

FEDCON SESSION TOPICS

Antenna Technologies & Interference Mitigation for Robust PNT

Novel approaches to multi-signal solutions for robust PNT, including novel antenna designs, interference mitigation technologies/techniques, incorporation of signals of opportunity to augment GNSS. While algorithms may be a component of this topic, they must be related to novel antenna approaches. This topic is seeking revolutionary approaches to robust PNT enabled by robust signal detection.

Topic Leads: Dr. Manorama “Rama” Gollakota, The Aerospace Corporation and Dr. Dontae Ryan, DLR Technologies

Application/Impact of PNT Technologies in the Homeland Critical Infrastructure

This session will focus on the use of PNT technologies in the critical infrastructure with emphasis on discussing usage, vulnerabilities, and providing mitigating solutions to safeguards against threats to the critical infrastructure. PNT based technologies, such as GPS, are now an integral part of the national critical infrastructure. Many sectors rely on some aspect of PNT ranging from timing for communication systems to clock synchronization for power transmission in the electrical grid. The growing use of PNT along with potential threats and vulnerabilities to the critical infrastructure such as the electrical grid, communication, transportation, finance, and emerging infrastructure for domestic employment of UAV systems creates a challenge for safeguarding national assets and maintaining homeland security.

Topic Lead: Jeremy Brown, OSD R-E

NEW! Applications of Atomic Standards in DoD Time Transfer and Dissemination

The transfer and acquisition of time in DoD applications from both GNSS and non-GNSS sources has become an important topic in recent decades with greater demands for precision. Many atomic clock products have been designed to strike a balance between performance and cost that allow these goals to be met. This session invites presentations on the development of such clocks or the use of atomic clocks in: time transfer, timescales, timekeeping, synchronization techniques, ranging measurements, and other applications of interest to DoD applications.

Topic Leads: Dr. Michael Coleman, Naval Research Laboratory and Ryan Dupuis, Excelitas Technologies

Autonomous Systems and PNT

Autonomous systems are especially reliant on PNT. Topics in this session include autonomous systems, leveraging of AI and machine learning for autonomy and PNT, challenges of using autonomous systems in military environments, use of GPS and non-GPS PNT for autonomous systems. These systems will be operating either independently or in collaborative groups performing tasks, where the PNT systems will need to adapt to the surroundings and make use of the sensors and signals that are functional in the area. Safety, resiliency and OPTEMPO are vital in the definition of the requirements for the PNT system for military autonomous systems.

Topic Leads: Dr. Robert Leishman, AFIT and Dr. J.P. Laine, Draper

Collaborative Navigation Techniques

This topic addresses techniques for the exploitation of network connectivity and ranging information between nodes to assist and improve navigation. The ability to exchange information among partners in a network can provide synergistic improvements in terms of rapid system initialization, navigation accuracy and resiliency. This includes efforts for supplying accurate up-to-date information to navigation processors; sharing of data for both absolute and relative navigation solutions within a defined group; and determining situational awareness for the warfighter and providing pertinent navigation-related information for missions such as search and rescue, targeting, joint operations and other applications requiring complex coordination. May also include the sharing of geo-registered imagery to support collaborative position/orientation updating, collaborative path planning to optimize joint navigation accuracy, and the use of network connected devices for navigation such as smartphones, navigation apps and GPS based personal navigation systems with on-line maps.

Topic Leads: Dr. Victor O. Sivaneri, AFRL Sensors Directorate and Dr. Mikel Miller, IS4S

Complementary PNT

Subjects of this session are navigation technologies and techniques that replace, or supplement, traditional GPS/INS solutions for overcoming application related challenges including degraded or denied GPS. This includes vision-aided navigation, RF-aided navigation, exploitation of naturally occurring signals that would be immune to denial of service by an adversary, and high precision quantum-enhanced inertial sensors. Examples include but are not limited to celestial, bathymetric, gravimetric, and quantum-based or other emergent navigation sensor technologies. This session covers both tactical and strategic applications.

I: Naturally Occurring Measurement Sources – Including gravity, magnetic fields, lightning

Topic Leads: Dr. Benjamin Lane, Draper and Dr. Gregory Hennessy, US Naval Observatory

II: Vision Aided Optical and RF

Topic Lead: Dr. Michael Veth, Veth Research Associates

III: Vision Aided Air

Topic Leads: Peter Lewis, Draper and Dr. John Raquet, IS4S

IV: Vision Aided Ground

Topic Leads: Mark Smearcheck, AFRL Sensors Directorate and Ann Adams Witt, Honeywell

V: RF Aided (Non-GPS)

Topic Leads: Chad Nash, PM PNT and Dr. Keith McDonald, The MITRE Corporation

GPS in Military Applications/NAVMAR

This session will involve integration of GPS into new and existing military systems; precision weapon delivery and military applications in land, sea, air, and space using GPS; and development of new military GPS and auxiliary sensor hardware. Includes PNT Situation Awareness sensing and information distribution, as well as interference and jamming aspects of GNSS from an unclassified perspective.

Topic Leads: Amelia Fortmayer, Army CCDC CSISR and Amanda Humphrey, JNWC

GPS Modernization

New military capabilities and performance, including integrity and accuracy improvement concepts; modernized space segment, constellation performance, and control segment; new GPS research and development status; and impact on future applications.

Topic Leads: Brian Louie, SMC/PCU and Renee A. Yazdi, Canyon Consulting

Inertial Measurement Unit (IMU)

A review of the latest developments, materials processing, manufacturing technologies, component integrations and applications of IMUs having performance improvements and the potential to yield Size, Weight, Power and Cost (SWAP-C) benefits for our warfighters. This includes device and electronics minimization, new interface standards and algorithms that will enable accuracy improvement. A review of theoretical physical principles and describe new sensing devices that measure and model such phenomena. Advancements leading to extremely precise inertial navigation devices such as cold atom physics.

Topic Lead: Dr. Kari Moran, NIWC Pacific

NEW! Integrity and Assurance

Positioning, Navigation and Timing (PNT) systems play a critical role in virtually all military systems. Integrity/Assurance is a becoming a principal requirement in all systems to ensure the mission is completed successfully and reducing the risks to our warfighters. Their design must include the capability to assess sensor inputs, detect anomalous/threat conditions, and mitigate properly to retain resilience. This session will cover the requirements for PNT Integrity/Assurance in various military systems, system functional allocation, algorithm development, design approaches, and review performance results from demonstrations.

Topic Leads: Tracey Young, Army CCDC CSISR and Dr. Samer Khanafseh, ITT/TruNav

Military GPS User Equipment

This session will provide the latest information on Military GPS User Equipment (MGUE), the SMC/GPU program developing M-Code based receiver technology for military applications. Topics will include status of receiver development, test, and integration efforts from both contractor and government representatives.

Topic Leads: Col. Clifford Sulham, SMC PCU and Michael Stanitis, The Aerospace Corporation

Modeling and Simulation

Includes GNSS, INS and complementary sensor models capable of assessing advanced algorithms/integrated systems and battlefield operations. Presentation of hardware-in-the-loop simulation capabilities that use software-defined receiver technology or other active/passive techniques for laboratory evaluation. Interfacing of PNT and mission/campaign modeling and simulation capabilities for the assessment of impacts to the warfighter and his commander.

Topic Leads: Matthew Oliver, LinQuest; Denice Jacobs, AFRL Sensors Directorate; and Lina Nasori, NIWC Pacific

Multi-GNSS Receivers for Military Applications

Recent technology developments have explored the combination of military GPS signals with foreign GNSS and commercial GPS signals. The complementary benefits of multi-GNSS include improved accuracy, integrity, availability, frequency diversity, and continued operations in GPS degraded environments. Military applications require considerations for signal assurance and security. Efforts entail concept development, analyses, modeling and simulation, and/or demonstrations. The future of military multi-GNSS receivers includes those, which track and use military signals from multiple GNSSs as well as those, which combine both military and civil signals from multiple GNSSs. This session is also interested in exploring the use and integration of additional terrestrial or space-based cooperative signals for timing, ranging, or augmentation with military multi-GNSS receivers.

Topic Leads: Jason Pontious, AFRL Sensors Directorate and Alinn Herrera, The Aerospace Corporation

Navigating in Challenged Environments (e.g., Urban, Indoor and Sub-Surface Navigation)

Systems and solutions to challenges to navigation systems due to low Size, Weight, And Power (SWAP) requirements such as in UAVs, UUVs, UGVs, Autonomous UGVs (i.e., robots), missiles, dismounted soldiers, etc., are all of interest. Other environmental challenges of interest are navigating in GPS denied conditions, high multipath locations, underground/cavernous environments, poor terrain (mountainous/canyons), or urban/indoor environments.

Topic Leads: Roger Fuller, USCG HQ Office of CSIT Capability and Connor Brashar, Sandia National Laboratories

Novel Clock Technologies and Timing Applications

Warfighter systems are reliant upon Precise Time and Frequency (PT&F) synchronization/syntonization for communicating, networking, positioning, and etc. These needs are supported by GPS timing capabilities or alternative time-keeping systems that consist of high-precision clocks synchronized by time dissemination. Development efforts to employ current and novel atomic clock architectures based on optical transitions, laser cooling, and ion trapping, for example, are underway. These efforts seek to produce rugged high-precision clocks for handheld, infrastructure, aerospace, and space-based applications. This session addresses timing device and system approaches, including advanced clocks, time dissemination techniques, and timing applications for military systems.

Topic Leads: Dr. John Elgin, AFRL Space Vehicle Directorate and Francine Vannicola, Naval Research Laboratory

Operational System Demonstrations

Demonstration of platforms to support PNT for the warfighter, with particular focus on open architecture solutions which allow incorporation of alternate or (r)evolutionary technologies. Demonstrations may include real time component demonstration, video of demonstration, and demonstration of SWiL/HWiL. Demonstrations may include, but are not limited to, human-in-the-loop, PNT sensors & algorithms, or novel approaches to deal with known limitations of current solutions, such as simplified keying solutions, user friendly interfaces, context aware energy conservation, etc. Encouraging demonstrations of technologies at varying stages of technology readiness levels (TRLs 4-6).

Topic Leads: Paul Olson, Army CCDC CSISR; William Deike, AFRL Sensors Directorate; and Chad Pinkelman, NIWC Pacific

PNT Open Systems Architecture

Threats to PNT systems are evolving at increasingly faster rates, driving the need for PNT systems to be adaptable to stay ahead of this evolving threat. Open System Architectures (OSA) for PNT can be structured to provide frameworks for affordable adaptable PNT systems. Adaptable PNT systems provide the ability to insert capability, countering threats and providing a resilient solutions. This session covers research, development, procurement, integration and sustainment of OSA PNT concepts and systems (software, hardware, backplanes, interfaces, etc.), including applications of VICTORY, PNTA, FACE, OMS, SOSA and more.

Topic Leads: Morgan Raymond, AFLCMC/WNY; Dr. Adam Schofield, Army CCDC CSISR; Del Champ, Functional Integration Division/AFWIC PNT and Jei Chen, NIWC Pacific

Precision Guided Munitions/Weapon Applications

The use of navigation technologies in the unique and challenging field of Precision Guided Munitions (PGMs) and weapon systems applications. This includes innovative design concepts, challenging performance and environmental requirements, laboratory and flight test results, compensation methods, alignment/initialization techniques, and size constraints/miniaturation as well as other issues related to the integration of navigation technologies in current and emerging PGM/Weapon systems.

Topic Leads: Marvin Fisher, AFLCMC/EBDT and Tim DeLoache, Booz Allen Hamilton

NEW! Reconfigurable SatNav

This session explores the alternatives for advancing the deployment of coordinated, reconfigurable PNT solutions to achieve superiority in a contested EW environment. This includes SatNav and UE reconfigurations that are being studied currently, as well as SA/ES elements that are needed to achieve effective reconfiguration. The topic delves into operational elements needed for reconfigurable SatNav and UE to be effective. This topic includes payloads, signals, control segments, and UE.

Topic Lead: Dr. Madeleine Naudeau, AFRL Space Vehicles Directorate

NEW! Software Defined Radios (SDRs) for PNT

This session will focus on the use of software defined radios (SDRs) for military PNT applications. Topics may include SDR architectures, SDR design considerations, operations concepts for SDR maintenance and upgrades, specific hardware/software instantiations, and updates from on-going developmental activities.

Topic Leads: Dr. Jeff Hebert, AFRL Sensors Directorate and Shawn Miller, The MITRE Corporation

Space and Satellite Applications, Including NTS-3 Experimental Plans

New concepts for satellite navigation, developments in PNT payload technologies, and advanced signals. Applications of PNT systems on space-based platforms; use of navigation sensors to aid primary objectives of orbit determination, attitude determination, and navigation, and application objectives such as mapping from space; and advances in space-based user equipment. This also includes next-generation flexible satellite navigation signals as well as PNT signals from satellites in GEO or LEO orbits.

Topic Leads: Joe Page, Joint Navigation Warfare Center; Doug Taggart, Overlook Systems; Dr. Steven Lewis, The Aerospace Corporation and Chris Gehant, Braxton Technologies

Warfighter Requirement and Solutions

Warfighter requirements, needs and possible solutions involving operational PNT. Logistical concerns (applied maintenance concepts; spares/replacement availability; interchangeability within host platforms; interoperability with form, fit, and function of host platforms) and international restrictions/concerns, as well as requirements for future technologies. PNT for pointing and stabilization; tri-service programs and commonality considerations; user comments and feedback; NDI/COTS; Homeland Security; and other critical issues such as target location errors.

Topic Lead: Ben Wash, JNWC

NEW! PANEL DISCUSSIONS (FEDCON U.S. ONLY)

PANEL: MGUE Integration

This panel will feature representatives from weapon systems conducting some of the initial integration of MGUE receivers. Panelists will share experience and lessons learned working with the first generation of M-Code receivers.

Moderator: Dr. Thomas Powell, The Aerospace Corporation

PANEL: National Critical Infrastructure Threat

This FEDCON panel will focus on PNT threats to the national critical infrastructure. Discussion topics may include threats to the electrical grid, communication, transportation, finance, and domestic DoD support infrastructure as well as emerging infrastructure for domestic employment of UAV systems that create a challenge for safeguarding national assets and maintaining homeland security.

Moderator: Karen Van Dyke, US DOT/ OST-R

PANEL: Rapid Agile Development and Manufacturing

Representatives from all three services will address their plans to respond to urgent PNT requirements from the field in a rapid manner. Panelists will present current plans to quickly allocate requirements to an open system architecture (OSA), cooperate with industry to demonstrate prototypes, where OSA promotes the ability to plug and play new sensors with flexible interfaces from a diverse set of providers, adaptive software development to support the fusion of PNT sensor information, iterative prototyping in a cooperative manner with industry conducting demonstrations/test in government laboratories, and move forward to conduct operational tests to ensure all requirements have been satisfied. Using this methodology manufacturing can begin in a very quick turnaround in comparison to current DoD acquisition.

Moderator: Dr. Adam Schofield, Army CCDC CSISR

CLASSIFIED PROGRAM (Secret-U.S. ONLY)

This includes topics where classified material is key to conveying the intent of the presentation. Abstracts submitted for consideration must be written/approved for public release. Sessions will include operational PNT developments related to Joint Urgent Operational Needs and Joint Emergent Operational Needs support and provide venues for the presentation for additional topics at the SECRET-U.S. Only level to discuss topics and information that cannot be shared in the FEDCON sessions. **Topic Leads:** Benjamin Wash and Fay Spellerberg, Joint Navigation Warfare Center
This session will include a keynote from a ranking general officer, the Warfighter panel and a Warfighter Requirement and Solutions panel.

PANEL: Warfighters (Secret-U.S. Only)

An interactive discussion between the audience and a panel of warfighters who have had recent operational experience that informs the community on how to better formulate military PNT systems. Warfighters who have had operational “in theater” experience in the past year are being solicited from all services; Electronic Warfare specialists are of particular interest. All those who can contribute to the panel please contact Kevin Coggins, E-mail: kevin.m.coggins.civ@mail.mil. Hotel accommodations and conference registration provided at no cost to panel members.

Moderators: Kevin Coggins, Booz Allen Hamilton and CAPT Andrew Gibbons, PEO C4I PMW/A 170

NEW! PANEL: Combatant Command Joint Urgent Operational Need (JUON)(Secret-U.S. Only)

This panel will present highlights of a current JUON to include requirements/funding, mission analysis, fielding, and effectiveness assessment. Discussion will also include use of modular capabilities to accommodate future expansion and modifications to address other combatant command needs and evolving threats.

Moderator: Fay Spellerberg, Joint Navigation Warfare Center