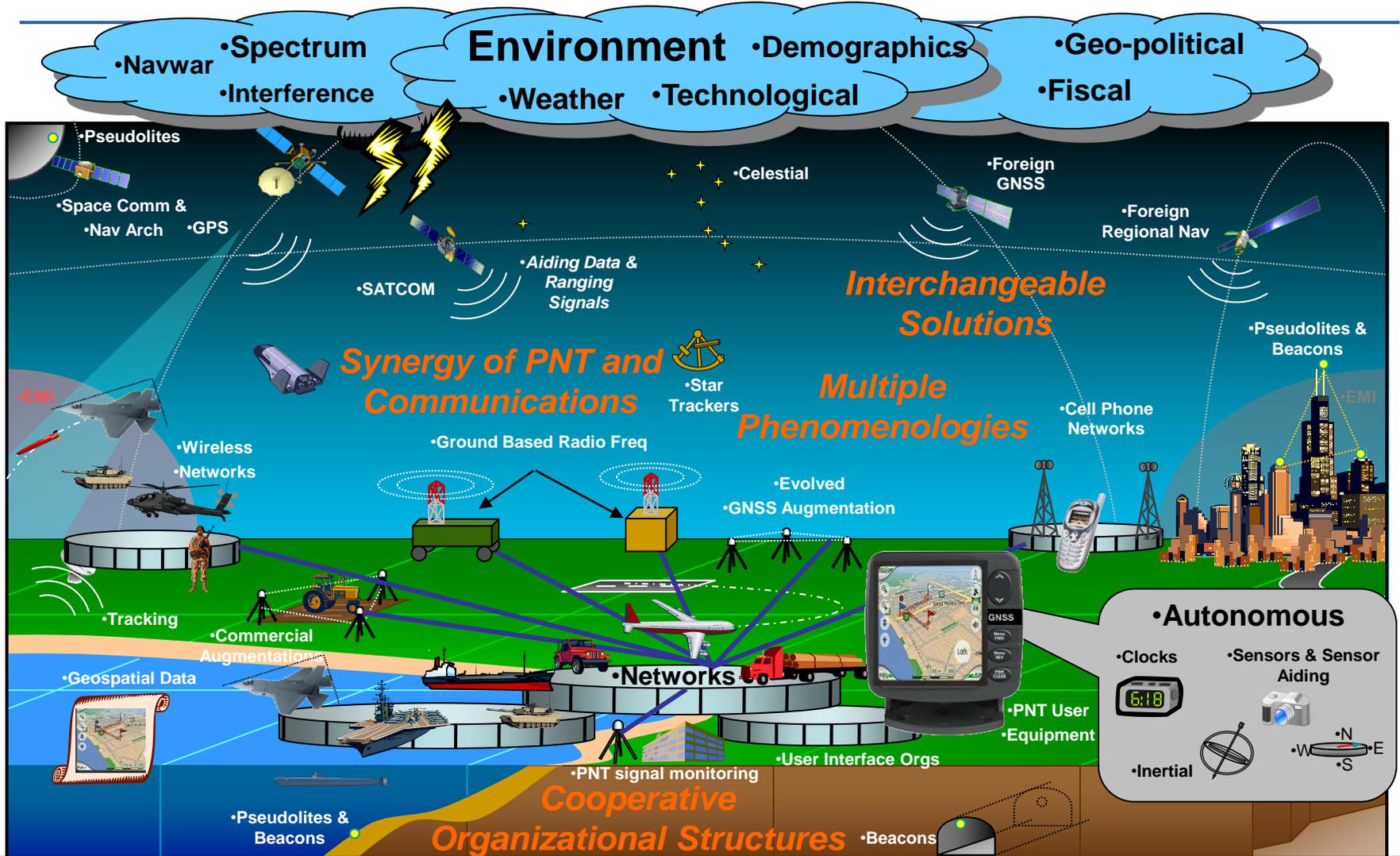
National PNT Architecture Implementation Plan

- 40+ tasks places the PNT community on a path to achieve the 2025 Should-Be Architecture
 - Eliminate capability gaps
 - Introduce efficiencies in acquisition and operations

- Tasks map to the National PNT Architecture strategy, vectors, and recommendations



National PNT Architecture Graphic (2025)



- ENABLERS & INFRASTRUCTURE**
- Standards
 - Reference Frames
 - Cryptography
 - Science & Technology
 - USNO
 - NIST
 - NGA
 - NGS
 - Star Catalogs
 - Launch
 - NSA
 - Industrial Base
 - Electro Optical Info.
 - Modeling
 - Mapping/Charting/Geodesy
 - Laser Ranging Network
 - Policies
 - Testing

National PNT Architecture Assessment

Near Term

- Identify current and planned efforts across the interagency that support National PNT Architecture recommendations and Implementation Plan tasks
 - Examine areas that are being worked by industry and universities
- Map future planned activities against PNT Architecture Implementation Plan
- Iterative, near-term implementation plans will nudge us from the Evolved Baseline (EBL) to the “Should Be” curve

Longer Term

- Perform assessment of how well we are moving toward “Should Be” Architecture
- Perform gap analysis of tasks not being implemented

National Space-Based PNT Advisory Board Task

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?

