



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

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Lt Col Patrick Husted, National Security Space Office
15 September 2008



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Overview

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



Foundations

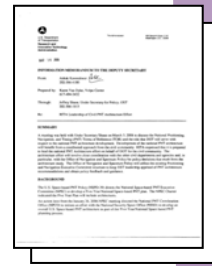
- RITA 
- FAA 
- FHWA 
- FRA 
- DOC 
- NIST 
- DHS 
- USCG 
- DOI 
- DOS 
- NASA 
- JPDC 
- NCO 

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



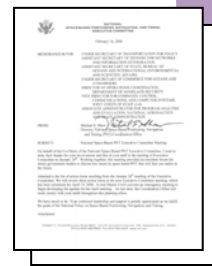
“NSSO develop a National PNT Architecture”

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



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

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



“NPCO will initiate an effort with NSSO”

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



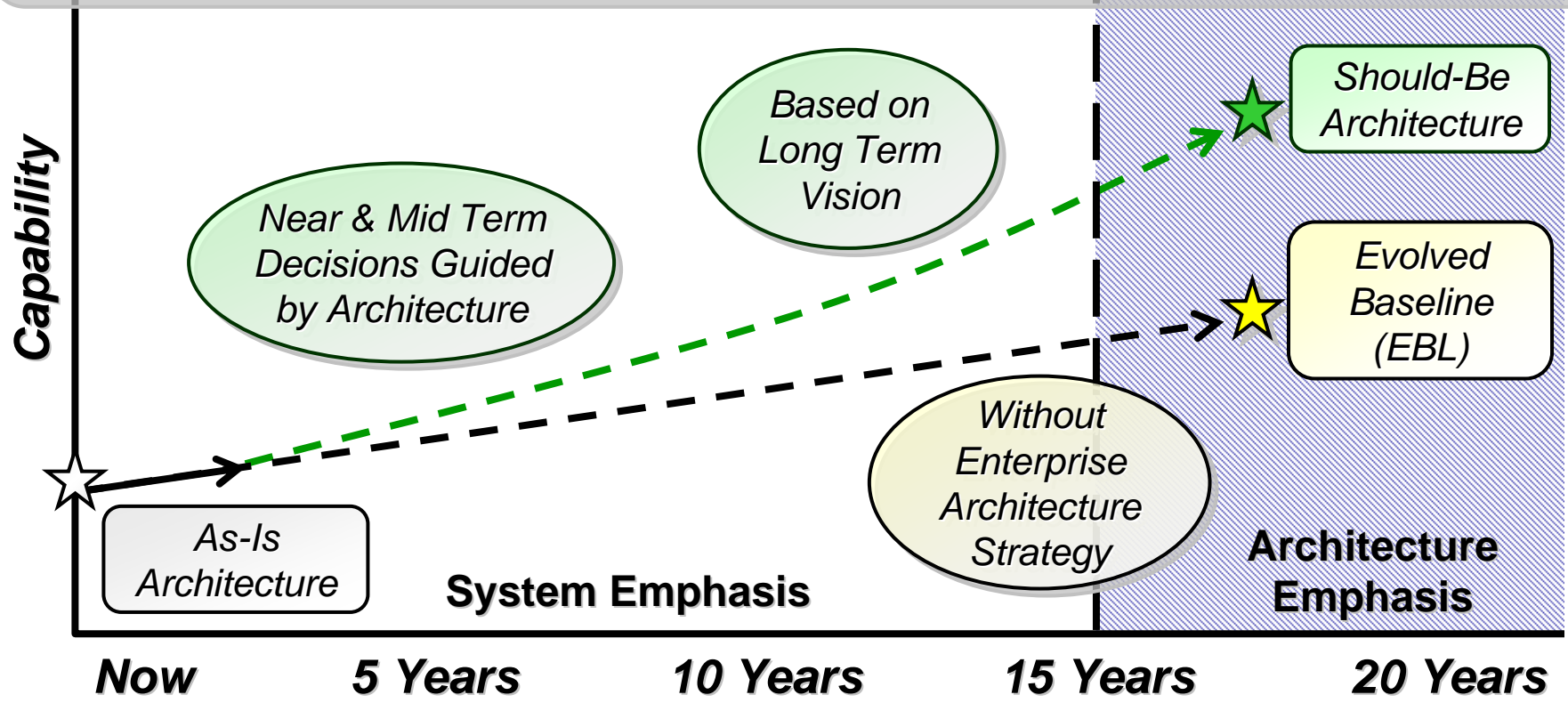
-  NII
-  AT&L/S&T
-  PBFA
-  JS
-  USA
-  USN
-  USMC
-  USAF
-  SAF/USA
-  NGA
-  NSA
-  STRAT
-  SMDC
-  AFSPC
-  USNO
-  NRL
- SMC

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



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



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



Primary PNT Gaps

- 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

PNT User Perspectives (2025)

PNT Gap: Physically Impeded Environments

Who: Cell phones, radios, PDAs for LBS, and asset tracking, surface transport

What: Assured and real time PNT in physically impeded environments

Where: Areas including indoors, urban canyons, underground, underwater, and under dense foliage, users moving at surface speeds; communications available

Issues: Cost a key constraint; multipath; user equipment size/weight

Reference: PNT_JCD pg 13

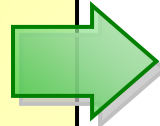
Functional Reference Model

PNT Evolved Baseline (2025)

Environment: Spectral, Weather, Geo-political, Fiscal

Needs & Gaps

Environment, Technology & Evolved Baseline



Concept Development

Example RA: Dependent Terrestrial

Job Aid – PNT Architecture Features

Hybrid Refinement Process

Hybrid A Concept

Trade Space, Features & Architectures

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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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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



Guiding Principles

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VECTOR

Interchangeable Solutions

VECTOR

Synergy of PNT & Communications

VECTOR

Cooperative Organizational Structures



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



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

The logo of the National Security Space Office, featuring an eagle with wings spread, holding a shield, with a globe in the background, surrounded by the text "NATIONAL SECURITY" and "SPACE OFFICE".

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



Recommendation Tree





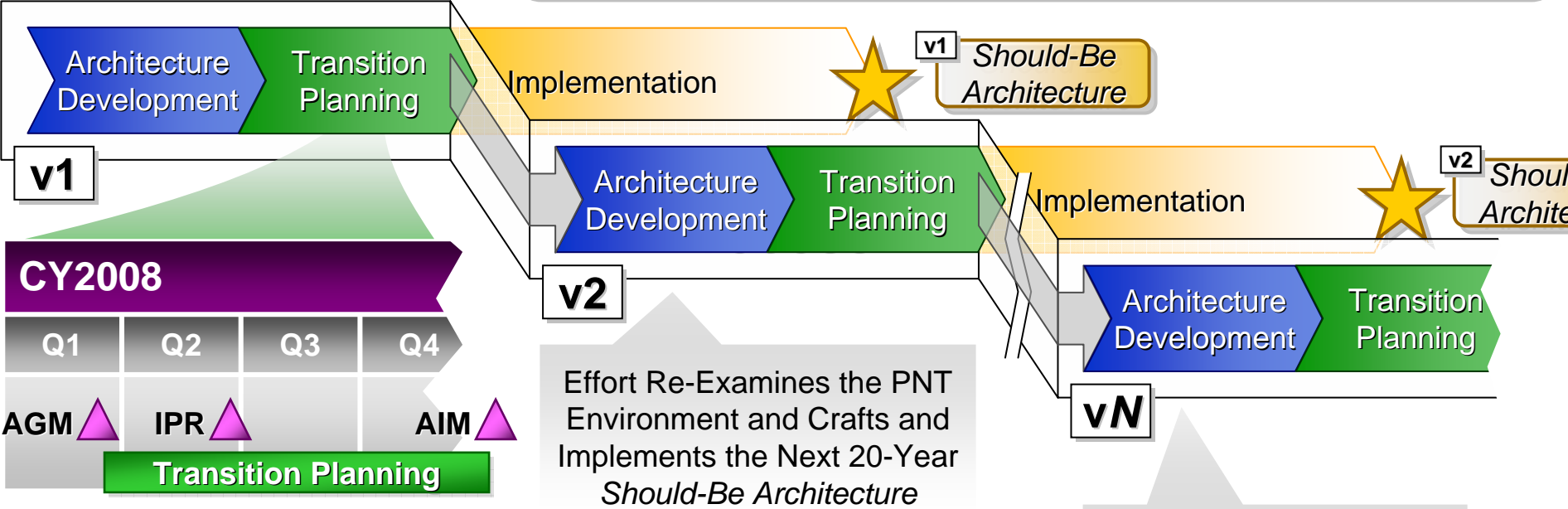
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Architecture Effort and Schedule



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

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



Transition Plan provided to agencies



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Next Steps

- **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



Points of Contact

- National Security Space Office
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