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***National Positioning Navigation and Timing  
Architecture***  
***Civil GPS Service Interface Committee Meeting***

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*Karen Van Dyke, DOT/RITA/Volpe Center*  
*Lt Col Patrick Husted, National Security Space Office*  
*15 September 2008*



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# Overview

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- PNT Architecture Background
- Architecture Development
- Guiding Principles
- Recommendations
- Next Steps



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# Foundations

- RITA 
- FAA 
- FHWA 
- FRA 
- DOC 
- NIST 
- DHS 
- USCG 
- DOI 
- DOS 
- NASA 
- JPDO 
- NCO 

**ASD/NII Memo  
23-Jan-2006**



**DOT/RITA  
Memo  
14-Mar-2006**



**NPEC  
Action Items  
26-Jan-2006**



***“NSSO develop a  
National PNT  
Architecture”***

***“RITA will lead  
effort on behalf of  
DOT for the civil  
community”***

***“NPCO will  
initiate an effort  
with NSSO”***

**PNT Architecture  
TOR  
11-Jul-2006**



***More Effective & Efficient PNT and an Evolutionary  
Path for Government Provided Systems & Services***

-  NII
-  AT&L/S&T
-  PBFA
-  JS
-  USA
-  USN
-  USMC
-  USAF
-  SAF/USA
-  NGA
-  NSA
-  STRAT
-  SMDC
-  AFSPC
-  USNO
-  NRL
-  SMC

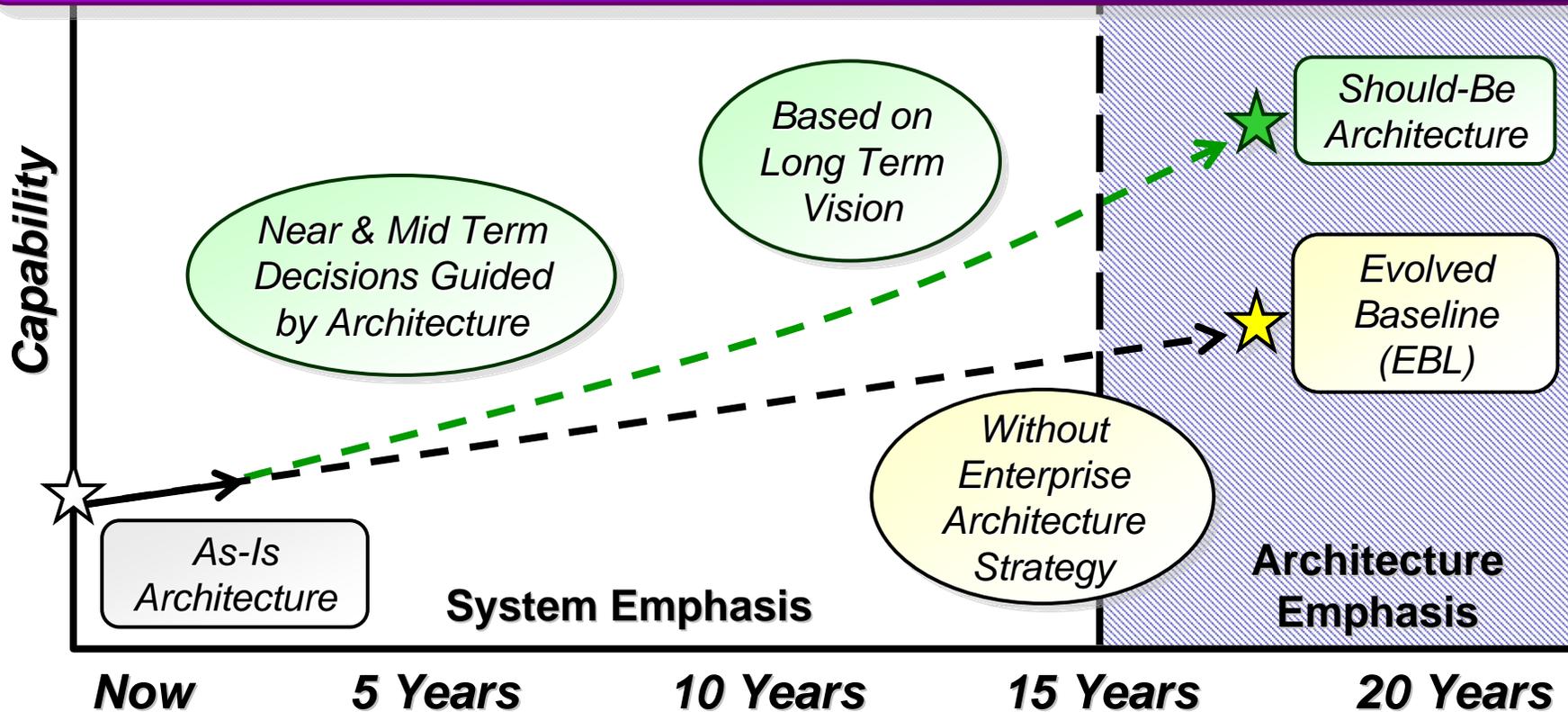


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# Primary Objective

*“...provide more effective and efficient PNT capabilities focused on the 2025 timeframe and an evolutionary path for government provided systems and services.”* -- Terms of Reference





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# Scope

USERS	DOMAIN	MISSIONS	SOURCES	PROVIDERS
Military	Space	Location Based Services	GNSS	Military
Homeland Security	Air	Tracking	GNSS Augmentation	Civil
Civil	Surface	Survey	Terrestrial NAVAIDS	Commercial
Commercial	Sub-Surface	Scientific	Onboard / User Equip	International
		Recreation	Networks	
		Transportation		
		Machine Control		
		Agriculture		
		Weapons		
		Orientation		
		Communications and Timing		

Broad Scope Required Innovative Approaches and Focused Analysis Efforts



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# Primary PNT Gaps

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- Gaps primarily drawn from military's PNT Joint Capabilities Document, with additions and modifications from parallel civil community documents and discussions
  - Operations in Physically Impeded Environments
  - Operations in Electromagnetically Impeded Environments
  - Higher accuracy with integrity
  - Notification of Hazardously Misleading Info (Integrity)
  - High Altitude/Space Position and Orientation
  - Geospatial information - access to improved GIS data (regarding intended path of travel)
  - Insufficient modeling capability



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# Cumulative Process

### Data Gathering

**Needs & Gaps**

**PNT User Perspectives (2025)**

**PNT Gap: Physically Impeded Environments**

**Functional Reference Model**

**PNT Evolved Baseline (2025)**

**Environment, Technology & Evolved Baseline**

### Concept Development

**Trade Space, Features & Architectures**

**Guiding Principles**

- VISION**: US Leadership in Global PNT
- STRATEGY**: Greater Common Denominator
- VECTOR**: Multiple Phenomenologies
- VECTOR**: Interchangeable Solutions
- VECTOR**: Synergy of PNT & Communications
- VECTOR**: Cooperative Organizational Structures

**Community Involvement**

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

### Analysis & Assessment

**Related Efforts & Upcoming Decisions**

**Preliminary Analysis - Feb 07**

**Hybrid Assessment Process**

**Analytical Framework**



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# Guiding Principles

## *VISION*

US Leadership in Global PNT

## *STRATEGY*

Greater Common Denominator

## *VECTOR*

Multiple Phenomenologies

## *VECTOR*

Interchangeable Solutions

## *VECTOR*

Synergy of PNT & Communications

## *VECTOR*

Cooperative Organizational Structures



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# Vision

## US Leadership in Global PNT

- Based on a foundation of national policy
- Efficiently develop and field the best technologies and systems (e.g. cost, schedule, acceptable risks, user impact)
- Promulgate stable policies (commitment to funding, commitment to performance, advanced notice of change, etc)
- Foster innovation through competition within the commercial sector
- Ensure robust and enduring inter-agency coordination and cooperation
- Maximize the practical use of military, civil, commercial and foreign systems and technologies
- Judiciously develop and apply standards and best practices



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# Strategy

**The US can Best Achieve Efficiency and Effectiveness through a Greater Common Denominator Approach**

- Recommendations
  - Maintain GPS as a cornerstone of the National PNT Architecture
  - Monitor PNT signals to verify service levels, observe environmental effects, detect anomalies, and identify signal interference for near real-time dissemination
  - Transition or divest US GNSS augmentation assets that are unnecessarily redundant after capability is available from GPS modernization or other methods
  - Continue to investigate methods to provide high-accuracy-with-integrity solutions for safety-of-life applications
  - Develop a national approach to protect military PNT advantage



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# Vector: Multiple Phenomenologies

1

## Use Multiple Phenomenologies to the Maximum Extent Practical to Ensure Robust Availability

- Recommendations

- Encourage appropriate development and employment of equipment that integrates information from diverse sources and information paths
- Assess the potential for the use of foreign PNT systems for safety-of-life applications and critical infrastructure users and, as appropriate, develop clear standards and criteria for their use
- Continue military PNT exclusive use policy while studying development of capabilities to enable military use of other signals
- Promote standards for PNT pseudolites and beacons to facilitate interchangeability and avoid interference
- Study evolution of space-based and terrestrial PNT capabilities to support diversity in PNT sources and information paths
- Ensure critical infrastructure precise time and time interval users have access to and take advantage of multiple available sources



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# Vector: Interchangeable Solutions

2

## Strive for Interchangeable Solutions to Enhance Efficiency and Exploit Source Diversity

- Recommendations
  - Use participation in international PNT-related activities to promote the interchangeability of PNT sources while assuring compatibility
  - Evolve standards, calibration techniques, and reference frames to support future accuracy and integrity needs
  - Identify and develop common standards that meet users' needs for PNT information exchange, assurance and protection
  - Establish common standards that meet users' needs for the depiction of position information for local and regional operations



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## Vector: Synergy of PNT & Communications



3

### Pursue, where Appropriate, Fusion of PNT with New and Evolving Communications Capabilities

- Recommendation
  - Identify and evaluate methods, standards and potential capabilities for fusion of PNT with communications



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## Vector: Cooperative Organizational Structures



4

### Promote Interagency Coordination & Cooperation to Ensure the Necessary levels of Information Sharing

- Recommendations
  - Develop a national PNT coordination process
  - Identify and leverage centers of excellence for PNT phenomenology and applications
  - Define, develop, sustain, and manage a PNT modeling and simulation core analytical framework



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# Recommendation Tree





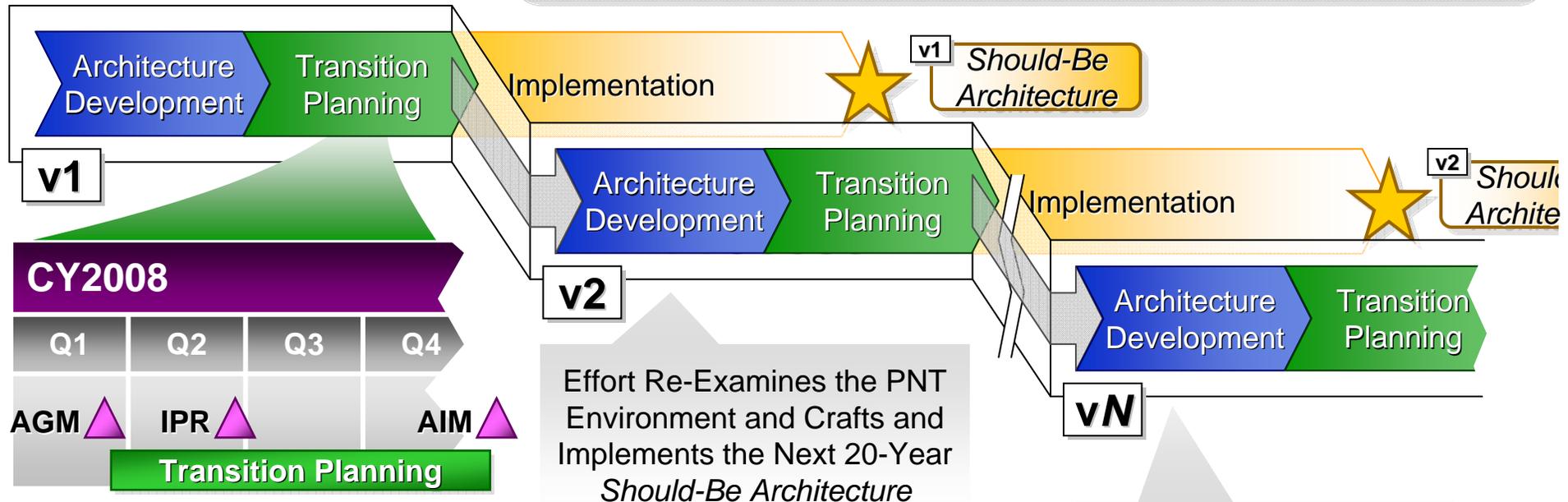
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# Architecture Effort and Schedule

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

The National PNT Architecture Effort Employs an Iterative, Interagency Process to Plan US Leadership in Global PNT



Transition Plan provided to agencies

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



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# Next Steps

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- **Workshop(s) to Obtain Public Feedback on Recommendations**
  - First “Industry Day” session in conjunction with the 2008 Institute of Navigation (ION) Global Navigation Satellite System (GNSS) conference.
    - **Date: September 16**
    - **Time: 1PM – 4PM, starting with a presentation by NSSO**
    - **Location: Savannah International Trade and Convention Center, Rooms 105 & 106**
- **Influence update to PNT planning documents**
  - Federal Radionavigation Plan
  - Five-Year National Space-Based PNT Plan
- **Architecture Transition Plan**
  - Event-based implementation timeline
  - Coordinate through Decision Coordination Group members and co-sponsors as appropriate



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# Points of Contact

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- National Security Space Office
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  - Website: <http://www.acq.osd.mil/nssso/pnt/pnt.htm>
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