2018 JOINT NAVIGATION CONFERENCE

ONSITE PROGRAM
July 9–12, 2018
Tutorials: July 9
Show Dates: July 10–11
Hyatt Regency, Long Beach, California
Classified Session: July 12, The Aerospace Corporation

Sponsored by the Military Division of the Institute of Navigation

ION
INSTITUTE OF NAVIGATION
www.ion.org/jnc
### Technical Program Overview

#### MONDAY, JULY 9: TUTORIALS

| TRACK AND CHAIR: | Track A: Jan Anszperger  
(AFRL Space Vehicles Directorate) | Track B: Dr. David Chapman  
(NAVCEN) 101 | Track C: Elliott Kaplan  
(The MITRE Corporation) | Track D: Joseph Schnecker  
(SPAWAR) |
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<tr>
<td>ROOM:</td>
<td>Beacon A (Floor 4)</td>
<td>Beacon B (Floor 4)</td>
<td>Seaview A/B (Floor 1)</td>
<td>Shoreline (Floor 1)</td>
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<tr>
<td>Time:</td>
<td>10:30 a.m. - 12:00 p.m.</td>
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<tr>
<td>Lunch is on Your Own:</td>
<td>12:00 p.m. - 1:30 p.m.</td>
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| 1:30 p.m. - 3:00 p.m. | GPS Cryptography - The Transition to M-Code is Here  
“Fires Kill Chain” and Assured PNT  
The Use of Time and Frequency References in Military Systems  
GPS Resilience for the Warfighter |
| Break: 3:00 p.m. - 3:30 p.m. |                            |                            |                            |                            |

#### JNC TECHNICAL SESSIONS

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<th>ROOM:</th>
<th>Beacon A (Floor 4)</th>
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<th>Shoreline (Floor 1)</th>
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<tr>
<td>Time:</td>
<td>3:30 p.m. – 5:00 p.m.</td>
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<td>Break in Exhibit Hall:</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Systron Donner Inertial</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Harris</td>
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| 4:00 p.m. – 5:30 p.m. | Lunch in Exhibit Hall: 12:15 p.m. – 1:45 p.m. | Plenary Session 1 (Room: Beacon Ballroom, Floor 4)  
Overflow seating provided in Seaview A/B (Floor 1) |
| Break in Exhibit Hall: | 3:15 p.m. – 4:00 p.m. , Sponsored by Harris |                            |                            |                            |

#### TUESDAY, JULY 10: FOUO SESSIONS

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<th>ROOM:</th>
<th>Beacon A (Floor 4)</th>
<th>Beacon B (Floor 4)</th>
<th>Seaview A/B (Floor 1)</th>
<th>Shoreline (Floor 1)</th>
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<tr>
<td>Time:</td>
<td>8:30 a.m. – 10:00 a.m.</td>
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<td>Break in Exhibit Hall:</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Northrop Grumman</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Harris</td>
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<tr>
<td>10:45 a.m. – 12:15 p.m.</td>
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| 1:45 p.m. – 3:15 p.m. | Plenary Session 2 (Room: Beacon Ballroom, Floor 4)  
Overflow seating provided in Seaview A/B (Floor 1) |
| Lunch in Exhibit Hall: | 12:15 p.m. – 1:45 p.m. |                            |                            |                            |

#### WEDNESDAY, JULY 11: FOUO SESSIONS

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<th>ROOM:</th>
<th>Beacon A (Floor 4)</th>
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<th>Seaview A/B (Floor 1)</th>
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<tr>
<td>Break in Exhibit Hall:</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Northrop Grumman</td>
<td>10:00 a.m. – 10:45 a.m. , Sponsored by Orolia Government</td>
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<td>10:45 a.m. – 12:15 p.m.</td>
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| 1:45 p.m. – 3:15 p.m. | Plenary Session 3 (Room: Beacon Ballroom, Floor 4)  
Overflow seating provided in Seaview A/B (Floor 1) |
| Lunch in Exhibit Hall: | 12:15 p.m. – 1:45 p.m. |                            |                            |                            |

#### THURSDAY, JULY 12: E8:CLASSIFIED SESSION HELD AT THE AEROSPACE CORPORATION, TITAN MEETING ROOM (All Sessions are Secret, U.S. Only)

| Time:            | Security Checks and Morning Coffee          | Opening Remarks and Keynote | Warfighter Panel  
9:20 a.m.–10:50 a.m.  
10:50 a.m.–11:10 a.m.  
11:10 a.m.–12:10 p.m.  
Lunch: 12:10 p.m.–1:30 p.m. - Sponsored by NORTHROP GRUMMAN |
|------------------|-------------------------------- |-------------------------------- |-------------------------------- |-------------------------------- |
| 7:30 a.m.–8:20 a.m. | 1:40 p.m.-3:20 p.m.  
1:40 p.m.-3:20 p.m.  
3:20 p.m.-3:40 p.m.  
3:40 p.m.-5:00 p.m.  
5:30 p.m. | Classified Session  
Break  
Classified Session  
Buses return to Hyatt Long Beach |
Conference Information

Conference Dress
Battledress uniform or business casual.

JNC Mobile Website
Point your mobile device’s web browser to m.ion.org to access JNC information such as:
- Real-time conference program
- Current exhibit hall map
- Local area info/weather
- Restaurant reservations

Sponsored by:

Complimentary Wi-Fi
Complimentary wireless internet access will be available in public lobby areas and conference meeting rooms.
- Network: PSAV_High_Speed
- Password: jnc2018

Conference Proceedings
Official FOOU conference proceedings are scheduled for electronic distribution in August to all eligible conference participants. You will receive a link by email from registration@ion.org to the verified email address you used when registering. This link is unique to your account and cannot be shared. You will have 30 days to download the electronic proceedings, after which your link will expire. ION is unable to distribute conference proceedings after the 30 day period has expired.

Customized Schedule
Log into the JNC meeting website at www.ion.org/jnc to build a customized schedule of conference presentations you wish to attend.

Photography Policy
Your presence at JNC constitutes your agreement to be photographed, filmed, videotaped or otherwise recorded by conference management, or its agents, and your agreement that your image or voice may be distributed in print or electronic communications media without any compensation being paid to you. Video recording by participants is not allowed without written permission of ION during any portion of the conference. Photography, audio recording, or video recording of any FOOU presentation is strictly prohibited.

Registration Hours
- Monday, July 9 9:00 a.m. - 5:00 p.m.
- Tuesday, July 10 7:30 a.m. - 5:00 p.m.
- Wednesday, July 11 7:30 a.m. - 5:00 p.m.

Hyatt Floor Plans

Lower Level (Floor 1)

Upper Level (Floor 4)

Security Notice

Technical Session Rooms: JNC technical sessions at the Hyatt are hosted in a U.S. Only, For Official Use Only (FOUO), environment. Photography, audio or video recording of any FOOU presentation is strictly prohibited. Entry is restricted. Conference badges must be visible at all times and photo ID may be requested at any time.

Exhibit Hall: The JNC exhibit hall will be accessible by all conference participants, exhibiting organizations, and related organizations who possess a valid conference badge, as well as accompanying guests during the exhibitor-hosted reception.

All materials displayed in the exhibit hall shall be publically releasable (Distribution A). All JNC participants shall restrict all conversations to those permissible in the public domain.
JNC 2018 Government Liaisons

ION Military Division Chair
Elliott Kaplan
The MITRE Corporation

ION Military Division Vice Chair
John Langer
The Aerospace Corporation

Program Chair
Greg Graham
U.S. Army AMRDEC

Program Co-chair
Eddy Emile
GPS Directorate, USAF

Track: A
Jan Anszperger
Draper

Track: B
Dr. David Chapman
AFRL Space Vehicles Directorate

Track: C
Elliott Kaplan
The MITRE Corporation

Track: D
Joseph Schnecker
SPAWAR

Tutorials Chair
John Del Colliano
U.S. Army CERDEC

Bill Boltwerk
Naval Observatory

Sharon Donald
Draper

Jalal Mapar
DHS Science and Technology Directorate

Paul Olson
U.S. Army CERDEC

Dr. Thomas Powell
The Aerospace Corporation

Neeraj Pujara
AFRL Sensors Directorate

Fay Spellerberg
Joint Navigation Warfare Center

Ben Wash
Joint Navigation Warfare Center

JNC 2018

2019

JOINT NAVIGATION CONFERENCE

Military Navigation Technology

The Foundation for Military Ops

SAVE THE DATE

July 8–11, 2019
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Hyatt Regency
Long Beach, California
Classified Session: July 11
The Aerospace Corporation

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Exhibit Hall Access
Exhibits are hosted in a public releasable environment. Conference registration and valid identification are required for entry.

Tuesday, July 10
10:00 a.m.-8:00 p.m. Exhibits Open
12:15 p.m.-1:45 p.m. Lunch in Exhibit Hall
Exhibitor Hosted Reception
6:00 p.m.-8:00 p.m.

Wednesday, July 11
10:00 a.m.-4:00 p.m. Exhibits Open
12:15 p.m.-1:45 p.m. Lunch in Exhibit Hall

All conference refreshments will be served in the exhibit hall during hall hours on Tuesday and Wednesday.

Floor Plan

JNC 2018 EXHIBITORS
(List current as of June 25, 2018)

Acutronic USA Inc. (Booth 513)
Air Force Research Laboratory (Booth 308)
Analog Devices (Booth 213)
Austion and Navigation Technology Center/AFIT (Booth 312)
Brandywine Communications (Booth 409)
Canyon Consulting, LLC (Booth 110)
CAST Navigation (Booth 113)
Curtiss-Wright (Booth 109)
EMCORE (Booth 411)
ENSCO (Booth 405)
FEI-Zyfer (Booth 305)
FIBERNETICS (Booth 304)
General Dynamics Mission Systems (Booth 509)
Harris (Booth 302)
Honeywell International (Booth 210)
Ideal Aerosmith, Inc. (Booth 206)
The Institute of Navigation (Booth 111)
ixBlue, Inc. (Booth 410)
Jackson Labs Technologies, Inc. (Booth 202)
Kearfott Corporation (Booth 511)
KVH Industries, Inc. (Booth 507)
L-3 Interstate Electronics Corporation (Booth 208)
LinQuest Corporation (Booth 309)
Lockheed Martin Space Systems Co. (Booth 508)
Mayflower Communications Company (Booth 207)
Microsemi Corporation (Booth 203)
The MITRE Corporation (Booth 506)
Northrop Grumman (Booth 307)
NovAtel, Inc. (Booth 303)
Orolia Government (Booth 505)
Polaris Sensor Technologies, Inc. (Booth 205)
Raytheon (Booth 313)
Rockwell Collins (Booth 502)
Rohde & Schwarz USA (Booth 403)
Sensonor AS (Booth 306)
Silicon Designs (Booth 503)
SpectraDynamics Inc. (Booth 212)
Spirent Federal Systems (Booth 404)
Systron Donner Inertial (Booth 402)
Talon-X (Booth 211)
Technology Advancement Group (TAG) (Booth 209)
TRX Systems, Inc (Booth 413)
VectorNav (Booth 107)
Monday Pre-Conference Tutorials
10:30 a.m. - 12:00 p.m.

PNT for Warfighting Autonomous Applications (Room: Beacon A, Floor 4)

This course will present a discussion of PNT needs for unmanned platforms in terms of safety, resiliency, and the ability to maintain optempo on the battlefield amid contested conditions. The course will develop PNT case studies for autonomous operations on the ground, underwater, and in the air. Unique PNT constraints will be examined in the context of PNT solutions available today, as well as solutions considered for future application. This course will appeal to R&D and systems engineers, managers and executives, and is accessible to both experienced and novice practitioners.

Dr. J.P. Laine is the Division Leader for Positioning, Navigation and Timing (PNT) at Draper where he leads the development of advanced PNT technology solutions, as well as optical sensor systems, with a specific focus on rapid implementation of novel technologies into new system concepts. Dr. Laine has held technical leadership roles on a variety of programs related to PNT, imaging, and free-spaceguided-wave optics. Dr. Laine is the author of many scientific papers and holds several patents in the field of optical sensing.

GPS/GNSS 101 (Room: Beacon B, Floor 4)

This course presents the fundamentals of the GPS and other GNSS, and is intended for people with a technical background who do not have significant GPS experience. Topics covered include time-of-arrival positioning, overall system design of GPS, signal structure, error characterization, dilution of precision (DOP), differential GPS, GPS modernization, and other GNSS systems.

Dr. John Raquet is the director of the Autonomy and Navigation Technology (ANT) Center at the Air Force Institute of Technology, where he is also a professor of electrical engineering. He has been involved in navigation-related research for over 25 years, has published over 160 navigation-related conference and journal papers and taught over 60 navigation-related short courses to approximately 3600 students in many different organizations. He is the recipient of numerous awards, has served in a number of positions within the ION, currently ION president, and is an ION Fellow. He received his PhD in Geomatics Engineering from the University of Calgary and MS in Aeronautical/Astronautical Engineering from MIT.

Coast Guard Navigation Center (NAVCEN) 101 (Room: Seaview A/B, Floor 1)

Interested in learning about why the Coast Guard is involved in GPS, what we do at NAVCEN and how we support the US government and civilian users around the world? This tutorial will cover the Coast Guard Navigation Center history and functions related to GPS, Position Navigation and Timing (PNT) and the Nationwide Automatic Identification System (AIS). Related topics will include the Civil GPS Service Interface Committee (CGSIC), whole of government coordination for interference, mitigation and detection (IDM), GPS Testing Notification Process and NAVCEN hosted GPS related products.

Captain Michael Glander assumed command of the U.S. Coast Guard Navigation Center (NAVCEN) in June 2018. Under his leadership, NAVCEN supports the nationwide automatic identification and differential GPS augmentation systems, ensures commercial vessel compliance with Long Range Identification Tracking (LRIT) requirements, publishes maritime advisories and navigation information services, manages the Coast Guard’s electronic chart portfolio, and coordinates investigation of civilian GPS outage reports to enhance the safety, security, and efficiency of U.S. waterways. Captain Glander has a Bachelor of Science Degree in Civil Engineering from the U. S. Coast Guard Academy, an M.P.A. from the George Washington University, and a Masters of Strategic Studies from the U.S. Army War College.

Atomic Clocks - Today and Tomorrow (Room: Shoreline, Floor 1)

Atomic frequency standards provide the ultimate source of accuracy and stability for all modern communications, navigation, and time-keeping systems. Commercially available “industrial” atomic clocks, including cesium beam frequency standards, rubidium oscillators, and hydrogen masers, are based on technology originally developed in the 1950’s. Since that time, technology evolution and field experience have led to a level of performance and reliability that atomic clocks are now deployed throughout critical infrastructure applications. With the advent of GPS and, consequently, global availability of precision timing, new applications for precision timing have emerged, with ever increasing demands for improved precision, robustness, and portability. In parallel, we are, at present, experiencing a renaissance of atomic timekeeping, as modern techniques of atomic and laser physics have enabled new techniques for confining, interrogating, and exploiting precision atomic timing signals. This tutorial will introduce existing and emerging atomic clock technologies. The first half of the tutorial will focus on mature technologies: rubidium oscillators, cesium beam frequency standards, and hydrogen masers, as well as commercially available chip-scale atomic clocks. The second half of the tutorial will address emerging atomic clock technologies: laser-cooled atoms and atomic fountains, optical-carrier-frequency clocks and optical frequency synthesis, and next-generation high-performance chip-scale clocks.

Dr. John H. Burke is currently a program manager at DARPA in the Microsystems Technology Office managing programs to develop navigation, timing and magnetic sensing devices; prior to this he worked at the Air Force Research Laboratory’s Space Vehicles Directorate, working on a combination of cold-atom inertial navigation and optical atomic clocks. The latter topic utilizes advanced photonic devices such as frequency combs to create very stable, low-phase-noise microwave for a variety of applications. Dr. Burke received his PhD in 2010 from University of Virginia in Atomic Physics, for developing a proof-of-principle gyroscope using coherent matter waves sourced from a Bose-condensed, laser-cooled source.

Dr. Robert Lutwak serves as senior technologist for Position, Navigation, and Timing (ST PNT) at the Air Force Research Laboratory in Dayton, OH (AFRL). Prior to this he was the program manager in the Microsystems Technology Office of the Defense Advanced Research Projects Agency (DARPA/MTD), where he led programs applying MEMS, atomic physics, and integrated photonics to the development of advanced clocks, inertial sensors, and other PNT-related sensors. He received his B.S. in Physics from Miami University in 1988 and his PhD in Atomic and Optical Physics from MIT in 1997.

Lunch is on your own: 12:00 p.m. - 1:30 p.m.
GPS Cryptography - The Transition to M-Code is Here (Room: Beacon A, Floor 4)

This course seeks to explore the importance of cryptography to military GPS from the perspective of the GPS user. This course will provide a brief history of cryptography, but will focus on the cryptographic architecture that has been developed to support the M-Code system. The course will also provide a description of the planned on-orbit test that will be run shortly after the conference and the operational M-Code key transition that will follow. The main intent of this course is to provide an insight to military GPS users regarding key loading and key management as the M-Code system is rolled out.

Ken Goussak is a member of the Hughes Design Group and is the navigation warfare technical lead at the GPS Directorate. Ken has over 30 years of navigation experience going. In 1995, Ken became the technical lead on the Selective Availability Anti-Spoofing Module (SAASM) program that has fielded almost 2 million SAASM-based receivers and attained Block II Electronic Protect Initial Operational Capability in 2014. Currently, he leads the development of the SAASM Mission Planning System and M-Code cryptographic architecture developments. Ken has a BS in biomedical engineering from the University of Southern California.

2d Lt Kaitlyn Trujillo is the cryptographic lead for the Global Positioning Directorate at the Space and Missiles System Center located at Los Angeles Air Force Base. She is currently leading the efforts in the development of the modernized cryptographic keys. Lt Trujillo has a BA in Chemistry from the University of North Texas.

“Fires Kill Chain” and Assured PNT (Room: Beacon B, Floor 4)

Not familiar with the PNT aspects of the system-of-systems Indirect Fires Kill Chain or how related Assured PNT investments can and are being leveraged to support Combat Overmatch? This tutorial will tie together the operational, architectural, system, and technology elements you need to know to better understand why Assured PNT related capabilities are critical enablers for the greater Lethality Community.

Paul C. Manz currently serves as chief scientist for PEO Ammunition at Picatinny Arsenal and oversees technology investments for a $38+ armaments portfolio. Paul is a multiple-certified Senior Acquisition Corps Member and certified Lean Six Sigma Black Belt with over three decades of experience spanning the entire materiel development life cycle. He has a MPA and BSEE, is an IEEE Senior Member, and recipient of the Ancient Order of Saint Barbara.

The Use of Time and Frequency References in Military Systems (Room: Seaview A/B, Floor 1)

Several military systems require precise time and frequency reference signals for proper operation. Often these systems extract reference signals from GPS satellites. However, many systems also rely on two-way time transfer protocols and internal atomic references. This tutorial will quantitatively detail the ways in which military systems utilize time and frequency signals to achieve their performance objectives. There will be a brief introduction to both clocks and time transfer links along with the performance metrics — such as Allan deviation — used to characterize them. Then there will be descriptions of how these time and frequency metrics map to the performance metrics of military systems in categories that include high-speed communications, navigation, and sensing. The tutorial will outline how time and frequency precision directly relates to such high-level performance metrics as: location accuracy, probability of intercept, and multiple access.

Dr. Olukayode K. Okusaga is a research engineer with Johns Hopkins Applied Physics Laboratory where he works on fiber-optic time transfer systems while performing multiple studies of the timing requirements of submarine and surface fleets. Dr. Okusaga received his BS degree in electrical engineering from Princeton University.

GPS Resilience for the Warfighter (Room: Shoreline, Floor 1)

This tutorial presents an overview of plans and studies at the GPS Program Office to enhance the resilience of the GPS enterprise. The program goal is to assess satnav-related options that will maintain positioning, navigation and timing services to military warfighters in future conflicts. The course reviews in-process Modernization actions and outlines several near-term study alternatives for possible future enhancements.

John Clark is a principal engineer at The Aerospace Corporation, supporting PNT resilience alternatives for the Space Enterprise Vision. Prior assignments include systems director of the GPS Systems Engineering Directorate, where Aerospace supported the Navigation Warfare analysis of alternatives and design of M-code, and principal director of the GPS Space Segment, where Aerospace supported design, development and deployment of the modernized IIRM, IIF and GPS III space vehicles. From 2006 to 2013, he also served as SMC/GPV chief engineer. Clark received his bachelor's degree in physics and his master's in general engineering from UCLA.
Monday Technical Sessions

Session A1: Application/Impact of GPS Technologies in the Homeland Critical Infrastructure
Room: Beacon A (Floor 4)


3:55 Protecting Downstream GPS Systems from Jamming and Spoofing: Tim Erbes and Tyler Hohman, Talen-X

4:15 Tests of Crowd-sourced Smartphones Measurements to Detect GNSS Disruptions: Sherman Lo, Stanford University; Dennis Akos, Brandon Cotts, Damien Miralles, University of Colorado Boulder


Alternates
1. Effective Spectral Enforcement for the GPS/GNSS L1 Band: Nathan Levigne and Dennis Akos, University of Colorado
2. Leveraging GPS/GNSS Automatic Gain Control (AGC) and Unique IF Data Processing to Detect GNSS Disruptions: Brandon Cott, Damien Miralles, University of Colorado; Sherman Lo, Stanford University; Dennis Akos, University of Colorado & Stanford University

Session B1: Modeling and Simulation
Room: Beacon B (Floor 4)

3:35 An Online Sensor Model Validation and Estimation Framework for All-Source Navigation: Juan Jurado and John Raquet, Air Force Institute of Technology


4:15 Low Cost, Standards based EO/IR Payload Simulation for Visual Aided Navigation Applications: Ben Thompson, Dynetics; Gregory Reynolds, Timothy Pitt, US Army AMRDEC; Paul Jackson, Peter Duong, Dynetics


Alternates
1. Simulating the Effects of Anti-Jam Antenna Electronics in a GNSS Software-Defined Receiver Framework: Andrew O’Brien, The Ohio State University
2. Simulation and Impact Analysis of Measurement Faults on Loosely Coupled GNSS/INS Filters: Ryan Cassel, Steven Langel, and Kevin Martin, The MITRE Corporation
3. Jammer Airborne Wavefront Simulator (JAWS): George Lee, Greg Helm, Steven Fuller, and Dan Dresher, Northrop Grumman; William Deike, Dana Howell, and Denice Jacobs, Air Force Research Laboratory/RYWN

Session D1: Warfighter Requirements and Solutions
Room: Shoreline (Floor 1)

3:35 A Tale of Two Mission Areas: Milton R. Clary, Overlook Systems Technologies, Inc. and Joseph W. Sapp, SAIC

3:55 PNT Assurance Capabilities in Response to an Urgent Need: Robert Horton and Gentry Gardner, GPS Source

4:15 Cohesive PNT Hardware/HMI Implementations for Aircrew Situational Awareness in GPS-denied Operations (ASiAGO): William Deike, AFRL/RYWN; Thomas Pestak, Jeremiah Shockley, The Perduco Group; Jeffrey Hebert, and Jacob Campbell, AFRL/RYWN


Alternate
1. SPACE JAM Overview, Evolution, and Upgrades Presentation: William Deike, AFRL/RYWN; Thomas Pestak, Jeremiah Shockley, The Perduco Group; Jeffrey Hebert, and Jacob Campbell, AFRL/RYWN
Mark Your Calendars!

ION GNSS+ 2018
The 31st International Technical Meeting of the Satellite Division of the Institute of Navigation
September 24–28, 2018
Hyatt Regency Miami, Miami, Florida
Register Now!

ION's Cognizant Autonomous Systems for Safety Critical Applications (CASSCA) Workshop
January 28–29, 2019
Hyatt Regency+ Reston, Virginia
SAVE THE DATE!

ION's Precise Time and Time Interval Systems and Applications Meeting
January 28–31, 2019
Hyatt Regency Reston

INTERNATIONAL TECHNICAL MEETING
2019
JOIN NAVIGATION CONFERENCE
SAVE THE DATE
July 8–11, 2019
Tutorials: July 8
Show Dates: July 9–10
Hyatt Regency, Long Beach, California
Classified Session: July 11, The Aerospace Corporation
Sponsored by the Military Division of the Institute of Navigation

PACIFIC PNT
Aloha from
April 8-11, 2019
Hilton Waikiki Beach
Honolulu, Hawaii
Where East Meets West in the Global Cooperative Development of Positioning, Navigation and Timing Technology
Register and reserve your hotel room by March 28 to take advantage of discounted rates

Where East Meets West In the Global Cooperative Development of Positioning, Navigation and Timing Technology

Aloha from
April 8-11, 2019
Hilton Waikiki Beach
Honolulu, Hawaii
PACIFIC PNT

SAVE THE DATE!
Tuesday Technical Sessions
8:30 a.m. - 10:00 a.m.

Session A2: Complementary PNT: Vision Aided 1
Room: Beacon A (Floor 4)

8:35 Vision Navigation Software Enhancements for Operational Use on the MQ-1C Gray Eagle UAV:
Dr. Greg Graham, US Army AMRDEC; Will Hotze, Kyle Craig, NTA, Inc.

8:55 Ground Vehicle Vision-Aided Navigation Demonstration at the Joint Warfighting Assessment 2018.1:
John Bollettiero, Peter Cash, Ramesh Gandham, Igor Kossin, Will Krzewick, Paul Machado, Jamie Mitchell, K. Richard Overstreet, Mike Silveira, Matt Stanczcyk, Ron Stevenson, Dwayne Taylor, Kevin Wellwood, Gary Wernsing, and Xianli Zhang, Microsemi

9:15 Closed-Loop Vision-Aided Navigation and Control: Fantastic Features and Where to Find Them:
Dr. Adam Schofield, US Army CERDEC

Alternates
1. Complementary Navigation and Geolocation of UAS Imagery:
David L. Page and Devin A. White, Oak Ridge National Laboratory
2. Robust Navigation for Small Fixed-wing Unmanned Aerial Vehicles:
Robert C. Leishman, Leidos, AutoNMT’s, and INMARSAT Navigation

Session B2: Precise Navigation, Azimuth and Survey
Room: Beacon B (Floor 4)

8:35 Improved Hemispherical Resonator Gyro Vibration Performance:
A. Douglas Meyer, James Campanile, and Sam Dimashkie, Northrop Grumman Systems Corporation

8:55 Development and Evaluation of a Navigation Grade Resonator Fiber Optic Gyroscope (RFOG) for the Micro Inertial Navigator (MiNav):
W. Williams, G. Sanders, M. Smickilas, J. Wu, L. Strandjord, E. Benser, Honeywell, Advanced Technology

9:15 Relative Navigation for Autonomous Refueling and Autonomous Shipboard Landing on UAVs:
Shahram Moafiipoor, Lydia Bock, Jeffrey A. Fayman, Geodetics Inc.

9:35 SkyPASS Generation 3 Results:
Todd Aycock, Katie McCann, David Chenault, Polaris Sensor Technologies; Kirk Peake, NTA; Paul White, US Army AMRDEC

Alternates
1. Advances in Lightweight Precision Azimuth and Navigation Systems for Far Target Location and Augmented Reality:
William Thodos, NVESD; Navin Mathur, MTEQ/NVESD; Johnny Garcia, Frederick Wirth, and Sofia Niarcho, NVESD
2. Thermal Atomic Beam Inertial Sensors:
Brenton Young, Arman Cingoz, Michael Matthews, Miroslav Shervinden, Ethan Pratt, Thang Tran, Alan Bell, Mark Kasevich, and Matthew Cashen, AOSense, Inc.
3. Advanced Survey Emplacement System (ASURES) Update:
Paul White, Greg Graham, US Army AMRDEC; Will Hotze, Kyle Craig, NTA, Inc.

Session C2: GPS Modernization
Room: Seaview (Floor 1)

8:35 GPS III and Contingency Operations Modernization:
Mark Crews, Chuck Frey, and Sharlea McMurtry, Lockheed Martin

8:55 Effects of Space Segment Evolution on Military Satnav Robustness:
Brady W. O’Hanlon, Daniel L. Shultz, Alina P. Pechacek, John W. Betz, The MITRE Corporation

9:15 Excelitas RAFS Design Enhancements for the GPS-III Program:
Mark Beauregard, Cameron Everson, Daniel Janssen, Thomas Lynch, John Vaccaro, Excelitas Technologies

9:35 Standalone Direct Acquisition of M-Code Under Jamming:
Chun Yang, Andrey Soloviev, QuNav; Jung C. Ha, AFRL/RYWN

Alternate
1. Rapid Synchronization for Spread Spectrum Communication Systems:
Kerry Frohling, Iris Technology

Session D2: Emerging Tactical and Strategic Atomic Clock Technology 1
Room: Shoreline (Floor 1)

8:35 Micro Mercury Trapped Ion Clock:
Gurpreet Kaur Gulati, Sang Chung, Jet Propulsion Laboratory (JPL), California Institute of Technology (Caltech); J. Gary Eden, University of Illinois; Christopher Holland, SRI International; Thanh Le, JPL/Caltech; Omeed Momeni, University of California, Davis; Sung-Jin Park, Sehyun Park, University of Illinois; John D. Prestage, Robert I. Tjoelker, JPL/Caltech; Hao Wang, University of California, Davis; Lin Yi and Nan Yu, JPL/Caltech

8:55 A Cold Atomic Beam CPT Clock:
Evan A. Salim, Jayson Denney, ColdQuanta Inc.; John D. Elgin, Thomas P. Heavner, John Kitching, and Elizabeth A. Donley, nist

9:15 Photonic-chip Frequency Combs for Optical Synthesis and Optical Clock Metrology:
Scott B. Papp, nist

9:35 Design Innovations for Miniaturized GPS Quality Clocks:
Chad Fertig, Karl Nelson, Jeff Kriz, Josh Dorr, Rob Compton, Jim Nohava, Matt Spurr, Terry Fabian, Honeywell Aerospace

Alternate
1. Chip Scale Atomic Clock (CSAC) and Miniature Atomic Clock (MAC) Updates and Applications:
John Bollettiero, Peter Cash, Ramesh Gandham, Igor Kossin, Will Krzewick, Paul Machado, Jamie Mitchell, K. Richard Overstreet, Mike Silveira, Matt Stanczcyk, Ron Stevenson, Dwayne Taylor, Kevin Wellwood, Gary Wernsing, and Xianli Zhang, Microsemi
**Session A3: Complementary PNT: Vision Aided 2**  
**Room: Beacon A (Floor 4)**

10:50 Using Vision Navigation to Provide Absolute Position Aiding for Ground Vehicles: Jonathan Ryan, Kyung-min Su, Christopher Rose, Christopher Yeager, Kevin Betts, Leidos; Paul Muench, TARDEC


11:30 Bandwidth Reduction via Structure from Motion on Remote Imaging Systems: Arnold Christian and Scott Nykl, Air Force Institute of Technology


**Alternates**

- 1. Matching Simulated Boom Occlusion Data to Truth Data for Automated Aerial Refueling: William Dallmann and Scott Nykl, Air Force Institute of Technology

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**Session B3: Precision Guided Munitions/Weapon Applications**

11:50 The Optical Rubidium Atomic Frequency Standard: John T. Nielson, Rockwell Collins


11:10 A Portable Cold 87Rb Atomic Clock with Frequency Instability at ten Days in the 10-15 Range: Donald Venable, Mark Smearcheck, Air Force Research Laboratory, Sensors Directorate; Jonathan Headlee, Kelsea Sullivan, Nicholas Pelini, Adriel Fillipini, Branden McNally, University of Dayton Research Institute

**Alternates**

- 1. High Performance Next Generation Mini-Navigator Systems Optimized for CSWaP: K.K. Wong, Bernard Chow, Amnon Talmor and David Faulkner, EMCORE Corporation; Paul White and Jeffrey Williams, US Army AMRDEC
- 2. 746 Test Squadron Guidance Sled Test Revitalization: Austin Prach, 746 Test Squadron

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**Session C3: Military GPS User Equipment**

10:50 MGUE: Rick Bieniak, Richard Townsend, Randall Jaffe, L3 Technologies (IEC)

11:10 GPS Threat Mitigation, Including M-Code: Charles A. Popeck, Rockwell Collins

11:30 CAAP - Next Generation Anti-Jam M-code Receiver: John Fleming and David Lewis, Raytheon, Space and Airborne Systems (SAS)


**Alternates**

- 1. SAASM to M-Code Transition for Fielded Capability: John T. Nielson, Rockwell Collins
- 3. MGUE Enhanced DAGR Distributed Device (ED3) Integration Update: Robert Horton, Perry Kloska, and Dave Jones, GPS Source

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**Session D3: Emerging Tactical and Strategic Atomic Clock Technology 2**


11:10 A Portable Cold 87Rb Atomic Clock with Frequency Instability at ten Days in the 10-15 Range: F.G. Ascrunzz, Y. Dudin, Maria C. Delgado Aramburo and L. I. Acrunz, SpectraDynamics; J. Savory, Alessandro Banducci and S.R. Jefferts, Time and Frequency Division, NIST


11:50 The Optical Rubidium Atomic Frequency Standard: Toward a Rugged, Space-worthy Optical Atomic Clock: Michael Wojcik, Space Dynamics Laboratory; Kyle W. Martin, Matthew S. Bigelow, ATA Corporation; Benjamin Stuhl, Michael Holt, Jason Wooden, Jordan Armstrong, Space Dynamics Laboratory; Stephanie Eddy and Gretchen Phelps, Nathan D. Lemke, Air Force Research Laboratory; John H. Burke, DARPA

**Alternate**

1. Superconductive Cavity Clock: Eric Bozeman, Kari M. Moran, Anirudha Siripuram, Teresa Emery-Adleman, SSC-Pacfic; Lee Lemay, Quinc.Tech
Tuesday Plenary Session  
1:45 p.m. - 3:15 p.m.

Plenary Session 1  
Room: Beacon Ballroom (Floor 4)  
Overflow Seating in Seaview Ballroom (Floor 1)

Lt. Gen. John F. Thompson  
Commander, Space and Missiles Systems Center  
Space Command, USAF

Dr. Bradford Parkinson  
Stanford University

Greg Graham  
US Army AMRDEC

Break in Exhibit Hall: 3:15 p.m. – 4:00 p.m., Sponsored by Harris

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Tuesday Technical Sessions

Session A4: Operational System Demonstrations (4:00 p.m. - 6:10 p.m.)
Room: Beacon A (Floor 4)

4:00 Real-Time Hardware-in-the-Loop Demonstration of a Prototype MQ-1C UAV Vision Navigation System: Greg Reynolds, Timothy Pitt, US Army AMRDEC; Kevin Betts, Jonathan Ryan, Patrick O’Leary, Leidos; Ben Thompson, Dynetics; Laura McCrain, Adam Liles, NTA; Jim Menne, Jason Gilbert, Aaron Finch, General Atomics

4:45 Subterranean Mapping and Tracking of Dismount Personnel: Operational Field Test and Demonstration: Carole Teolis, Carol Politi, and John Karvounis, TRX Systems

5:30 Fusion of Computer Vision and PNT Sensors: James J. Ter Beest III, Booz Allen Hamilton

Session B4: Open Architectures (OAs)
Room: Beacon B (Floor 4)

4:05 Establishing the DoD-Wide PNT Open Architecture: Justin Malek, Samuel Griffin, Matthew Kascak, Booz Allen Hamilton; Jacob Campbell, AFRL/RYWN

4:25 Development of an Air Force PNT Strategy: Jeffrey M. Hebert, AFRL/RYWN and Mitchel B. Miller, AFLCMC/EZ

4:45 PINTO Software Library for Precision Velocity and Frequency Estimation using GPS Carrier Phase and INS Measurements: Edward V. Byrne, Microsemi; Thao Q. Nguyen, AFRL/RYWN; Chip Grandits, Microsemi; Frank van Graas, Ohio University; Andrew T. Baster, AFRL/RYWN; Lars Boehnke, Microsemi


Alternate
1. PNTWERX: The DoD Innovation Hub for PNT: Jacob Campbell, Jeff Hebert, Donald Venable, Rex Mykrantz, Air Force Research Laboratory, Sensors Directorate; Christopher Garrett, Air Force Life Cycle and Management Center

Session C4: GPS Constellation Performance
Room: Seaview (Floor 1)

4:05 GPS and the Signal-in-Space User-Range-Error: Reducing the Clock’s Contribution via Lamplight Intensity Stabilization: Michael Huang, Andrew Stapleton, and James Camparo, The Aerospace Corporation

4:25 Enhancements and Improvements to USNO-produced Earth Orientation Results Using Navy or US-only Produced Atmospheric and Oceanic Angular Momentum Efforts: Nicholas Stamatakos, US Naval Observatory; David Salstein, Atmospheric and Environmental Research; Dennis McCarthy, US Naval Observatory

4:45 Evaluation of EPOCHA Near Real-Time Precision GPS Products: Jason T. Drotar, NSWCDD

5:05 Multi-Year Assessment of GPS Performance Against the PPS and SPS Performance Standards: Brent Renfro, Miquela Stein, Nicholas Boeker, APL, The University of Texas at Austin

Alternate
1. L-Band Monitor Anomaly Detection Capabilities: Mark Mendiola, The Aerospace Corporation
2. Monitoring Concepts to Support GNSS Augmentation in GEO: Penina Axelrad, University of Colorado Boulder; Tom Roberts and Madeleine Naudeau, AFRL Space Vehicles Directorate

Session D4: Timing Applications
Room: Shoreline (Floor 1)


4:25 Techniques for Providing Time Resiliency in WIN-T through the use of Network Centric Waveform (NCW): Eugene Korsunsky, Ashley Carlson Michael Zeug, and Amy Johnson, General Dynamics Mission Systems; Yoonkee Kim and Paul Olson US Army CERDEC

5:05 Improvements to AFRL’s Precise Time and Frequency Reference System to Achieve Sub 10 ps Distributed RF Stability: Timothy J. Kelly, Microsemi, Inc.; Thao Q. Nguyen, Andrew T. Baster, AFRL/RYWN; Michael J. McDonnell, and Edward V. Byrne, Microsemi, Inc.

5:05 Wireless Synchronization Approach To Create Distributed Coherent Phased Arrays: Daniel T. Goff, Robert B. Alwood, Alex Moody, Michael Picciolo, ENSCO, Inc.

Alternate
1. Precise Time and Frequency Using the TimeLoc Technique: Paul Benshoof, Locata Corporation
Wednesday Technical Sessions
8:30 a.m. - 10:00 a.m.

Session A5: Complementary PNT: RF Aided 1
Room: Beacon A (Floor 4)


9:15 Artificial Neural Networks for Navigation Applications: Joseph Curro and John Raquet, Air Force Institute of Technology


Alternate
1. Enhanced Loran (eLoran) and GNSS Receiver for PNT Testing and Development: Daniel Artis, Booz Allen Hamilton

Session B5: Space and Satellite Applications 1
Room: Beacon B (Floor 4)

8:35 Augmenting Military GPS with Hosted Payloads at GEO: Jon Anderson, Canyon Consulting; Kevin Slimak, Joanna Hinks, and Tom Roberts, Air Force Research Laboratory

8:55 GEO Military Hosted Payload: Operating Through Host Station-Keeping Maneuvers: Madeleine Naudeau, AFRL/RVES

9:15 Multi-Level Space Segment Architecture that Provides Resiliency, Extends GPS Signals to Disadvantaged Users and Controls Space Segment Costs: Frank Czopek, James R. Wertz, Richard Van Allen, and John Collins, Microcosm Inc.


Alternate

Session C5: GPS in Military Applications/NAVWAR
Room: Seaview (Floor 1)


8:55 Military Underwater Navigation System for the Navwar Environment: Allen Morrison, Booz Allen Hamilton; Bruce Tunnah, Australian Defence Force; Eddy Emile, GPS Directorate

9:15 Understanding the Effects of Relative Time Alignment on Satnav Spoofing: Spencer Carmichael, Connor Brashar, and Kevin S. Martin, The MITRE Corporation

9:35 Innovative Applied Training for the Joint Warfighter: GPS Contested, Degraded and Operationally-limited Lab (GPS CDO Lab): Steve Lewis, Air Force Space Command; Dennis Akos, University of Colorado at Boulder; Karol Cortright and Brett Bateman, Army Future Warfare Center Space Prototyping and Experimentation; Logan Maynard, Navy Information Forces Colorado

Alternate
1. GPS M-code to C/A Translator for Assured Navigation: Mark Carroll, AFRL Sensors Directorate; Pranav Patel, Sanjeev Gunawardena, Air Force Institute of Technology

Session D5: Navigating in Challenged Environments (e.g., Urban, Indoor and Sub-Surface Navigation)
Room: Shoreline (Floor 1)

8:35 Accurate Ground Navigation in a GPS Denied Environment: Greg Farley, Rockwell Collins; David Hodo, Integrated Solutions for Systems; Evans Jacobson, Rockwell Collins


9:35 Test Results of a Dismounted Warfighter Navigation System in a GPS-Denied Environment: William Travis, Cody Salmon, IS4S; David M. Bevly, Auburn University; Mark Smearcheck, AFRL/RY

Alternate
1. Observations of Operating COTS UAVs in GPS/GNSS Spoofing Conditions: Alexander W. Ray and Dennis M. Akos, University of Colorado Boulder

Break in Exhibit Hall: 10:00 a.m. – 10:45 a.m., Sponsored by Northrop Grumman
**Session A6: Complementary PNT: RF Aided 2**
*Room: Beacon A (Floor 4)*

10:50 Handheld Device for Positioning using Space and Terrestrial Signals of Opportunity: John Carlson, Martin Alles, Joe Kennedy, Echo Ridge, LLC; Mark Smearcheck, Air Force Research Laboratory


11:50 Positioning with Signals of Opportunity Subject to Mobile Fading and Clock Errors: Chun Yang and Andrey Soloviev, QuNu, LLC

Alternate

1. A Methodology for Estimation of Ground Phenomena Propagation: Sharon Rabinovich, Ren Curry, and Gabriel H. Elkaim, University of California Santa Cruz

**Session B6: Space and Satellite Applications 2**
*Room: Beacon B (Floor 4)*

10:50 Effects of RAFS Frequency Jumps on GPS Clock-Health Monitoring: Travis Driskell, The Aerospace Corporation

11:10 GPS III On-Orbit Clock Ensembling: John P. Janis and Michael R. Jones, Harris Corporation

11:30 High Efficiency GaN RF Front-End of GPS Block-III Transmitter Supporting Boost-Mode, Multi-Carrier and Multi-Code Waveforms: Donald F. Kimball, Bardia Ghajari, Jonmei J. Yan, Houman Ghajari, MaXentric Technologies LLC; Aly E. Fathy, University of Tennessee Knoxville

11:50 On-orbit Reprogrammable Digital Waveform Generator for SatNav Signal Transmission: Carl Smith and John Liebetreu, General Dynamics Mission Systems

Alternate

1. Northrop Grumman’s On-Orbit Digital Waveform Generator Program Introduction and Status: Dennis Hall, Scott Takahashi, Craig Barack, Mark Lyubarev, Neeraj Venkatesan, Northrop Grumman

**Session C6: Military GPS/Antenna Technologies and Interference Mitigation**
*Room: Seaview (Floor 1)*


11:10 A Dynamic SatNav Constellation Simulation System for Anechoic Chambers: Josh Clanton, Josh Starling, Integrated Solutions for Systems; Lloyd Riggis, Houston Cleveland, Auburn University

11:30 GPS Anti-Jam/Anti-Spoof using a Small Antenna Array and Space-Time/Space-Frequency Signal Processing: Mark L. Psiaki and Michael C. Esswein, Kevin T. Crofton, Virginia Tech

11:50 Small Foot-Print Antenna Array for all Signal GNSS Receiver: Teh-Hong Lee, Inder J. Gupta and Chi-Chih Chen, The Ohio State University

Alternates

1. SMI Implementation of Adaptive Weighting Algorithms in GNSS Receiver Antenna Arrays: Justin D. Kuric and Inder J. Gupta, The Ohio State University

2. GNSS Adaptive Multi-band Antenna (GAMA) System Manufacturing Technology: Michael Berarducci, Dana Howell and John Woods, Air Force Research Lab./Sensors Directorate; Kerry Bennington, Air Force Research Lab./Materials and Manufacturing Directorate; Edward Urbanik and Julia Marcum, Applied Research Assoc./Berriehill Research Division

**Session D6: Surface and Sub-Surface PNT**
*Room: Shoreline (Floor 1)*

10:50 Decentralized Filtering Architectures for GNSS-Denied Navigation: Demoz Gebre-Egziabher, University of Minnesota, Twin Cities; Justin Gorgen, Space and Naval Warfare Systems Center Pacific

11:10 GPNTS Independent Verification and Validation (IV&V): Samir Shammas, Jei Chen, Richard Huynh, and Chad Pinkelman, SSC Pacific

11:30 Ships’ Ocean Current Correction Enhanced Routine (SOCCER): Richard Willis, Office of Naval Research; Matthew J. Schultheis, Marvin B. May, ARL, Penn State University

11:50 Evaluation of the Lost-at-Sea Skymark Positioning Algorithm using Experimental Data: Patrick O’Shea, Draper & Massachusetts Institute of Technology; William Whitacre; Ben Lane, Draper

Alternates


2. Sensor Diverse Integrated Navigation Fusion Based on Optimal Reduced State Estimation: Mookerjee Purusottam, Leszek Szaniecki; Thomas Metzger, Hugh Rice, Lockheed Martin
Plenary Session 2
Room: Beacon Ballroom (Floor 4)
Overflow Seating in Seaview Ballroom (Floor 1)

1. André Hentz
Deputy Under Secretary (Acting), Science and Technology/OUS, Department of Homeland Security

2. Dr. Christopher Ekstrom
Deputy Oceanographer and Navigator of the Navy

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Break in Exhibit Hall: 3:15 p.m. – 4:00 p.m., Sponsored by Orolia Government
Wednesday Technical Sessions

Session A7: Inertial Measurement Unit (IMU)
Room: Beacon A (Floor 4)

4:05 A New IMU with a Digitally Controlled PZT CVG-Part 2: A.D. Challoner, J.D. Popp, and P.W. Bond, InertialWave Inc.


4:45 Sidewall Mirrors for High Finesse Optical Cavity MEMS Accelerometers: Clinton Blankenship, Brian Grantham, U.S. Army AMRDEC; Michael Kranz, Michael Whitley, Paul Ashley, and Brian English, EngeniusMicro

5:05 IMU-12: More Performance in Smaller Size: Evgeny Zaitsev, Itzik Engel, Arnon Arbel, Al Cielo Inertial Solutions Ltd.; Andy Continisio, Kearfott Corporation

Alternates
1. 200mm Manufacturing Transition of a High-Performance MEMS Gyroscope: Jeffrey DeNatale, Teledyne Scientific & Imaging; Francois Dion and Stephane Martel, Teledyne DALSA Semiconductor
2. Super-TAC Tactical Grade Inertial Measurement Unit Qualification: Steve Root and Douglas Blischok, L3 Defense Electronic Systems

Session B7: New Signals from Space
Room: Beacon B (Floor 4)

4:05 Advanced Signals Research at AFRL Space Vehicles: Current Status and Plans: Joanna Hinks, Justin Guerrero, Air Force Research Laboratory; Jon Anderson, Canyon Consulting; Nathan DeVilbiss, ATA Aerospace

4:25 Phase-Rotation Watermarking for GPS Authentication and Messaging: Philip S. Kossin, Harris Corporation

4:45 Enhancing GPS PNT Resiliency with a Frequency Hop Acquisition Aiding Signal: Philip A. Dafesh, The Aerospace Corporation


Alternates
2. Analysis of GPS Signal Quality Variability Due to Testing Methods: Gregory Myer, ATA Aerospace and Hanna Gjermo, AFRL Space Vehicles Directorate

Session C7: Multi-GNSS Receivers for Military Applications
Room: Seaview (Floor 1)


4:25 Detection and Exclusion of Spoofing in GNSS Carrier Phase Solution Using RANSAC: Zhen Zhu, East Carolina University and Eric Vinande, AFRL

4:45 Bringing Spectrum Situational Awareness to the GNSS Receiver: Steven Kimball, BAE Systems


Alternates
2. A Method to Allow a MGUE Receiver to Make use of “Other” GNSS Systems: Frank Czopek, Microcosm, Inc.

Session D7: Complementary PNT: Naturally Occurring Measurement Sources
Room: Shoreline (Floor 1)


4:25 Airborne Magnetic Anomaly Navigation Over Ocean Using Sparse Map Data: Michael Malec and Aaron Canciani, Air Force Institute of Technology

4:45 Non-GNSS Smartphone Pedestrian Navigation Using Barometric Elevation and Digital Map-Matching: Daniel Broyles, John Raquet, Kyle Kaufman, Air Force Institute of Technology

5:05 Sferics-VLF Precision Time Synchronization: Eric Bozeman, Justin Gorgen, Jack Dea, SSC-Pac; Lee Lemay, Quinc.Tech

Alternates
2. Using Sky Polarization to Find Absolute Position: Todd Aycock, Art Lombardo, David Chenuault, Katie McCann, Polaris Sensor Technologies; Jeff Williams, NTA; Paul White, US Army AMRDEC
Clearances and Attending the Classified Session

**FOUO U.S. ONLY SESSIONS**  
(Monday, July 9 - Wednesday, July 11)

All sessions and exhibits will be held in an U.S. ONLY FOR OFFICIAL USE ONLY (FOUO) environment at the Hyatt Regency Long Beach. To attend you must provide the following:

1. Proof of U.S. citizenship
2. Visit Request/including a Need-to-Know Statement (Need-to-Know not required if using JPAS)
3. Photo ID
4. JNC Conference Badge and Paid Registration

**Visit Request and Need-to-Know Statements:**

All Visit Requests must be received by June 15, 2018 and be verified by the JNWC Security Office. Visit authorization requests received after June 15 may not be processed.

Prospective U.S. attendees must submit their Visit Authorization Requests through JPAS to JPAS SMO: STRATJNWC. JPAS visit request POC field must be filled with “JNC 2018” instead of a POC name. For your convenience, if JPAS is not an option, a Visit Request Form can be found at www.ion.org/jnc.

Fax all FOUO Visit Requests to:  
Diane Jacobson  
Security Specialist  
Joint Navigation Warfare Center  
Phone: 505-853-6360  
Fax: 505-853-6677  
E-mail: diane.jacobson.ctr@us.af.mil

**CLASSIFIED U.S. ONLY SESSION**  
(Thursday, July 12)

The classified session will be held in a CLASSIFIED U.S. ONLY environment at The Aerospace Corporation's Corporate Headquarters, located at 2310 E. El Segundo Blvd., El Segundo, CA 90245. Information required for clearances is as follows:

- Classification: Secret
- Visit Type: One Time
- Request Type: Facility Invitation
- Request Category: Government
- Anticipated Level of Classified Information: Secret
- Visit Dates: 12 July 2018
- Purpose of Visit: Attend the 2018 Joint Navigation Conference, El Segundo, California
- Facility Information: The Aerospace Corporation
- Name: Joint Navigation Warfare Center/USSTRATCOM
- Visit request should be received by June 15, 2018

Program/Agreement: Navigation Warfare MOU

Knowledgeable U.S. POC:  
Diane Jacobson  
Security Specialist  
Joint Navigation Warfare Center  
Phone: 505-853-6360  
Fax: 505-853-6677  
E-mail: diane.jacobson.ctr@us.af.mil

★★★★ Accessing the Classified Session ★★★★

Seating at the Thursday Classified Session is limited. Admission to the session will follow this order of priority:

- Attendees who complete a visit request prior to June 15 will be given first priority for seating. (Green ★ on conference badge)
- Those who submit a visit request after June 15, but prior to the conference, will be second priority. (Yellow ★ on badge)
- Those who complete their visit request at JNC will be admitted to the classified session based on available seating (Red ★ on badge).
- Late arrivals will forfeit their seat regardless of star color on their badge. Seats will be held for attendees who travel to The Aerospace Corporation on the ION-provided shuttle based on when their visit request was received.
- Those unable to gain immediate admission to the classified session will be wait-listed and allowed admission as others depart.

**Below are the options for travel to/from The Aerospace Corporation to attend Thursday’s classified session:**

- Onsite parking is available at The Aerospace Corporation, located at 2310 E. El Segundo Blvd. in El Segundo, California. Follow signs to park in the conference parking area. Follow conference signage, and security will direct you to the Titan Meeting Room.
- Complimentary shuttle bus transportation will be provided Thursday, from the Hyatt to The Aerospace Corporation, and in the evening at the conclusion of the classified session, back to the Hyatt. **Shuttle buses will depart from the front of the Hyatt Regency Long Beach no later than 6:15 a.m., and will return to the Hyatt following the conclusion of the Classified Session.**
- For those attendees departing from Los Angeles International Airport (LAX) the afternoon/evening of July 12, there will be a single shuttle bus run from The Aerospace Corporation to LAX at 12:30 p.m. on July 12.
- Please note that hired transportation services such as taxis, Uber and Lyft cannot drive onto Aerospace property, and will need to be met at the main gate for pick up.
Thursday Classified Session  
8:20 a.m. - 5:00 p.m.

Session E8: CLASSIFIED SESSION (SECRET-U.S. ONLY)
Room: Titan Room, The Aerospace Corporation
8:20 Opening Remarks

8:30 KEYNOTE
Brigadier General Thomas L. James  
Joint Forces Space Component Command  
J3/7, U.S. Army

9:20 Warfighter Panel
- CPT Jon Fanelli, Field Artillery Regiment (HIMARS), U.S. Army
- LCDR Samuel Fromilie, Submariner, U.S. Navy
- CPT Stoney Grimes, U.S. Army
- ETVCS(SS) William Hoyt, COMSUBFOR Force Assistant Navigator, U.S. Navy
- SFC(P) Alex Joy, Hardware SME, U.S. Army
- LCDR Michael Maas, U.S. Coast Guard

10:50 a.m. Break

11:10 GYPSY KILO Results: Rod Earwood, JNWC
11:30 Blue Force Electronic Attack (BFEA)/Counter PNT Developments: Fay Spellerberg, JNWC; Kevin Martin, The MITRE Corporation
11:50 Responses of Weapons Systems to Complex Emerging Threats: Donald E. Morales, Jose Diaz, and James Brewer  
USAF/746TS

12:10 p.m. - 1:30 p.m. Lunch, Sponsored by

1:40 Signal Agnostic Navigation Denial (SAND): Philip Dafesh and Adam Parower, The Aerospace Corporation
2:00 Discriminating GPS Signal Emulation Hardware: Joshua C. Egan, USAF; Michael A. Temple, Sanjeev Gunawardena, Air Force Institute of Technology
2:20 FORTUNE 17-02 Execution and Results: Rod Earwood, Dan Healey and Wally Vincent, Joint Navigation Warfare Center; Jason Pagan, Overlook Systems; Gilberto Santacruz, PreTalen
3:00 Warfighter Situational Awareness and Advanced PNT Capabilities – an Update on iPNT: Fred Capria, COMSUBPAC; George Klaus, Tim Magnani, Vivek Viswanathan, Jeff Girsch, David Stark, Mannomare Sommerville, Eric Adles, Michelle O’Toole, Ted Campbell, Dileep Simha, David Wawro, Ben Schilling, Steve Stafford, Kathy Straub, Rajen Patel, and David Chamberlin-Long, Johns Hopkins University/APL

3:20 p.m. Break

4:00 GPS Interference and its Operational Effects on Air Force Platforms: Andrew Braun, Air Force Life Cycle Management Center (AFLCMC) Engineering Directorate; Jonathan Neu, AFLCMC Engineering Directorate; Gary Green, PreTalen, Ltd.; Sultan Mahmood, Odyssey Systems
4:20 GPS Adjacent Band Compatibility Test Results for Department of Defense Receivers: Robyn Anderson, David Besson, and David Hazelton, GPS Directorate
4:40 Military GPS User Equipment (MGUE) Test Article Performance Characterization: Bradley Stine, Shelby Savage, Tynan MacLeod, Adam Paranay, K. Brian Kulig, The MITRE Corporation

Alternates
1. Analysis and Modelling of the Time and Frequency Requirements of Military and Civilian Systems: Okukayode K. Okusaga, Eric Adles, Greg Weaver, and George Klaus, Johns Hopkins University/APL
Systron Donner introduces the industry’s first “All-Causes” tactical-grade SDI600 MEMS IMU. The SDI600 features a breakthrough High-Bandwidth (HBW) gyro-design that is proven to significantly reduce vibration sensitivity and improve 1°/hr gyro & 1mg accel bias stability under >25Grms captive carry environments. Designed specifically for easy integration into missile and munition applications, the SDI600 is shorter, delivers full performance in 1 second, and features industry standard serial communication, TOV sync, and 95% BIT coverage. SDI600 is the better alternative to older generation optical RLG/FOG technologies.

For more information visit Booth 402