National PNT Architecture Update

Civil GPS Service Interface Committee

September 21, 2010

Civil and Military PNT Capability Gaps

- **Operations in Electromagnetically Impeded Environments**
  - Operations during spoofing, jamming and unintentional interference
- **Operations in Physically-Impeded Environments**
  - Areas including indoors, urban canyons, underground, underwater, and under dense foliage
- **Insufficient Modeling Capability**
  - Model PNT capabilities in impeded conditions in order to determine impact
- **Higher Accuracy with Integrity**
  - 10cm accuracy for Intelligent Transportation System applications
  - 1m accuracy for positive train control
- **Notification of Degraded or Misleading Information**
  - As short as 1 sec in some situations
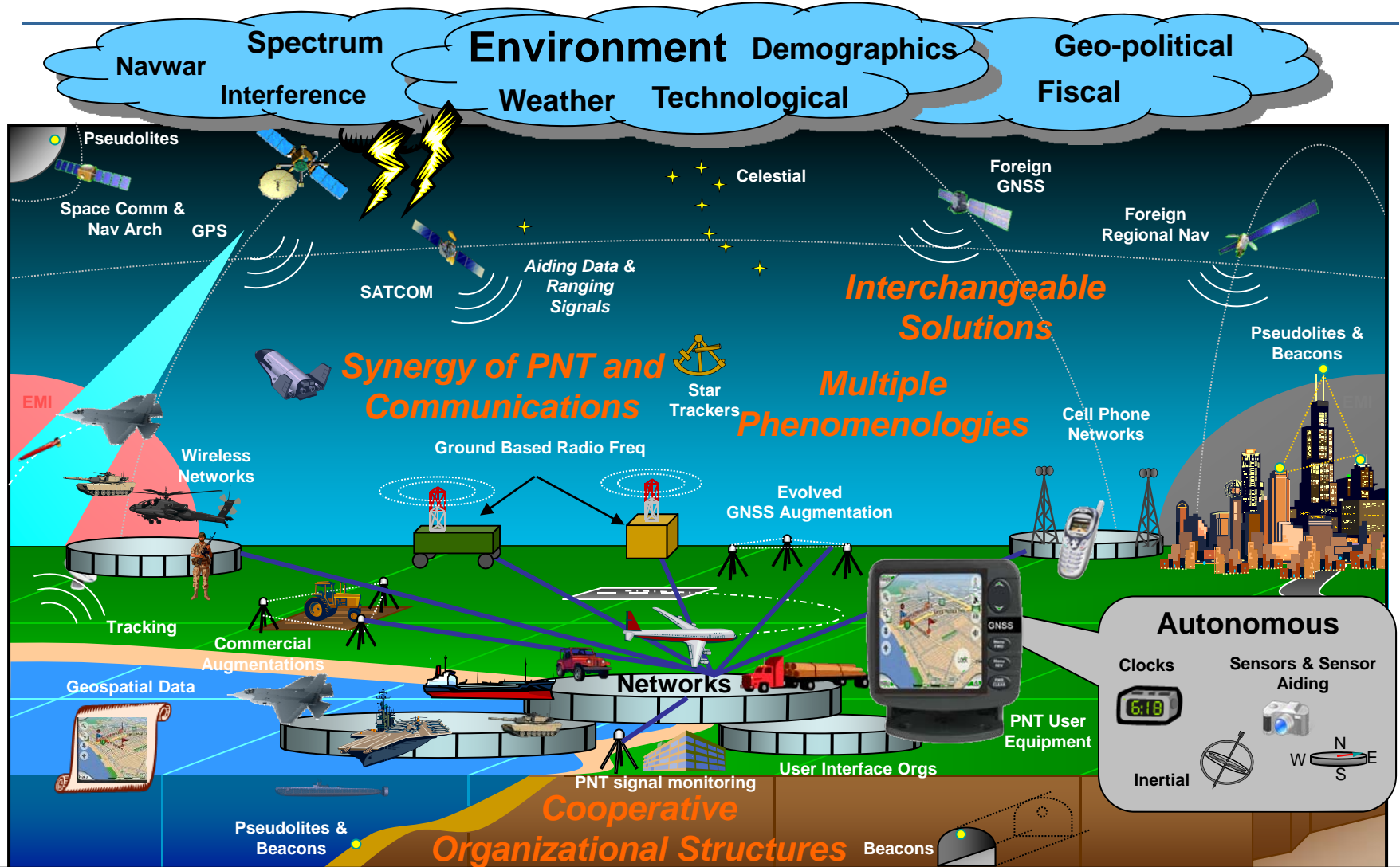- **Geospatial Information**
  - Users require access to timely geospatial information to help navigate through impeded environments
- **High Altitude/Space Position and Orientation**
  - Current star catalog degrading
  - Precise positioning at GEO and beyond

U.S. Department of Transportation
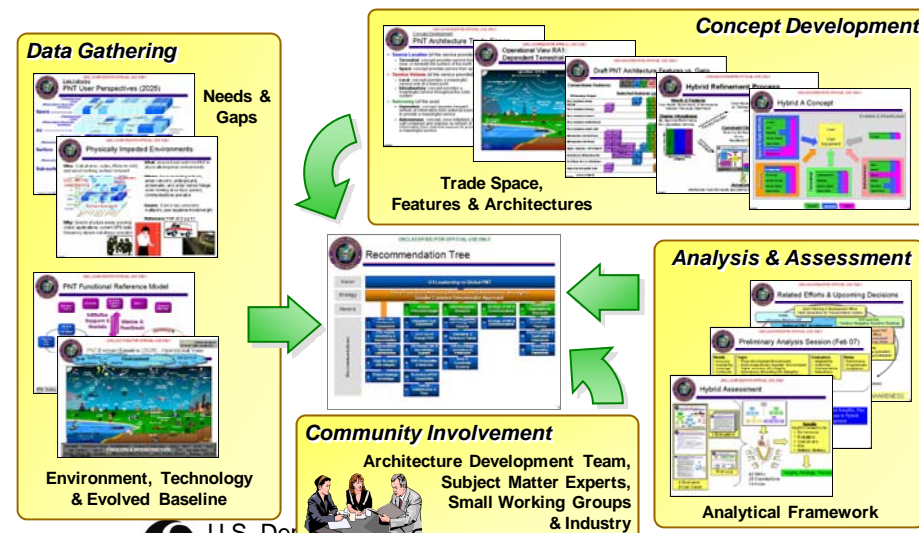**Research and Innovative Technology Administration**

"Should-Be" PNT Architecture Graphic (2025)

PNT Architecture Recommendation Tree

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

Vectors

1 Multiple Phenomenologies	2 Interchangeable Solutions	3 Synergy of PNT & Communications	4 Cooperative Organizational Structures

Recommendations

1 GPS – An Architecture Cornerstone	6 Integrated User Equipment	12 Interchangeability with Foreign PNT Sources	16 Synergy of PNT & Communications	17 National PNT Coordination Process
2 PNT Signal Monitoring & Dissemination	7 Civil Use of Foreign PNT	13 Standards & Reference Frames		18 Phenomenology & Application Champions
3 Augmentation Transition Opportunities	8 US Military Use of Non-Military Signals	14 Info Exchange, Assurance & Protection		19 Modeling & Simulation Framework
4 High Accuracy with Integrity	9 PNT Pseudolites & Beacons	15 Grids & Coordinate Systems		
5 Protect Strategic Advantage	10 Evolution of PNT Capabilities			
	11 Critical Infrastructure & Time			

Discussed at 2010 CGSIC

U.S. Department of Transportation
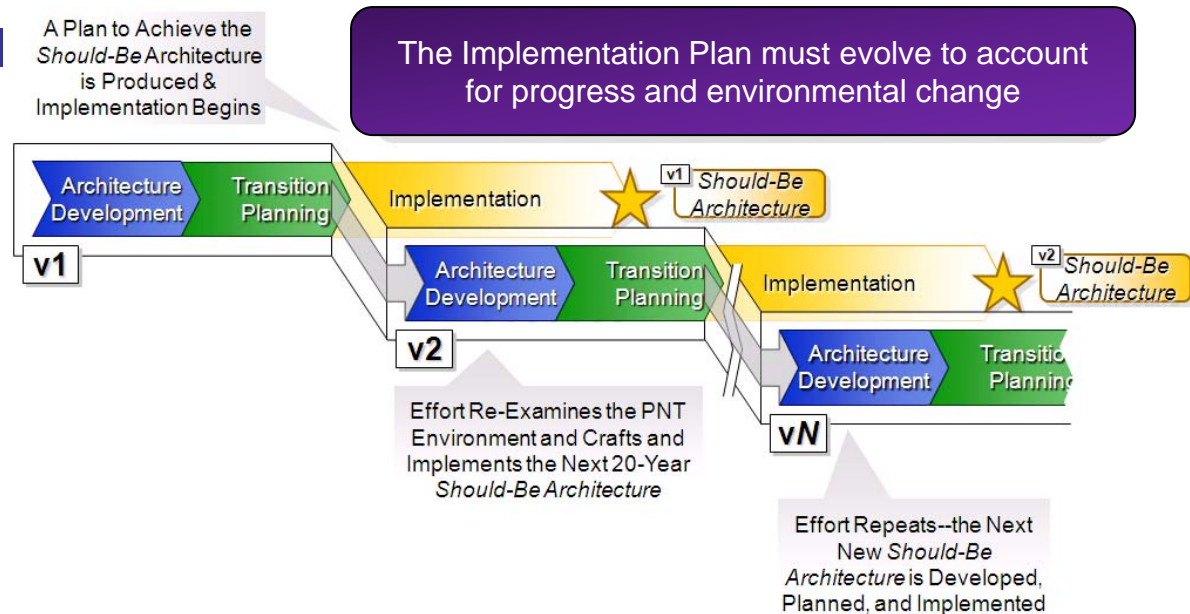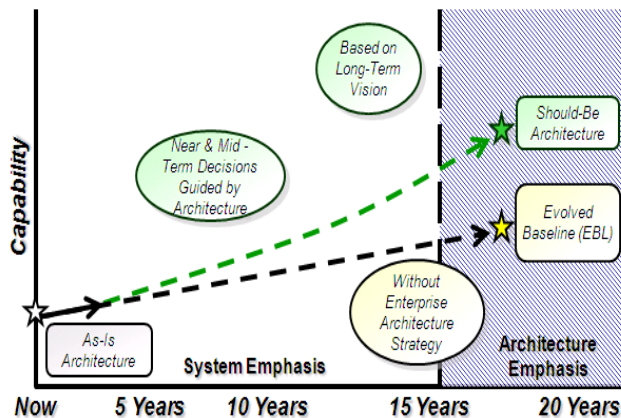**Research and Innovative Technology Administration**

Designing the 2025 Architecture

- The team identified the *attributes* of the 2025 "Should-Be" Architecture, directly linked to the *capability gaps*
  - *Multiple phenomenologies*
  - *Interchangeable solutions*
  - *Fusion of PNT with* new and evolving *communications* capabilities
  - Promote *interagency coordination & cooperation*

- *Nineteen recommendations* were conceived to achieve the *attributes*

- *350+ tasks* were formulated to achieve the *nineteen recommendations*

- Over forty of the tasks are bound into an *"Implementation Plan"* to place us on a vector to the 2025 "Should-Be" architecture

Data Gathering
PNT User Perspectives (2025)
Needs & Gaps
Physically Impeded Environments

Concept Development
PNT Architecture
Operational View RA1 Dependent Terrestrial
Draft PNT Architecture Features vs. Gaps
Hybrid Refinement Process
Hybrid A Concept
Trade Space, Features & Architectures

Analysis & Assessment
Related Efforts & Upcoming Decisions
Preliminary Analysis Session (Feb 07)
Hybrid Assessment
Analytical Framework

Recommendation Tree

Community Involvement
Architecture Development Team, Subject Matter Experts, Small Working Groups & Industry

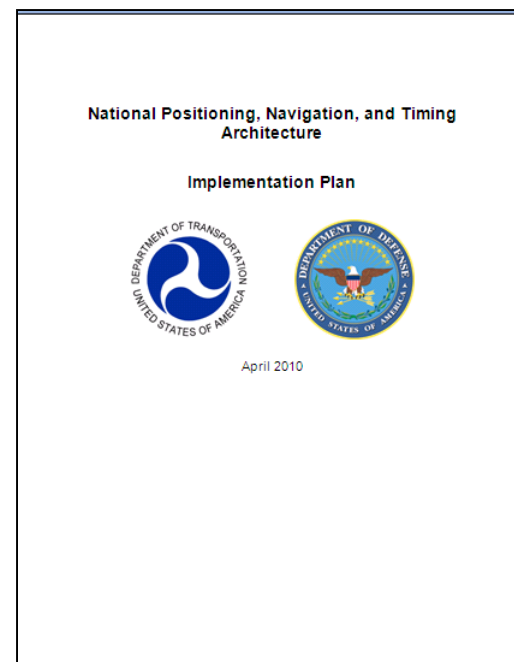Environment, Technology & Evolved Baseline

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

A Plan to Achieve the *Should-Be* Architecture is Produced & Implementation Begins

The Implementation Plan must evolve to account for progress and environmental change

Architecture Development → Transition Planning → Implementation → v1 *Should-Be Architecture*

v1

Architecture Development → Transition Planning → Implementation → v2 *Should-Be Architecture*

v2

Effort Re-Examines the PNT Environment and Crafts and Implements the Next 20-Year *Should-Be Architecture*

Architecture Development → Transition Planning

vN

Effort Repeats--the Next New *Should-Be Architecture* is Developed, Planned, and Implemented

Capability

Based on Long-Term Vision

Near & Mid - Term Decisions Guided by Architecture

Should-Be Architecture

Evolved Baseline (EBL)

Without Enterprise Architecture Strategy

As-Is Architecture

System Emphasis

Architecture Emphasis

Now   5 Years   10 Years   15 Years   20 Years

National PNT Architecture Implementation Plan

- National Architecture Implementation Memorandum

  - Implementation Plan signed July 28, 2010
  - Distributed to departments and agencies for planning, programming, budgeting, and execution

  - http://www.acq.osd.mil/nsso/pnt/pnt.htm

National Positioning, Navigation, and Timing Architecture

Implementation Plan

April 2010

National PNT Architecture – Next Steps

- Identify and take credit for work across the interagency that is in line with National PNT Architecture Implementation Plan
  - Examine areas that are being worked by industry and universities
  - DOT to roll out a Research, Development, and Technology Collaboration site through in October Promote collaboration on the PNT Architecture from Industry and Academia

- Map future planned gov't.activities against Implementation Plan Tasks

- 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

National PNT Architecture Summary

- Effort has already impacted the following interagency products/processes

  □ DoD Science and Technology (S&T) roadmap

  □ Federal Radionavigation Plan

  □ National Security Space Program Assessment

  □ Acknowledged in DoD Navigation Warfare effort

The PNT Architecture is now a common expression - used, known, and understood by many members of the USG PNT community
- *Recognized by commercial companies, NATO, and known internationally*