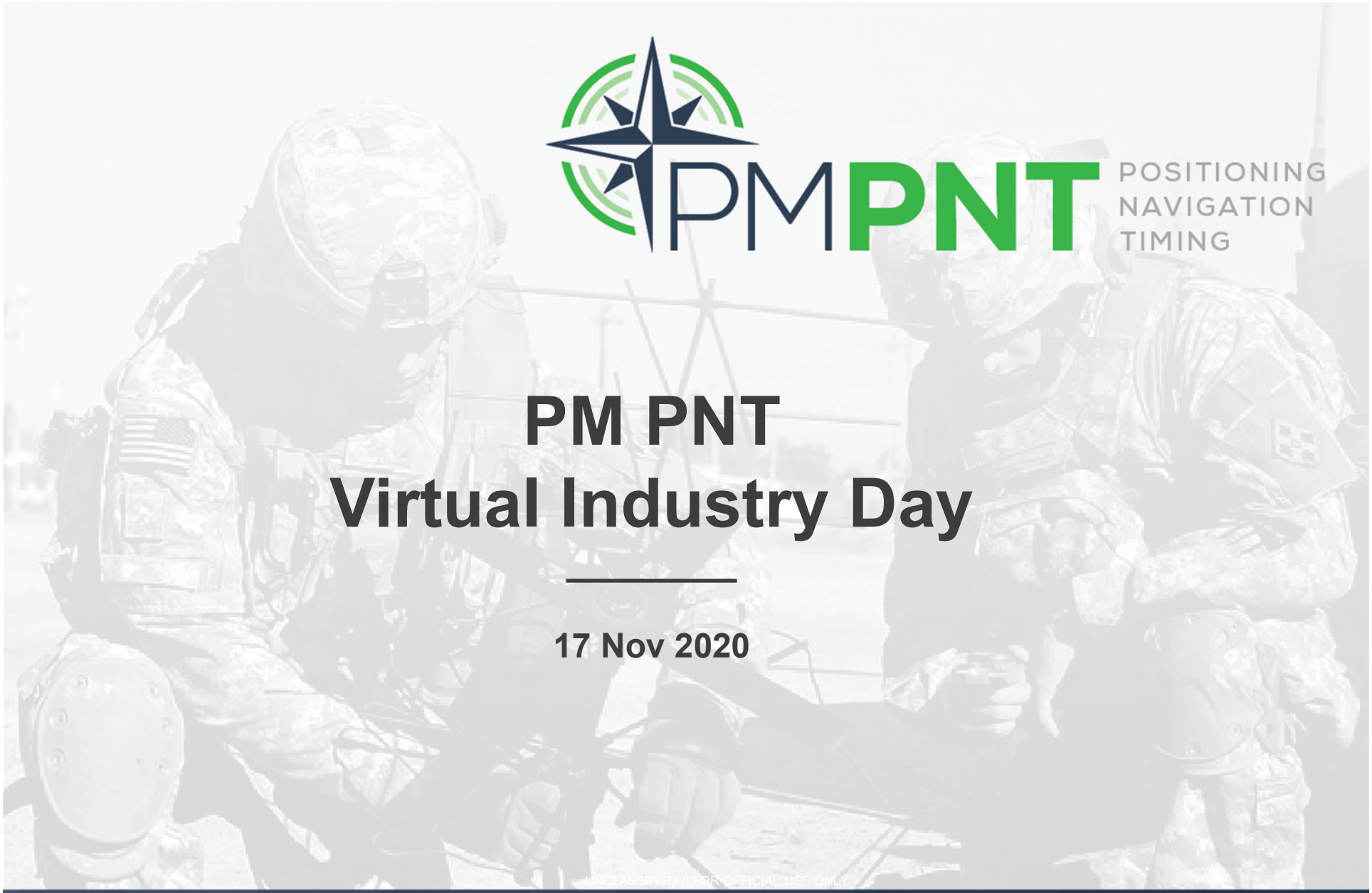


PM PNT
POSITIONING
NAVIGATION
TIMING

PM PNT
Virtual Industry Day

17 Nov 2020

UNCLASSIFIED // FOR OFFICIAL USE ONLY

PM PNT Virtual Industry Day Agenda

- Welcome / Opening Remarks
- PNT Modernization Overview
- Open Innovation Lab (OIL) Overview
- Future Opportunities
- RFI Feedback
- Closing Remarks

Welcome / Opening Remarks

Nickolas Kioutas

Colonel, U.S. Army

Project Manager - Positioning, Navigation & Timing
(PM PNT)

PMPNT

PMPNT POSITIONING NAVIGATION TIMING

MISSION: Provide Warfighter-valued **Assured PNT** solutions Today that enable Multi-domain Operations in rapidly evolving denied environments.

VISION: Ensure overmatch capability through innovative acquisition & rapid integration of cutting-edge Modular and Open System **Assured PNT** technologies.

CHALLENGE: Commercial and Military GPS systems can be disrupted due to a number of frequency interferences such as weather, terrain, urban areas and adversary intervention, which could affect Army forces ability to shoot, move and communicate.

PNT ≠ GPS

PNT includes GPS (SAASM/M-Code) but layers other capabilities to provide **Assured** position and timing data

ASSURED PNT = ACCESS + INTEGRITY

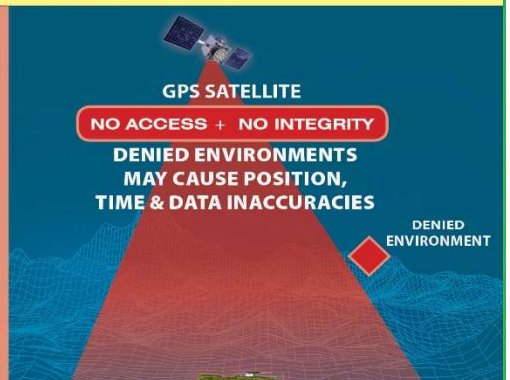
DISMOUNTED ASSURED PNT SYSTEM (DAPS)
Assured PNT to Nett Warrior (extensible)
SAASM/M-Code GPS + Non-RF
Access Alternate Signals When Available

MOUNTED ASSURED PNT SYSTEM (MAPS)
Distributes **Assured** PNT to Onboard Systems
M-Code GPS + Non-RF + Anti-Jam Antenna
Access Alternate Signals When Available

RESTORING ACCESS + INTEGRITY

RESILIENCY & SOFTWARE ASSURANCE MEASURES (RSAM)
Software updates enduring SAASM GPS (DAGR/GB-GRAM)

ALTERNATE PNT & AREA PROTECTION (APAP)
Develops and implements Non-RF and Alternate Signal technologies, providing agile & adaptive upgrade of MAPS/DAPS

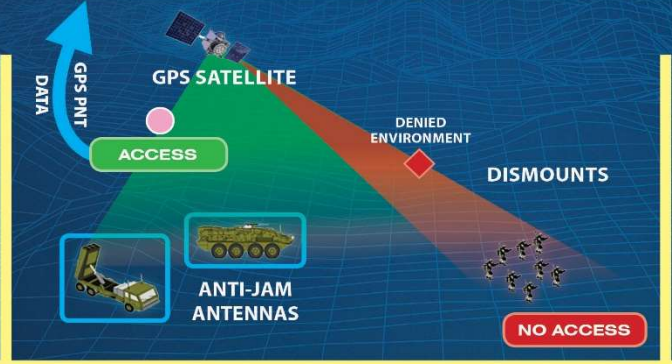


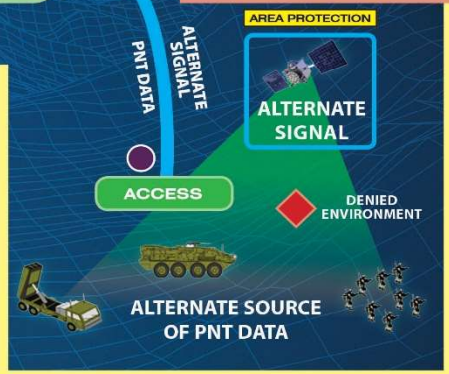
INTEGRITY: LAYERING INPUTS FROM MULTIPLE PNT SOURCES MITIGATES DENIAL

NON-RADIO FREQUENCY TECHNOLOGIES
- Inertial Navigation Systems
- Clock Technologies
- Odometers
- Machine Vision Aided (Emerging)

ACCESS — NON-RF PNT DATA

SUBJECT TO "DRIFT" OVER TIME





TECHNOLOGIES
- MIL GPS
- NON-RF
- ANTI-JAM
- ALT SIGNALS
- BASELINE
- FUTURE

PROVIDE ACCESS + INTEGRITY THROUGH NON-RF TECHNOLOGIES, ANTI-JAM ANTENNAS, ALTERNATE SOURCES

DISTRIBUTION STATEMENT A. APPROVED FOR PUBLIC RELEASE.

PM PNT Mission and Vision

Mission:

Provide Warfighter-valued Assured Positioning, Navigation, and Timing (APNT) solutions, today, that enable Multi-Domain Operations in rapidly evolving threat environments.

Vision:

Ensure future overmatch through innovative acquisition and rapid integration of cutting-edge Modular and Open System Assured PNT technologies

PM PNT Intent

Purpose: Enable Multi-Domain Operations domination

Key Tasks:

- Focus on Soldier needs against emerging threats
- Implement Modular/Open Systems
- Optimize Layered Technologies
- Continuously pace threat though component upgrades

Endstate: Deploy Soldier valued capability at Relevant Speed to Pace the Threat

PNT Strategy

- PM PNT is embarking on an innovative agile rapid capability approach to better support the PNT mission and the warfighter

- Three primary initiatives:
  1) Standing up Product Manager PNT Modernization
  2) Establishing the Open Innovation Lab (OIL)
  3) Leveraging open standards as a strategic capability; Modular Open Systems Architectures (MOSA)

Mr. Chris Jais

Product Manager - PNT Modernization

PNT Modernization

Product Manager (PdM) PNT Modernization established 1 October 2020

PdM PNT Modernization

- Accelerate the transition of incremental & disruptive PNT capabilities from Industry, Academia and Government Science & Technology (S&T) to overmatch evolving PNT threats through prototyping to system development (products) utilizing PNT Reference Architecture and Modular Open System Architecture (MOSA).
- Leverage the investments of S&T, Industry, and Academia
- Delivering solutions ready for final engineering integration to products

Transition to Products

MAPS
- Final development + engineering integration
- NET, Operational testing, fielding, sustainment

DAPS
- Final development + engineering integration
- NET, Operational testing, fielding, sustainment

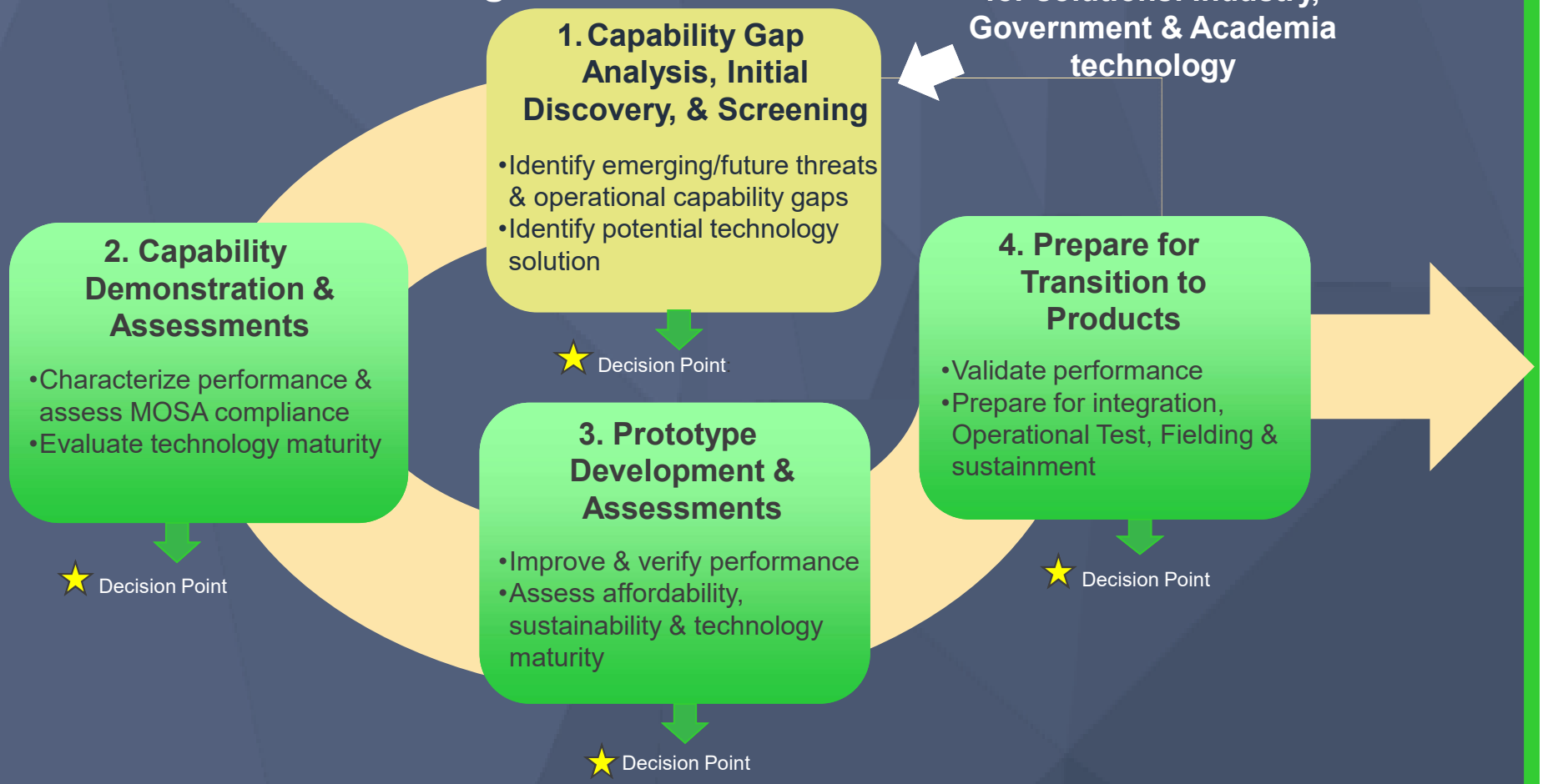
ALTNAV
- Final development + engineering integration
- NET, Operational testing, fielding, sustainment

Other
- Final development + engineering integration
- NET, Operational testing, fielding, sustainment

Ensure overmatch capability through innovative acquisition and rapid integration of cutting-edge modular and open system Assured PNT technologies

PNT Modernization Process

- **Feeds promising solutions into the PNT Modernization Process**
- **Informs the PNT Learning Plan**



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Open Innovation Lab (OIL) https://apntoil.army.mil/

The Open Innovation Lab (OIL) is a facility that will **accelerate** technology transition and integration as part of the PNT Modernization Process and across the C5ISR Community

- Provides a unique, **unclassified**, facility for DevOps, **integration and assessment** of technology against Modular Open Systems Approach (e.g. CMOSS), PNT Reference Architecture, pntOS, and other open standards.

- Enables Academia, Industry, Government and other organizations to collaborate on Army PNT future capabilities and solutions.
  - **Leverages the investments** of S&T, Industry, and Academia

- **Collaboration**, development and integration lab to accelerate mature PNT technology for insertion into the MAPS GEN 3 (CMOSS Mounted Form Factor (CMFF)) and DAPS GEN 3 capabilities.

- **Partnership** with the S&T community to conduct research, experimentation and development of emerging and novel PNT technologies to solve far term gaps.

Open Innovation Lab (OIL)

https://apntoil.army.mil/


TIONING, NAVIGATION, AND TIMING MODERNIZATION - OPEN INNOV
ON LAB


NING, NAVIGATION, AND TIMING MODE

PNT Standards Library

https://apntoil.army.mil/standards-and-specifications

- MOSA and Open Source standards
  - Purpose: Design Strategy that adopts open standard and supports a modular scalable coupled system structure
- PNT Reference Architecture
  - Purpose: Guide and constrain the development of Army systems providing, consuming, and/or hosting PNT Information
    - Principles: High-Level statements of rules, values that drive technical positions
    - Technical Positions: Standards to be followed
    - Patterns: Relationship mapping between architecture elements
- pntOS software framework and API
  - Purpose: Fully government-owned open architecture PNT sensor fusion approach with pluggable components
- C5ISR/EW Modular Open Suite of Standards (CMOSS)
  - Purpose: A holistic open architecture that leverages existing standards, maximizes scalability , and provides the flexibility to rapidly insert capabilities
  - Existing Standards: VICTORY, MORA, FACE, OpenVPX

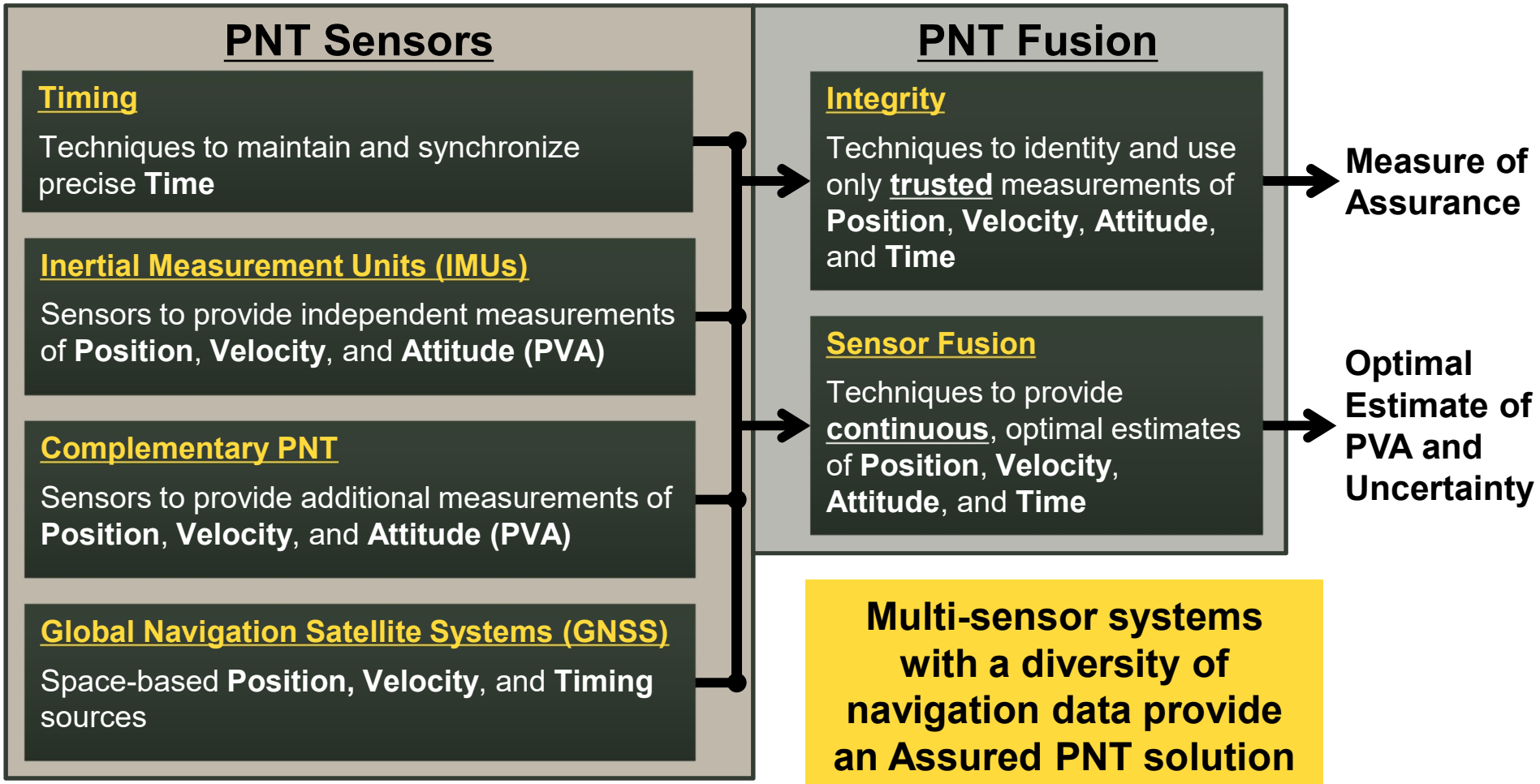
Dr. Adam Schofield

Senior Scientific Technical Manager (SSTM), PNT

C5ISR Center, Command Power and Integration Directorate U.S. Army Combat Capabilities Development Command (CCDC)

TAXONOMY OF ASSURED PNT SYSTEMS

Assured PNT is achieved through the use of multi-sensor approaches that provide continuous and trusted sources of PNT data



TIMING

Problem Statement

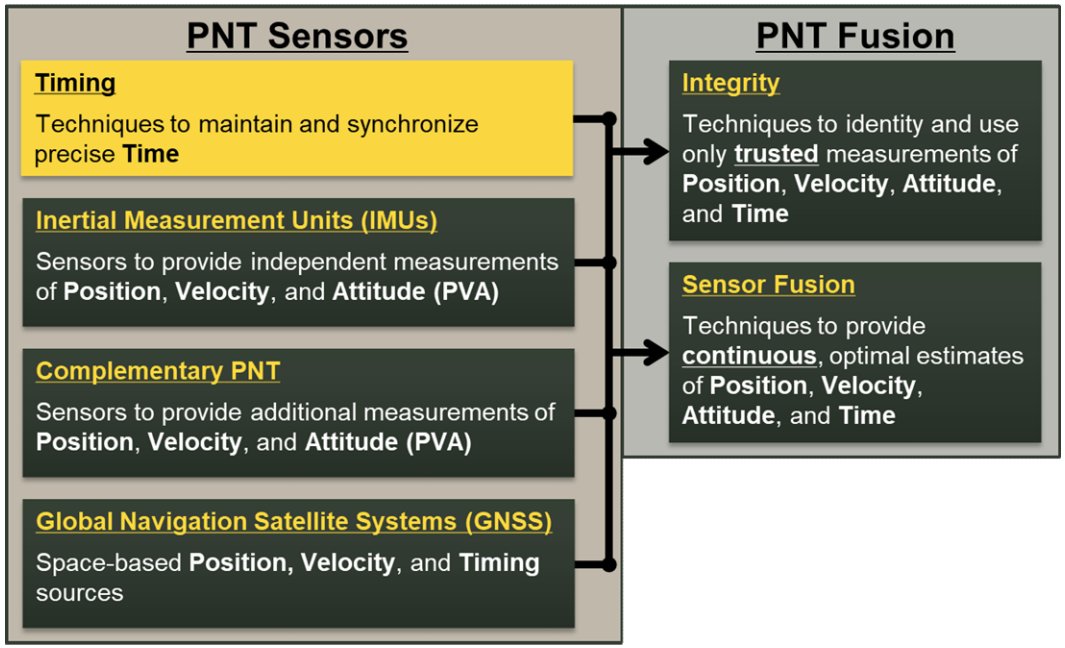
- Military systems require precision time and frequency in the absence of GNSS for integrity

Technical Challenges

- With increasing performance comes increasing SWaP-C and sensitivity to the operating environment

Technical Approach

- Working to reduce the SWaP-C of high performance clocks
- Implementing GNSS-free time transfer techniques



Opportunities

- Better, smaller, and more accurate clocks driven by better component technology
- Time-transfer and time synchronization techniques

INERTIAL MEASUREMENT UNITS

Problem Statement

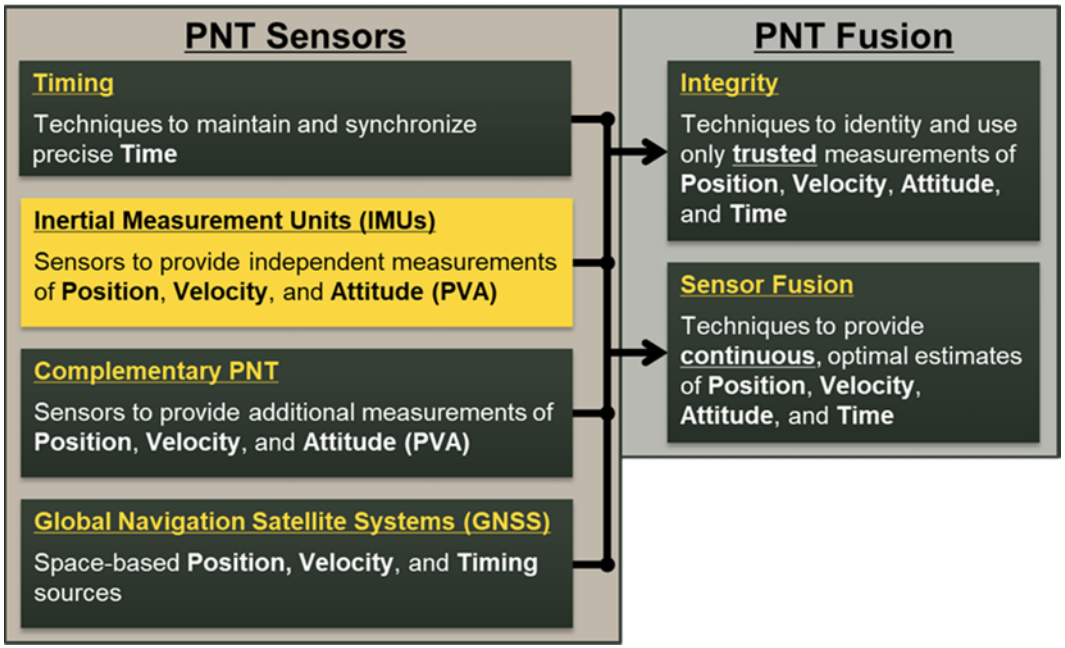
- IMUs are the primary non-GNSS technology, however they do not meet long-term performance requirements for GNSS challenged environments

Technical Challenges

- Navigation performance degrades with decreasing SWaP-C

Technical Approach

- Working to increase the performance of IMUs that currently meet the SWaP-C requirements of Army systems



Opportunities

- Better, smaller IMUs driven by improvements in the component technology
- Novel IMU designs as well as new measurement and sensing techniques

COMPLEMENTARY PNT

Problem Statement

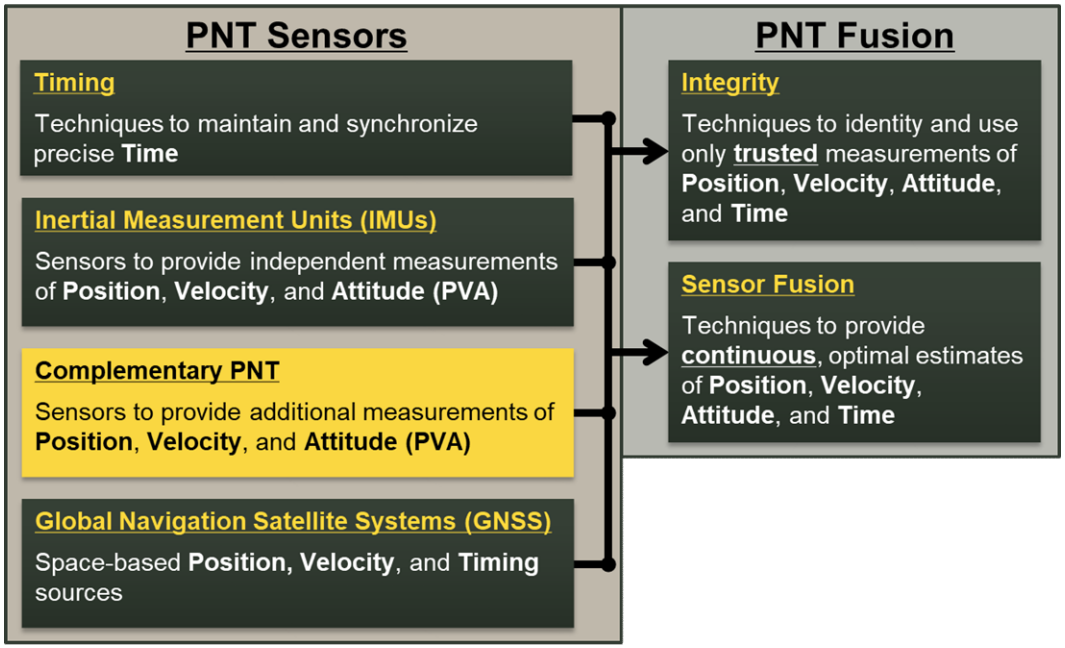
- Military systems are highly dependent on GNSS for position and time

Technical Challenges

- Difficult to achieve the global position and time accuracy of GNSS with constrained SWaP-C requirements

Technical Approach

- Use additional non-GNSS sensors and algorithms to provide diversity of PNT data sources
- Utilize both relative and absolute measurements



Opportunities

- New approaches to sensing and measuring position, velocity, and attitude
- Enhance or replace existing GNSS technologies

SENSOR FUSION AND INTEGRITY

Sensor Fusion

Techniques to provide continuous, optimal estimates of Position, Velocity, Attitude, and Time

Problem Statement

- Current sensor fusion approaches are locked to specific sensor configurations.

Technical Challenges

- Proprietary interfaces reduce innovation and the speed of capability insertion

Technical Approach

- Government owned hardware and software standards

Integrity

Techniques to identity and use only trusted measurements of Position, Velocity, Attitude, and Time

Problem Statement

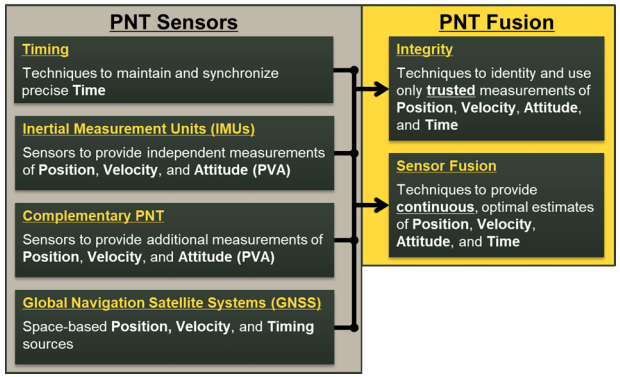
- DoD systems require assured PNT solutions to accomplish their mission

Technical Challenges

- Current assurance approaches are based on GPS-only techniques

Technical Approach

- Algorithms and approaches to detect and remove untrusted data without GPS



Opportunities

- Real-time sensor calibration, fault detection and integrity
- Novel sensor fusion and integrity approaches utilizing artificial intelligence

Mr. Chris Jais

Product Manager - PNT Modernization

Future Opportunities

- PM PNT planning several opportunities for Industry and Academia to demonstrate its technology:
  - Plugfests
  - Lab Demos
  - Soldier Touch Points
- Further requirement identification
- Follow-on Industry days

All announcements and opportunities will be made through the OIL Website and betaSam.gov

https://apntoil.army.mil/

https://beta.sam.gov/

Request For Information Summary

- PM PNT asked industry and academia for insights on how to best collaborate and create a win-win business model.
- The information provided will be used by the Government to improve the OIL facility, processes, and infrastructure.
- Additionally, the information will support the broader PNT development and procurement strategy.
- PM PNT is currently in the process of incorporating the feedback to implement a mutually beneficial value proposition.

Not too late to provide feedback

Request For Information Feedback

- Availability of a range of PNT reference architecture standards and interfaces to be used in the OIL so we can rapidly plan and plug-in our modeling, simulation & test resources for incremental prototype and demonstration.

- Confirm the availability of Government Furnished (GFx) PNT-related simulation, modeling and testing tools for our contractor use.

- Please describe configuration control board and modification control board processes for contractors to bring new tools and applications to the OIL and make modifications to those tools and applications once part of the OIL baseline.

- In addition to simulation capabilities, provide access to a government test vehicle for local drive test evaluations.

- OIL provide an overview to industry of the processes, procedures and requirements guiding collaboration and experimentation with OIL.

Ideas for Us


HOW IT WORKS
STEP 1
Register and tell us about yourself
• What is your PNT-relevant technology?
• What is your interest in the OIL?
STEP 2
If selected, we will contact you to learn more about you and your technology - we may invite you to the OIL
STEP 3
You come to the OIL, where we will evaluate your technology and determine the best path forward

Closing Remarks

Nick Kioutas

Colonel, U.S. Army

Project Manager - Positioning, Navigation & Timing (PM PNT)