ONSITE PROGRAM

Joint Navigation Conference

The Largest U.S. Military Navigation Conference with Joint Services & Government Participation

"Military Navigation Technology: The Foundation for Military Ops"

June 27-29, 2011

US-Only FOUO Sessions

Crowne Plaza Hotel ▪ Colorado Springs, Colorado

June 30, 2011

Classified 4-Eyes Sessions

Elkhorn Conference Center, Ft Carson ▪ Colorado Springs, Colorado

JNC 2011 Program Committee

Chair:
Paul Olson,
U.S. Army CERDEC

Vice-Chair:
Bill Bollwerk,
U.S. Naval Observatory

Program Chair Track A:
Greg Graham, *U.S. Army AMRDEC*

Program Chair Track B:
John Del Colliano, *U.S. Army CERDEC*

Program Chair Track C:
Jan Anszperger, *C.S. Draper Laboratory*

Other Officers & Directors:

Ron Beard, *U.S. Naval Research Laboratory*

Jim Doherty, *Institute for Defense Analyses*

Eddy Emile, *GPS Directorate*

Greg Kohls, *ASC Combat Electronics Division*

Jalal Mapar, *U.S. Department of Homeland Security*

Dr. Mikel Miller, *AFRL Munitions Directorate*

Neeraj Pujara, *Air Force Research Laboratory*

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JNC 2011 Session Overview • June 27–30, 2011

Date	Time	**Track A:** Greg Graham, *U.S. Army AMRDEC*
Monday, June 27	**8:30 a.m. – 10:00 a.m.**	Tutorial — **GPS 101 – *Foothills***
	10:30 a.m. – 12:00 p.m.	Tutorial — **Precise Time and Frequency – *Pikes Peak 3/4***
		Lunch — 12:00 p.m. – 1:00 p.m. (Lunch is on your own)
	1:35 p.m. – 3:00 p.m.	**A1: Marine Applications – *Pikes Peak 3/4***
	3:35 p.m. – 5:00 p.m.	**A2: Micro Navigation Applications – *Pikes Peak 3/4***
Tuesday, June 28	**8:30 a.m. – 12:00 p.m.**	**Plenary Session – *Foothills***
		Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***
	1:35 p.m. – 3:00 p.m.	**A3: Warfighter Requirements and Solutions – *Foothills***
		Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.
	3:35 p.m. – 5:00 p.m.	**A4: Atomic Clocks and Timing Applications – *Pikes Peak 1/2***
		Exhibitor Hosted Reception — 6:00 p.m. – 8:00 p.m.
Wednesday, June 29	**8:30 a.m. – 9:55 a.m.**	**A5: Missile/Projectile Applications – *Pikes Peak 1/2***
		Break in Exhibit Hall —10:00 a.m. –10:30 a.m.
	10:30 a.m. – 11:55 a.m.	**A6: Land Applications –– *Pikes Peak 1/2***
		Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***
	1:35 p.m. – 3:00 p.m.	**A7: MEMS Inertial Measurement Units – *Pikes Peak 1/2***
		Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.
	3:35 p.m. – 5:20 p.m.	**A8: Aviation Applications – *Pikes Peak 1/2***
Thursday, June 30	**8:45 a.m. – 9:15 a.m.**	**A9: Classified Sessions – Adversary Developments in NAVWAR – *Elkhorn Catering & Conference Center, Ft Carson***
	9:15 a.m. – 11:25 a.m.	**A10: NAVWAR Testing – *Elkhorn Catering & Conference Center, Ft Carson***
		Lunch — 11:30 a.m. – 12:45 p.m.
	12:45 p.m. – 2:45 p.m.	**Warfighter Cross Talk Panel - Miller/Doherty – *Elkhorn Catering & Conference Center, Ft Carson***
	3:15 p.m. – 5:20 p.m.	**A11: Classified Session – Flexibility in NAVWAR – *Elkhorn Catering & Conference Center, Ft Carson***
	5:20 p.m. – 5:30 p.m.	**Closing Remarks – Buses Load at 5:35 p.m.**

Exhibit Hall & Exhibit Hours

JNC GUIDANCE, NAVIGATION & CONTROL

2011 JOINT NAVIGATION CONFERENCE

Tuesday, June 28

10:00 a.m. – 4:00 p.m.
(lunch: 12:00 p.m. – 1:00 p.m.)
6:00 p.m. – 8:00 p.m.
(Exhibitor Hosted Reception)

Wednesday, June 29

10:00 a.m. – 5:00 p.m.
(lunch: 12:00 p.m. - 1:00 p.m.)

Coffee and conference refreshments will be served in the exhibit hall.

Crowne Plaza Hotel, Colorado Springs, Colorado

Track B: John Del Colliano, *U.S. Army CERDEC*	**Track C:** Jan Anszperger, *C.S. Draper Laboratory*
Tutorial — **Alternative Navigation – *Pikes Peak 1/2***	Tutorial **— Vector Tracking Theory & Implementation – *Pikes Peak 3/4***
Tutorial — **Urban Indoor Navigation – *Foothills***	Tutorial **— Fundamental Reference Systems – *Pikes Peak 1/2***
Lunch — 12:00 p.m. – 1:00 p.m. (Lunch is on your own)	Lunch — 12:00 p.m. – 1:00 p.m. (Lunch is on your own)
B1: Modeling and Simulation 1 – *Pikes Peak 1/2*	**C1: Military GPS Receivers & Mil. GPS Receiver Tech 1 – *Foothills***
B2: Modeling and Simulation 2 – *Pikes Peak 1/2*	**C2: Military GPS Receivers & Mil. GPS Receiver Tech 2 – *Foothills***
Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***	Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***
B3: Collaborative Navigation Techniques – *Pikes Peak 1/2*	**C3: Mil. GPS/Antenna Tech & Interference Mitigation – *Pikes Peak 3/4***
Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.	Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.
B4: Navigating in Challenged Environments – *Foothills*	**C4: Navigation Warfare – *Pikes Peak 3/4***
Exhibitor Hosted Reception — 6:00 p.m. – 8:00 p.m.	Exhibitor Hosted Reception — 6:00 p.m. – 8:00 p.m.
B5: Alternative Navigation Technologies (Vision) – *Foothills*	**C5: Military GPS Use and Experiences – *Pikes Peak 3/4***
Break in Exhibit Hall — 10:00 a.m. –10:30 a.m.	Break in Exhibit Hall — 10:00 a.m. –10:30 a.m.
B6: Alternative Navigation Technologies (RF) – *Pikes Peak 3/4*	**C6: GPS in Military Applications – *Foothills***
Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***	Lunch in Exhibit Hall — 12:00 p.m. – 1:00 p.m. **– *Colorado Grand Ballroom***
B7: Altn. Nav. Tech. (Nat. Occur. Phenom.) – *Pikes Peak 3/4*	**C7: GPS Modernization – *Foothills***
Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.	Break in Exhibit Hall — 3:00 p.m. – 3:35 p.m.
B8: Robust Navigation Systems/Solutions – *Pikes Peak 3/4*	**C8: GPS Constellation Performance – *Foothills***

Note that the photographing of sessions/presentations and/or the audio or video recording of sessions/presentations is prohibited. As a courtesy to others, please set all cell phones to vibrate. No electronic devices will be permitted in the classified sessions.

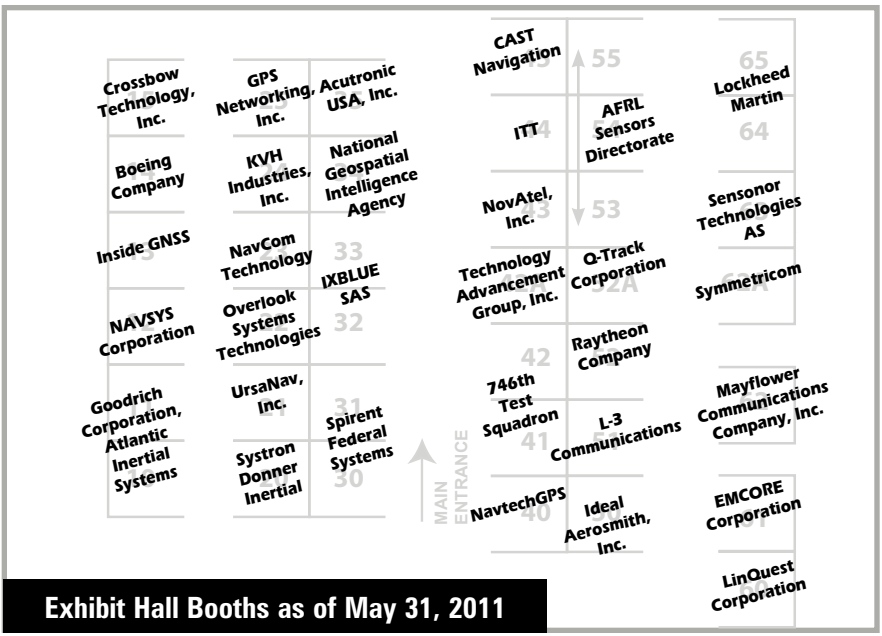

Exhibit Hall Booths as of May 31, 2011

FOUO & Classified Session Requirements

FOUO US ONLY SESSIONS

(Monday – Wednesday, June 27-29)

All US ONLY FOUO sessions and exhibits (June 27-29) will be held in a US ONLY FOR OFFICAL USE ONLY (FOUO) environment at the Crowne Plaza Colorado Springs. 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

Prospective U.S. attendees must submit their Visit Authorization Requests through JPAS to JPAS SMO: OD3QFJ6ZB6. JPAS visit request POC field must be filled with "JNC 2011" instead of a POC name. For your convenience, if JPAS is not an option, Visit Request Form can be found at www.jointnavigation.org.

Fax all FOUO Visit Requests to:
Gloria N. Dumone, Personnel Security Specialist
JNWC/JFCC SPACE/USSTRATCOM
1351 Wyoming Blvd SE, Bldg 20201
Kirtland AFB, NM 87117
P: 505-853-6360; F: 505-853-1974; M: 505-206-7595
gloria.dumone.ctr@kirtland.af.mil

CLASSIFIED SESSION (Thursday, June 30)

The CLASSIFIED SESSION will be held in a classified 4-eyes environment (open to citizens of Australia, Canada, U.K. and U.S.A.). Citizens of Australia, Canada and U.K. should submit their visit requests through normal embassy process. Information required for embassy Clearances is as follows:

Classification: Secret
Visit Type: One Time
Request Type: Facility Invitation
Request Category: Government
Anticipated Level of Classified Information to be Involved: Secret
Visit Dates: 30 June 2011
Purpose of Visit: Attend the 2011 Joint Navigation Conference, Colorado Springs, CO
Facility Information: Elkhorn Catering and Conference Center in Ft Carson, CO
Way to Contact: E-mail
Name: Joint Navigation Warfare Center/ USSTRATCOM
Program/Agreement: Navigation Warfare MOU
Knowledgeable US POC:
Name: Gloria Dumone
Phone: 505-853-6360/Fax: 505-853-1974/
Email: gloria.dumone.ctr@kirtland.af.mil
Organization: Joint Navigation Warfare Center/ USSTRATCOM

TUTORIALS (included in registration) Monday, June 27, 2011

8:30 a.m.– 10:00 a.m.

Alternative Navigation ..... Lt. Col. Michael Veth, *U.S. Air Force 46th Range Group*.... ***Pikes Peak 1/2***
GPS 101 ..... Dr. Jacob Campbell, *Air Force Research Laboratory;*
Dr. John Raquet, *Air Force Institute of Technology* ..... ***Foothills***
Vector Tracking Theory and Implementation..... Dr. Matthew Lashley, *AMRDEC/NTA* ..... ***Pikes Peak 3/4***

10:30 a.m.– 12:00 p.m.

Fundamental Reference Systems ..... Dr. B. Luzum, *U.S. Naval Observatory* ..... ***Pikes Peak 1/2***
Precise Time and Frequency Applications..... Dr. Joe White, *U.S. Naval Research Lab*..... ***Pikes Peak 3/4***
Urban Indoor Navigation ..... Dr. R. James Duckworth, *Worcester Polytechnic Institute*..... ***Foothills***

12:00 p.m.– 1:00 p.m. LUNCH BREAK (Lunch is on your own)

TUTORIAL DESCRIPTIONS

Lt. Col. Michael Veth, *U.S. Air Force 46th Range Group*

Alternative Navigation

Pikes Peak 1/2 8:30 a.m. – 10:00 a.m.

This tutorial develops the concept of navigation using non-traditional methods. Topics include techniques used to calculate the navigation solution based on general classes of available measurements: Examples of various techniques from both man-made and biological systems will be presented and discussed. These will include pseudolite navigation techniques, vision-based navigation, signals-of-opportunity navigation, and a general discussion of biological navigation systems. This tutorial will be presented at the introductory level and will be conceptual in nature.

Dr. Brian Luzum, *U.S. Naval Observatory*

John Bangert, *U.S. Naval Observatory*

Fundamental Reference Systems

Pikes Peak 1/2 10:30 a.m. – 12:00 p.m.

Navigation is the process of determining a position (or direction) and its motion with respect to a specific reference system. The navigational accuracy depends directly on the accuracy with which that reference system can be specified. Two components are required to realize a reference system for practical applications. These are (1) the reference frame and (2) the conventionally accepted models and standards used in the process. The frame is specified by an adopted set of coordinates and motions of the elements (site coordinates and motions, for example) used in its definition. The models and standards also include the software used in the navigational solutions. The tutorial reviews the fundamental elements of reference systems and demonstrates the practical aspects of the procedures used to transform from the terrestrial to celestial reference systems.

Dr. John Raquet, *Air Force Institute of Technology*

Dr. Jacob Campbell, *AFRL Sensors Directorate*

GPS 101

Foothills 8:30 a.m. – 10:00 a.m.

This course presents the fundamentals of the GPS system, and it is intended for people with a technical background who do not have a 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, and GPS modernization.

Dr. Joe White, *U.S. Naval Research Lab*

Precise Time and Frequency Applications

Pikes Peak 3/4 10:30 a.m. – 12:00 p.m.

This tutorial will introduce precise time and frequency (PT&F) applications and includes an overview of the fundamentals of PT&F signals, their generation and measurement. An introduction to time scales, those in use, and their origin will be described to provide an understanding of how traceability of PT&F is needed throughout its generation, dissemination and use. The distinction between global time scales and those generated and used within systems will be described to provide an understanding of their basic differences and strengths. The distinctions and commonalities between telecommunications and navigation positioning will be discussed. How GPS supports time dissemination and time transfer interfaces with many and varied systems will be covered and examples of different system applications will be discussed. The session will conclude with a projection of future directions of PT&F and its application.

Dr. R. James Duckworth, *Worcester Polytechnic Institute*

Urban Indoor Navigation

Foothills **10:30 a.m. – 12:00 p.m.**

Many research and development projects have been funded by government agencies and industry over the past two decades to develop indoor location and tracking systems, yet no single or composite technology solution has yet achieved demonstration of a fieldable system that provides reliable operation in settings representative of typical urban structures. There is a broad range of scientific problems to be blamed for the current unavailability of deployable indoor navigation systems. This tutorial will review current technologies, either singly, or through integration, that are being used on systems designed for urban and indoor navigation, and discusses their advantages and weaknesses for this difficult problem. Recent field testing results will be presented to indicate the current state of the art and the areas where new research and development thrusts may be required.

Dr Matthew Lashley, *AMRDEC/NTA*

Vector Tracking Theory and Implementation

Pikes Peak 3/4 **8:30 a.m. – 10:00 a.m.**

This course provides an overview of GPS vector tracking receiver algorithms, their performance, and their coupling with inertial measurement units (IMUs). The course begins with a review of the standard, scalar tracking loop based architecture and then introduces vector tracking. The differences between scalar and vector tracking loops are then explored. The performance of vector tracking relative to scalar tracking loops is discussed in detailed. The course then focuses on the fusion of GPS vector tracking loops with IMUs.

The combination of a vector tracking receiver architecture with an IMU is commonly called ultra-tight coupling (UTC) or deep integration (DI). The performance advantages of UTC and DI relative to tightly coupled systems are then discussed.

Capt. Raymond Chartier Jr., *Navigation Branch, USN*

David Brown, *Navigation Branch, USN*

A1: Marine Applications — Pikes Peak 3/4

1:40 **1. Automated Celestial Navigation Augmentation of a Shipboard Navigation Sensor Suite for GPS Backup:** J.C. Hunt, M. Ferguson, *SPAWAR System Center Pacific*

2:00 **2. Geophysical Navigation Algorithms and Progress:** D. Fischer, R. Greer, *SPAWAR Systems Center Atlantic;* Y.S. Nam, M.B. May, *PSU/ARL NRDC*

2:20 **3. Mine Counter-Measures Precision Navigation and Lane Marking:** J.P. Cunningham, A.G. Evans, *Naval Surface Warfare Center Dahlgren Division;* B. Almquist, *Office of Naval Research;* K. Warson, *Naval Surface Warfare Center Panama City Division*

2:40 **4. GPS Function Testing at Various HAE Levels:** A.L. Scoca, R. Daniels, J. Yen, *Lockheed Martin;* J. Kallenberger, *SP24, U.S. Navy*

Alternate

1. Enhancing Vision-Based Navigation Technology with the True Bearing Transmitter: W.R. Woodward, R. Webb, *UrsaNav, Inc.;* R. A. Greer, *SPAWAR Systems Center*

Denice Jacobs, *AFRL Sensors Directorate*

Sharon Donald, *C.S. Draper Laboratory*

B1: Modeling and Simulation 1 — Pikes Peak 1/2

1:40 **1. GIANT/ANEFS CRPA/AE Beam Pointing Upgrades:** G.L. Green, *LinQuest Corporation;* I.M. Weiss, *The Aerospace Corporation;* J. Fitch, *LinQuest Corporation*

2:00 **2. GPS Roll Estimation for Gun-Launched Spinning Projectiles: Hardware-in-the-Loop Simulation and Experimental Validation:** M. Ilg, F. Fresconi, J. Maley, *Army Research Laboratory*

2:20 **3. Combined Simulation and RF Record/Playback Capability for Future Navigation System Studies:** E.T. Vinande, J.L. Campbell, D.T. Venable, *AFRL Sensors Directorate*

2:40 **4. Modeling and Simulation of the GNSS Channel Through the Stochastic Search and Parameterization of Received Signals:** M.E. Haker, J.F. Raquet, *Air Force Institute of Technology*

Alternates

1. Application of the Poisson-Binomial Distribution to the Calculation of GPS Satellite Constellation Reliability: P. Pitoscia, *U.S. Army CERDEC*

2. Design of a JMSRE-Compliant GNSS Instrument for Signal Analysis: J. York, J. Little, S. Nelsen, O. Caldwell, B. Shutt, D. Munton, *ARL, The University of Texas at Austin*

3. Spectrum Sharing or Jamming. How Much is Too Much?: G. Gerten, C. Moyer, *Analytical Graphics Inc.*

Eddy Emile, *GPS Directorate*

Dr. Alex Cerruti, *The MITRE Corporation*

C1: Military GPS Receivers and Military GPS Receiver Technology 1 — Foothills

1:40 **1. Advantages of Dynamically Reconfigurable Software Defined Radios for Military GPS Applications:** A. Brown, D. Reed, J. Sullivan, *NAVSYS Corporation*

2:00 **2. Coherent Carrier Phase in a SAASM-based GPS Receiver:** J. Maenpa, J. Fleming, *Raytheon Space and Airborne Systems*

2:20 **3. Next Generation SWAP Optimized Secure Military GPS Receivers:** D. Minton, N.B. Jarmale, *Mayflower Communications Company, Inc.;* J. Nilsen, *U.S. Army, JPEO JTRS HMS Program and Army WIN-T Program;* A. Ali, B. Brown, *U.S. AFRL/RWAV*

2:40 **4. Design and Performance Analysis of Federated Vector Tracking Architectures:** M. Lashley, *National Technology Associates, Inc.;* D.M. Bevly, *Auburn University*

Alternate

1. NavFest 2011 Receiver Performance Data: B. McCullough, C. Wallace, *Rockwell Collins*

Al Hasselbring, *Honeywell Aerospace*

A2: Micro Navigation Applications — Pikes Peak 3/4

3:40 **1. Controlling Micro Air Vehicles with Piezo-Electric Actuators:** K. Shortelle, *System Dynamics International, Inc.*

4:00 **2. The Boeing Effort Toward Navigation-Grade Integrated Micro Gyroscopes:** W. Snapp, B. Buchanan, J. Popp, A. Hurtado, *Boeing Research & Technology;* D. Challoner, *Boeing Satellite Systems;* R. Kubena, *HRL Laboratories;* M. Huff, *MEMS Exchange;* R. M'Closkey, *UCLA, Los Angeles;* B. Grantham, *U.S. Army AMRDEC;* M. Berarducci, *AFRL Sensors Directorate*

Dr. Vicki LeFevre, *Navigation & Control Technology Weapons*

4:20 **3. milli-HRG Inertial Navigation System: Taking HRG Technology from Space to Terrestrial Applications:** D.M. Rozelle, A.D. Meyer, *Northrop Grumman Electronics Systems International Inc., NSD*

4:40 **4. Precision Navigation and Timing Enabled by Microtechnology: Are We There Yet?:** A.M. Shkel, *DARPA, MTO*

Alternates

1. **Fabrication and Performance of the Stabilized Precision Inertial Navigator (SPIN):** J.F. Kline, M.M. Salamon, D.J. Sullivan, *Research Support Instruments, Inc.*
2. **Development of Time Domain Switched Inertial Technology:** R.L Waters, P. Swanson, *SSC San Diego;* G. Abramov, B. Chisum, *Lumedyne Technologies, Inc.*
3. **Single Chip Inertial Sensor Package Development:** T.D. Hudson, B. Grantham, C. Blankenship, *U.S. Army AMRDEC;* M. Kranz, *CGI/Federal Systems;* M. Whitley, *Engenius Micro, LLC.*

Gary Green, *LinQuest Corporation*

Howard Last, *Institute for Defense Analyses*

B2: Modeling and Simulation 2 — Pikes Peak 1/2

3:40 **1. A Testbed for Positioning with Mixed Signals of Opportunity: Initial Results:** M. Quigley, J. Casper, *Casper Quigley Research, LLC;* T. Nguyen, *AFRL Sensors Directorate;* C. Yang, *Sigtem Technology, Inc.*

4:00 **2. GPS M-code Signal Simulation Using an Open Source Radio Platform:** A.K. Brown, R. Tredway, R. Taylor, *NAVSYS Corporation*

4:20 **3. P-NET: A Navigation/Synchronization Testbed for Spatio-Temporal Lateration Algorithms:** H. Brunk, C. Davidson, *Venture Ad Astra;* J.L. Keener, *AFRL Strategic Systems*

4:40 **4. The GPS System Simulator Architecture – Leveraging Existing Capabilities and Open Standards:** D. Jenks, *Raytheon Company;* C. Gehant, *Braxton Technologies*

Alternate

1. **Application of the Poisson-Binomial Distribution to the Calculation of GPS Satellite Constellation Reliability:** P. Pitoscia, *U.S. Army CERDEC*

Capt. Ammy Cardona, *SMC/ GPEV, GPS Directorate*

C2: Military GPS Receivers and Military GPS Receiver Technology 2 — Foothills

Tenny Sharpe, *The Aerospace Corporation*

3:40 **1. Advantages of M-Code: Overview of War-Fighter Benefits:** J. Anderson, *GPS Directorate;* J. Langer, *The Aerospace Corporation*

4:00 **2. GEM VI CNM Update – Detection and Transmission of Multiple SNM Data Sets:** D.M. Schmitt, *Rockwell Collins*

4:20 **3. Antijam Benefits of High-power Satellite Assisted GPS:** P. Dafesh, E. Valles, P. Massatt, *The Aerospace Corporation*

4:40 **4. Performance of GPS Receivers with Spectrally Equivalent GPS III Signals:** J. Potukuchi, *SAIC;* P. Bauer, *LinQuest Corporation*

Alternate

1. **M-code Vector Tracking with Extended Range Correlator Technology and Multibit Correlation:** C. Zarowski, J. Luo, W.E. Vander Velde, N.B. Jarmale, *Mayflower Communications Company, Inc.;* T. Kawakami, *NGA;* J.G.Coupet, *U.S. Army CERDEC*

PLENARY SESSION

Foothills

Honorable Teresa M. Takai, *Acting Assistant Secretary of Defense for Networks and Information Integration/ DoD Chief Information Officer (Invited)*

General C. Robert "Bob" Kehler, *Commander, U.S. Strategic Command (Invited)*

General William L. Shelton, *Commander, Air Force Space Command (Invited)*

Lieutenant General Ellen M. Pawlikowski, *Commander, Space and Missile Systems Center (Invited)*

Major General John E. Hyten, *Director, Space Programs, Office of the Assistant Secretary of the Air Force for Acquisition*

Rear Admiral Jonathan W. White, *Commander, Naval Meteorology and Oceanography Command*

Brigadier General James H. Doty Jr., *Acting Senior Commander, Ft Carson, Colorado (Invited)*

Informal Lunch with Exhibitors: 12:00 p.m.-1:00 p.m., Exhibit Hall, Colorado Grand Ballroom

Col. Nathan Lindsay Jr., *USAF*

Bill Bollwerk, *U.S. Naval Observatory*

A3: Warfighter Requirements and Solutions — Foothills

1:40 **1. GPS Operations Center (GPSOC) Updates:** B. Barbour, *2SOPS*

2:00 **2. Life Without the Leap Second:** B. Luzum, D. McCarthy, *U.S. Naval Observatory*

2:20 **3. Modernizing the Warfighter Handheld Navigation System:** K.H. McKneely Jr., J.A. McKneely, D. McDonnell, R. Gwinn, M. Anderson, *JHU Applied Physics Laboratory*

2:40 **4. The M-Code 10dB Challenge:** J. Gevargiz, B. Tran, P. Dafesh, W. Lillo, E. Valles, *The Aerospace Corporation;* K. Skey, M. Jeffris, D. Moulin, *The MITRE Corporation;* C. Neidhart, *SAIC*

Alternates

1. **Ultra High Accuracy Reference System Development for Next Generation Navigation Systems Test and Evaluation:** D. Ruff, A. Trunzo, C.D. Morin, *746th Test Squadron*
2. **Honeywell's JPALS Increment I (Sea-Based) Relative Navigation Capability:** J. Syrstad, B. Schipper, L. Mills, C. Cutright, *Honeywell*
3. **Army TACMS Block 1A S-Test Utilization for Inertial Sensor Health Monitoring:** G.W. Kendrick, *Digital Fusion Solutions, Inc.;* S.E. Dudley, *Systems Team, Navigation Technology Function, WDI Directorate, AMRDEC, RDECOM*

Dr. David Taylor, *ENSCO, Inc.*

Dr. Stan Sokolowski, *QED Systems*

B3: Collaborative Navigation Techniques — Pikes Peak 1/2

1:40 **1. High-Precision Low-Latency GPS Carrier-Phase-Based Satellite Orbits, Clocks, and Geophysical Parameters Available from the United States Naval Observatory:** C. Hackman, *U.S. Naval Observatory*

2:00 **2. Collaborative Navigation Technology for Urban and Indoor Environments:** C. Zarowski, N.B. Jarmale, *Mayflower Communications Company, Inc.;* V. Tran, *U.S. Army, CERDEC Command & Control Directorate*

2:20 **3. Collaborative Navigation Using GPS Distributed Aperture Positioning:** A.K. Brown, B.G. Johnson, *NAVSYS Corporation*

2:40 **4. Collaborative Navigation for Distributed Sensing:** J.L. Campbell, D.T. Venable, *AFRL Sensors Directorate*

Alternates

1. **Dual Aircraft Dataset for AFRL Collaborative Robust Integrated Sensor Positioning (CRISP) Effort:** D.T. Venable, J.L. Campbell, *AFRL Sensors Directorate;* F. van Graas, *Ohio University*
2. **M-Code Communications/Navigation Integration:** D. Goldstein, *GPS Directorate;* F. Maurel, *The Aerospace Corporation*

Dr. Inder Gupta, *The Ohio State University*

Jeffry Ross, *The MITRE Corporation*

C3: Military GPS/Antenna Technologies and Interference Mitigation — Pikes Peak 3/4

1:40 **1. J911: The Case for Fast Jammer Detection and Location Using Crowdsourcing Approaches:** L. Scott, *Lonestar Aerospace*

2:00 **2. Ultra-low SWAP Anti-Jam (AJ) GPS Receiver Technology:** R. Siferd, *RBS Technologies, LLC;* K. Green, D. Howell, D. Jacobs, *AFRL Sensors Directorate*

2:20 **3. A Metric for Assessing Multibeam Steering (MBS) Antenna/Antenna Electronics Performance – Point Improvement Factor (PIF):** I. Weiss, *The Aerospace Corporation;* J. DeCoste, *Hughes Design Group*

2:40 **4. Integrated SWAP-Optimized Full Anti-Jam Performance SAASM GPS Receiver:** W. LeComte, N.B. Jarmale, *Mayflower Communications Company, Inc.;* N.J. Gray, *U.S. Army, RDECOM ARDEC*

Alternate

1. **RFI Mitigation for GPS Receivers:** L. Cooper, G. Gallien, C. Smith, *The Aerospace Corporation*

Break in Exhibit Hall — 3:00 p.m.-3:35 p.m.

Ed Powers, *U.S. Naval Observatory*

Ronald Beard, *U.S. Naval Research Laboratory*

A4: Atomic Clocks and Timing Applications — Pikes Peak 1/2

3:40 **1. Investigation of Chip Scale Atomic Clock for Timekeeping Augmentation in a Composite Clock System:** G. Weaver, J. Garstecki, M. Miranian, *JHU Applied Physics Laboratory*

4:00 **2. New Clock Technologies:** P.G. Howe, *AFRL Sensors Directorate;* C. Everson, *Kernco*

4:20 **3. A GPS Laser-Cooled Clock:** M. Weiss, S. Jefferts, T. Heavner, *NIST*

4:40 **4. Micro Ion Frequency Standard:** P.D.D. Schwindt, Y-Y. Jau, H. Partner, L. Fang, A. Casias, K. Wojciechowski, R. Olsson, D. Serkland, R. Manginell, R. Boye, *Sandia National Laboratories;* J. Prestage, N. Yu, *Jet Propulsion Laboratory*

Alternates

1. **Deriving Stratum-1 Time-of-Day and Frequency Using a Pulsed Low-frequency System: Design and Test Results of an eLoran Timing Receiver:** A. Helwig, G. Offermans, C. Stout, *UrsaNav, Inc.*
2. **Time for the DoD:** D. Matsakis, *U.S. Naval Observatory*

Jalal Mapar, *Department of Homeland Security*

Dr. R. James Duckworth, *Worcester Polytechnic Institute*

B4: Navigating in Challenged Environments (e. g., Urban, Indoor and Subterranean) — Foothills

3:40 **1. Enhanced Multi-Sensor Navigation System for GPS Denied Navigation in Urban Environments:** B.A. Schnaufer, *Rockwell Collins*

4:00 **2. Signals of Opportunity Navigation Using Wi-Fi Signals:** W.E. Noel, K.A. Fisher, *Air Force Institute of Technology*

4:20 **3. Velocity- and Range-aided Inertial Measurement for Dismounted Soldier Navigation:** M. Laverne, M. George, D. Lord, A. Kelly, T. Mukherjee, *Carnegie Mellon University*

4:40 **4. Robust Kalman Filter:** J. Karvounis, C. Teolis, *TRX Systems, Inc.*

Alternates

1. **Performance of a DAGR in Urban Canyons:** J. Harlin, J. Miller, *Joint Navigation Warfare Center*
2. **Intelligent Human Motion Labeling and Quantification for Navigation in Limited-GPS or GPS-Denied Conditions:** R. Narayanaswami, D. Diel, A. Gandhe, R.K. Mehra, *Scientific Systems Company, Inc.*

Bob Greenlee, *Joint Navigation Warfare Center, USSTRATCOM*

Albert Trivison, *GPS Directorate, USAF Space Command*

C4: Navigation Warfare — Pikes Peak 3/4

3:40 **1. System-Level Testing of iGPS PNT at 2011 NAVFEST:** J. Oaks, *Naval Research Laboratory;* B. Alvarado, K. Ghassemi, J. Beser, B. Marymee, S. Drexler, J. Ballent, D. Fleiner, P. Stranahan, R. Gerardi, A. Fry, D. Zaferis, K. Murphy, K. Cory, B. Patti, A. Stevens, *The Boeing Company;* I. Miller, A. Nathan, R. Brumley, B. Ledvina, W. Bencze, C. Cohen, *Coherent Navigation, Inc.;* J. Rice, *Iridium Communications;* D. Burch, *Rockwell Collins, Inc.;* D. Koch, D. Boehm, S. Sage, *Naval Research Laboratory*

4:00 **2. A Proposed Methodology for Integrating NAVWAR into Current Exercises:** C. Vaughan, D. Hamilton, T. Rocco, *Joint Navigation Warfare Center*

4:20 **3. Prototype for a Fieldable Navigation Warfare (NAVWAR) Testbed:** D. Dresher, *Northrop Grumman;* S. Mahmood, *AFMC AAC/EB Eglin AFB;* D. Howell, D. Jacobs, *AFRL Sensors Directorate*

4:40 **4. GYPSY Hotel 2: M-Code Receiver Performance:** D. Goldstein, A. Arredondo, P. Massatt, *The Aerospace Corporation*

Alternates

1. **Civilian GPS Signal in Space Enhancements for AntiSpoofing and Location Authentication:** L. Scott, *Lonestar Aerospace*
2. **NAVFEST – A Cost Effective Solution to GPS Vulnerability Testing:** R. Vasta, M. Watson, *746th Test Squadron*

Steve Stockbridge, *AFRL Munitions Directorate*

A5: Missile/Projectile Applications — Pikes Peak 1/2

8:35 **1. Design, Development, and Test of the KEAPS Program Inertial Measurement Unit:** B.E. Grantham, D.W. Tarrant, *Weapons Development and Integration Directorate, AMRDEC;* M.A. Bailey, P.N. Osterc, *NTA Incorporated;* G. Hanson, B. Roberts, *Honeywell Inc.*

8:55 **2. Roll Orientation from COTS Sensors in the Presence of Inductive Actuators:** J. Maley, *U.S. Army Research Laboratory*

9:15 **3. Particle Filter State Estimation Using Inertial Measurement Unit and Nuisance Parameter Estimation for Precision Projectiles:** L.D. Fairfax, F.E. Fresconi, *U. S. Army Research Laboratory*

Christopher E. Roberts, *Weapons Development & Integrated Directorate*

9:35 **4. Satellite Coverage for GPS Receivers Mounted on Spinning Projectiles:** A.S.C. Svendsen, I.J. Gupta, C-C. Chen, *The Ohio State University*

Alternates

1. **An Independent Assessment of MEMS Inertial Measurement Unit (IMU) Performance:** P.B. Renfroe, *U.S. Army AMRDEC;* J.L. Seal, *NTA, Inc.*
2. **Air-to-Air Missile Vector Scoring Using COTS Sensors:** N. Sweeney, K.A. Fisher, *Air Force Institute of Technology*
3. **SDI500 IMU Performance Testing Conducted At AMRDEC WDI Navigation Laboratories:** S.J. Pethel, *NTA Incorporated;* D.W. Tarrant, C.B. Blakenship, B.E. Grantham, *Weapons Development and Integration Directorate, AMRDEC;* C.T. Hughes, *NTA Incorporated*

Dr. Jeff Dickman, *Northrop Grumman*

B5: Alternative Navigation Technologies (Vision) — Foothills

8:35 **1. Results from LADAR EO GPS/INS Atomic-Clock Navigation Demonstration (LEGAND) Testing and Demos:** J.L. Campbell, D.T. Venable, *AFRL Sensors Directorate;* J.T. Dickman, *Northrop Grumman;* B. Mohr, *Honeywell*

8:55 **2. Soldier Affixed, Vision Aided Navigation Technology (SAVANT), Part 1:** R. Madison, P. Lommel, G. Angelosanto, *C.S. Draper Laboratory*

9:15 **3. A General Framework for Trajectory Optimization with Respect to Multiple Measures:** D.D. Diel, R.E. Smith, *Scientific Systems Company;* J. Touma, *U. S. Air Force Research Laboratory;* N. da Vitoria Lobo, O. Oreifej, *University of Central Florida*

Donald Venable, *AFRL Sensors Directorate*

9:35 **4. EO Camera and Lidar Measurements for Autonomous Aerial Refueling Operations:** M. Smearcheck, T. Pestak, J. Kresge, J. Raquet, K. Fisher, *Air Force Institute of Technology*

Alternates

1. **Image-Aided Navigation Applied: Wide Area Sensing:** D.T. Venable, J.L. Campbell, *AFRL Sensors Directorate;* J. Raquet, *AFIT/ENG;* M. Veth, *U.S. Air Force 46th Range Group*
2. **Bayesian Visual-Inertial Odometry:** J.L. Center, Jr., *Autonomous Exploration, Inc.*

Michael Harms, *RTLogic*

C5: Military GPS Use and Experiences — Pikes Peak 3/4

8:35 **1. Utilization of LOCAITS in Department of Defense RDT&E Environments:** T. Prohaska, J. Beene, *U.S. Army;* T. Collins, *ERC*

8:55 **2. Advanced Military SAASM Testing in the SAT-CAVE:** J. Killian, E. Thompson, C. Broughton, *746th Test Squadron, Holloman AFB NM*

9:15 **3. Military GPS Augmentation:** A.G. Evans, J.P. Cunningham, *Naval Surface Warfare Center Dahlgren Division*

Greg Kohls, *ASC Combat Electronics Division*

9:35 **4. The UHARS Non-GPS Based Positioning System:** A. Trunzo, P. Benshoof, *746th Test Squadron, Holloman AFB;* N. Gambale, *Locata Corporation, Australia*

Alternate

1. **GPS Testing at the Electromagnetic Vulnerability Assessment Facility:** P.B. Simpson, *U.S. Army ARL/SLAD/IEPD*
2. **Navigation Warfare Research at AFRL Sensors Directorate:** D. Howell, D. Jacobs, P. Geraci, *AFRL Sensors Directorate*

Break in Exhibit Hall — 10:00 a.m.-10:30 a.m.
Compliments of NAVSYS

Eric F. Edwards, *U.S. Army AMRDEC*

A6: Land Applications — Pikes Peak 1/2

10:35 1. The Far Target Location Improvement Program and the U.S. Army's Path Forward: J. Miller, *Night Vision & Electronic Sensors Directorate;* N. Mathur, *EOIR*

10:55 2. Far Target Location Demonstration Results: P. White, *U.S. Army AMRDEC;* K. Peake, *Navigation Technology Associates, Inc.;* G. Graham, *U.S. Army AMRDEC*

11:15 3. Short Distance Ground Wave Propagation Modeling in Irregular and Forested Environments: Z.M. Crane, P.B. Crilly, *University of Tennessee/Oak Ridge National Laboratory;* S.F. Smith, *Oak Ridge National Laboratory*

Dr. Mikel Miller, *AFRL Munitions Directorate*

11:35 4. Precision Cooperative Tracking in GPS-Limited Environments: J. Torgerson, A. Reiter, P. Sherman, M. McManus, T. Esterrich, K. Houston, J. Scudiere, *C.S. Draper Laboratory*

Alternates

1. **Honeywell Light Weight North Finding (LWNF) System Latest Test Results and Next Phases:** A. Hasselbring, *Honeywell Aerospace – Defense and Space*
2. **Low-Cost Jam-Resistant INS/GPS Multi-Sensor Land Navigation System:** T. Suita, *KVH Industries Inc.*

Dr. Jacob Campbell, *AFRL Sensors Directorate*

Dr. Timothy Klausutis, *Air Force Research Laboratory*

B6: Alternative Navigation Technologies (RF) — Pikes Peak 3/4

10:35 1. PTAN – Technological Capabilities: W. Hawkinson, *Honeywell*

10:55 2. Feasibility Study of Integrating High-Precision RF Ranging with JTRS HMS Radios: C. Foster, B. D. Farnsworth, S. Sayed, D. W. A. Taylor, *ENSCO, Inc.*

11:15 3. WPI Precision Personnel Locator System – Inertial Filtering for Improved Positioning Accuracy in Challenging RF Environments: M. Lowe, A. Cavanaugh, D. Cyganski, R.J. Duckworth, *Worcester Polytechnic Institute*

11:35 4. Low Frequency (LF) Solutions for Alternative Positioning, Navigation, Timing, and Data (APNT&D): A. Helwig, G. Offermans, C. Schue, *UrsaNav, Inc.;* B. Walker, T. Hardy, K. Zwicker, *Nautel, Inc.*

Alternates

1. **Cooperative Navigation Using Wideband Cellular Waveforms:** H. Sridhara, M. Enright, *Quantum Dimension;* T. Nguyen, *AFRL Sensors Directorate*
2. **Multipath-Resistant Ultrawideband Range Measurement and Range Noise Estimation for Navigation Aiding Through Pulse Signature Analysis:** B. Beeler, B. Dewberry, J. Johnson, *Time Domain*

Lt. Col. Jennifer Grant, *2nd Space Operations Squadron (2SOPS)*

Capt. Frank Parker, *U.S. Coast Guard*

C6: GPS in Military Applications — Foothills

10:35 1. Enabling NAVWAR through OCX Netcentricity: C.A. Corwin, W.A. Al-Masyabi, *Raytheon Company*

10:55 2. Development and Demonstration of a GPS Situational Awareness Implementation: E. Hogan, *U.S. Army AMRDEC;* J. Rhea, *NTA, Inc.*

11:15 3. Global Positioning System (GPS) Operational Mission Planning: A.M. Trivison, *USAF AFSPC SMC/GPE;* K.N. Duby, *USAF USSTRATCOM JFCC SPACE/J33;* T. Ochi, A. Everspaugh, *ARINC*

11:35 4. Robust Alternate Position Navigation and Time (APNT) Systems to Support Aviation Communications, Navigation, and Surveillance: M. Narins, L. Eldredge, *U.S. Federal Aviation Administration;* P. Enge, *Stanford University;* M. Harrison, R. Kenagy, *Aviation Management Associates;* S. Lo, *Stanford University*

Alternate

1. **JLOC Android Application for GPS Interference Detection and Effects Situational Awareness:** A. Brown, D. Vollmer, R. Edwards, *NAVSYS Corporation*

Dr. Navin Mathur, *U.S. Army Material Command, EOIR Directorate*

Dr. David Bevly, *Auburn University*

A7: MEMS Inertial Measurement Units — Pikes Peak 1/2

1:40 **1. Navigation Grade Integrated Micro-Gyroscope (NGIMG) Phase III Independent Evaluation Results:** B. Grantham, C. Blankenship, *U.S. Army AMRDEC;* M. Bailey, *Navigation Technology Associates, Inc.*

2:00 **2. Near Term, Low Cost- SWaP Navigation, Position and Control- 6 DOF MEMs INS:** K. Shcheglov, D. Smukowski, M. Inbar, *Sensors in Motion*

2:20 **3. Development of a Single-Chip MEMS Gyrocompass:** A.A. Trusov, I.P. Prikhodko, S.A. Zotov, B.R. Simon, *University of California - Irvine;* L.G. Andrade, C.A. Ward, *Naval Surface Warfare Center Dahlgren;* A.M. Shkel, *University of California - Irvine/DARPA*

2:40 **4. Development of a Single Chip 6 DOF MEMS IMU for Robotic and UV Navigation:** R.M. Boysel, T.E. Fiscus, L.J. Ross, *Virtus Advanced Sensors, Inc.*

Alternates

1. **Low Size, Weight and Power Environmental Resistant Packaging (ERP) for High Performance MEMS Sensors and Systems:** J. Mitchell, *ePack, Inc.;* A. Borna, *University of Michigan;* S.W. Lee, *ePack, Inc.*
2. **In-situ Calibration Technique of an Optical MEMS Accelerometer and Its Application to Azimuth Sensing:** R.L. Waters, *SSC Pacific;* M.S. Fralick, G. Abramov, B. Chisum, *Lumedyne Technologies Incorporated*

James Doherty, *Institute for Defense Analyses*

David Lyon, *Army Research Laboratory*

B7: Alternative Navigation Technologies (Natural Occurring Phenomena) — Pikes Peak 3/4

1:40 **1. Compact Atomic Magnetometer for Global Navigation:** M.D. Bulatowicz, M.S. Larsen, *Northrop Grumman, NSD*

2:00 **2. Gravity Gradiometer Integrated Passive Precise Aircraft Navigation:** T.C Welker, R.E. Huffman, Jr., M. Pachter, *Air Force Institute of Technology*

2:20 **3. Modeling of Magnetic Fields for Applications on Precision Munitions:** M. Hamaoui, T.E. Harkins, *Army Research Laboratory*

2:40 **4. A Low-Cost Orientation Estimator for Smart Projectiles Using Thermopiles and Magnetometers:** J. Rogers, M. Costello, *Georgia Institute of Technology*

Alternates

1. **Magnetic Navigation in GPS-denied, Improved Environments:** J. Zellner, C. Davis, *Raytheon, UTD*
2. **A Closed-Form Position and Velocity Solution for Angles-Only Navigation:** G.H. Kaplan, *Consultant to U.S. Naval Observatory*

Gary Rafferty, *Braxton Technologies, LLC*

Maj. Wynn Sanders, *USAF SMC/ GPUG*

C7: GPS Modernization — Foothills

1:40 **1. GPS Block IIR Modernized Services to the Warfighter:** W. Marquis, J. Burdick, *Lockheed Martin Space Systems Company;* J. Harvey, *ITT Geospatial Systems;* M. Forsyth, *Infinity Systems Engineering*

2:00 **2. GPS OCX Program Overview/Update:** R.N. Canty, *Raytheon Company*

2:20 **3. On the Intrinsic Jamming Robustness, Accuracy and Adaptability of M Code:** P.W. Ward, *Navward GPS Consulting;* W.E. Lillo, *The Aerospace Corporation*

2:40 **4. Investigation of User Position Error Prediction and Navigation Upload Management for the GPS Mission Control Station:** N. Collins, *Air Force Institute of Technology*

Alternates

1. **Application of Global Differential GPS in High Dynamic Environments:** P. Hwang, H. Phan, S. Aab, G. McGraw, E. Bolte, *Rockwell Collins*
2. **Early MNAV Opportunities:** T. Sharpe, *The Aerospace Corporation*

Break in Exhibit Hall — 3:00 p.m.-3:35 p.m.

CDR John Kennard, *Joint Navigation Warfare Center, USN*

LTC James Bamburg, *Aviation Mission Equipment, US Army*

A8: Aviation Applications — Pikes Peak 1/2

3:40 **1. Joint Precision Approach and Landing System (JPALS):** E.P. Brown, *PMA213 Naval Air Traffic Management Systems Program Office/Raytheon/Rockwell Collins/Coherent Technical Solutions, Inc.*

4:00 **2. Evaluating JPALS Availability with Different Glide Path Angle and Ground Station Location Under Jamming Environment:** D.K. Zhao, B.R. Peterson, *ARINC*

4:20 **3. Effects Nulling and/or Beamsteering on GPS Measurement Quality:** J. Fleming, J. Maenpa, *Raytheon Space and Airborne Systems*

4:40 **4. Honeywell's Next Generation EGI:** M. Ignac, B. Van Nortwick, *Honeywell*

5:00 **5. Geo-registration Improvements of a Wide Area Sensing Aircraft:** C. Cohenour, F. van Grass, *Ohio University;* D.T. Venable, S. DeVilbiss, J.L. Campbell, *AFRL Sensors Directorate*

Alternates

1. **High Performance Fiber Optic Gyroscope with Noise Reduced Source:** W.K. Burns, G. Dillon, V. Scalesse, J. Prince, *Photonic Systems, Inc.;* J.C. Ha, *Air Force Research Laboratory*
2. **A New Guidance Algorithm for Aviation and Sailing:** C.P. Gilbertson, *AMRDEC/SED*

Dr. Stefanie Tompkins, *DARPA*

Dr. Bernard Schnaufer, *Rockwell Collins*

B8: Robust Navigation Systems/Solutions — Pikes Peak 3/4

3:40 **1. Adaptable Navigation Systems:** S. Tompkins, *DARPA*

4:00 **2. Ultra-Weak GPS Signal Processing Using a SAASM Receiver:** A. Brown, S. Stankevich, *NAVSYS Corporation*

4:20 **3. Vector Tracking Divergence Criteria:** B.J. Clark, D.M. Bevly, *Auburn University*

4:40 **4. Sferics-Based Underground Position Estimation:** D. Watters, D. Bubenik, *SRI International;* F. Dowla, *Lawrence Livermore National Laboratory;* D. Ceperley, J. Poplawski, *SRI International*

5:00 **5. Cold Atom Inertial Sensors for Precision Navigation:** B. Young, A. Black, M. Boyd, B. Dubetsky, T. Gustavson, L. Hollberg, *AOSense, Inc.;* M. Kasevich, *AOSense, Inc./Stanford University;* T. Loftus, M. Matthews, J. Pease, F. Roller, P. Studt, T. Tran, A. Vitouchkine, A. Zorn, *AOSense, Inc.*

Alternate

1. **Extreme Fade GPS: Acquisition to 10 dB-Hz Levels and Below:** K.M. Houston, *C.S. Draper Laboratory*

Capt. John Taylor, *USAF 2SOPS*

Chaz Bowman, *LinQuest Corporation*

C8: GPS Constellation Performance — Foothills

3:40 **1. Net-Assisted TTFF Improvement for M-Code Capable and Civil GPS Receivers:** E. Shokri, J. Fedor, C. Yu, C. Kong, A. Wu, P. Li, *The Aerospace Corporation*

4:00 **2. LightSquared Status:** J. Deifel, *GPS Directorate/System Verification Branch*

4:20 **3. 2nd Space Operations Squadron (2SOPS) Command Update:** J. Grant, *2nd Space Operations Squadron Command*

4:40 **4. Verifying GPS Performance Against the PPS Performance Standard:** B.A. Renfro, A. Farris, D. Munton, J. Little, *APL/The University of Texas at Austin*

5:00 **5. GPS QoS Under The GAO 2010 Constellation Forecast: What The GAO Report Should Also Have Said:** J. McGowan, P. Pitoscia, *U.S. Army CERDEC;* S. Sokolowski, *QED Systems*

JNC 2011 CLASSIFIED DAY AGENDA

Buses Depart Crowne Plaza Hotel **7:15 a.m.**

Security Validation/Entry Control **7:45 a.m. – 8:30 a.m.**

Opening Remarks: Mr. West Kasper, JNWC **8:30 a.m. – 8:45 a.m.**
Administrivia: Mr. Scott Mudge, JNWC
Security: Ms. Gloria Dumone, JNWC

West Kasper, *JNWC*

A9: Adversary Developments in NAVWAR 8:45 a.m. – 9:15 a.m.

8:50 1. NAVWAR Threat

A10: NAVWAR Testing 9:15 a.m. – 11:25 a.m.

9:15 1. JNWC GYPSY HOTEL 2 Trial Methodology and Preliminary Results: J. Harlin, *Joint Navigation Warfare Center*

9:40 2. Gypsy Hotel 2: Threat Emulation and Experimentation: K. McDonald, M. Fitzgibbons, D. Shultz, A. Cerruti, *The MITRE Corporation;* A. Arredondo, *The Aerospace Corporation;* R. Kurtz, *Overlook Systems Technologies, Inc./Joint Navigation Warfare Center*

Break: 10:05 a.m.-10:35 a.m.

10:35 3. Small Antenna System Program Overview and Way Forward: I. Weiss, *The Aerospace Corporation;* J. DeCoste, *Hughes Design Group*

11:00 4. Overview of the MAGNET Receiver + Testing of an M-Code Receiver in Realistic Jamming Environments: A. Choy, P. Dafesh, *The Aerospace Corporation*

Informal Luncheon for Classified Session Attendees: 11:30 a.m. – 12:45 p.m.

James Doherty, *Institute for Defense Analyses*

Dr. Mikel Miller, *AFRL Munitions Directorate*

PANEL DISCUSSION 12:45 p.m. – 2:45 p.m.

Warfighter Cross Talk: James Doherty, *Institute for Defense Analyses;* Dr. Mikel Miller, *AFRL Munitions Directorate*

"Cross Talk" is an interactive discussion with war fighters who have had recent operational experience that informs the navigation development community on how to better formulate military navigation systems. Panel members will make an opening statement on how current navigation systems are meeting the needs of their missions, followed by questions from the audience. Confirmed Panel Members as of May 31, 2011:

Major John Krellner, USAF, F-22 Pilot
Major Winston Lee, USAF, A-6 Aircraft
Major Frank Kinkaid, USAF, Space Liaison
Major Chris Ortiona, USA, Infantry

Break: 2:45 p.m.-3:15 p.m.

continued ☛

JNC 2011 CLASSIFIED DAY AGENDA (con't.)

West Kasper, *JNWC*

A11: Flexibility in NAVWAR 3:15 p.m. – 5:20 p.m.

3:15 **1. Estimation and Prediction of Orbits and Clocks to High Accuracy (EPOCHA):** C.F. Minter, S.J. Rubbelke, H.I. Young, S.P. Simmons, D.M. Manning, P.D. Kopcha, R.L. Staker, *National Geospatial-Intelligence Agency;* E.R. Swift, J.B. Lundberg, M.J. Merrigan, *Naval Surface Warfare Center, Dahlgren Division*

3:40 **2. M-Code Receivers: The Way Forward:** J. Anderson, *GPS Directorate;* T. Sharpe, *The Aerospace Corporation*

4:05 **3. Improving the Security and Safety of PNT Based Applications and Critical Infrastructure by Detecting and Locating Sources of Interference to Global Navigation Satellite Systems (GNSS):** A. Proctor, *Chronos Technology Limited, UK*

4:30 **4. Determination of the MGUE Blue Force Electronic Attack Operational Environment:** E. Kaplan, D. Moulin, *The MITRE Corporation;* J. Wollam, *LinQuest Corporation;* J. Lortie, *Independent Consultant*

4:55 **5. Flex Power Observations from Fortune Hawk:** J. Harlin, N. Corea, S. Vincent, *Joint Navigation Warfare Center*

Alternate

1. Operational Performance Observations of the Defense Advanced GPS Receiver (DAGR): J. Harlin, N. Corea, J. Aldrich, *Joint Navigation Warfare Center*

Closing Remarks 5:20 p.m. – 5:30 p.m.

Bob Greenlee, *Joint Navigation Warfare Center*

Paul Olson, *JNC General Chair*

Buses Load 5:35 p.m.

The classified session will be held at the Elkhorn Catering and Conference Center located at 1725 Woodfill Road, Building 7300, Ft Carson, CO 80913. Shuttle Buses will be provided from the Crowne Plaza.

Driving Directions from Crowne Plaza to Elkhorn Catering & Conference Center:

1.	Head west on S. Circle Dr.	0.1 mi
2.	Turn left to merge onto I-25 S	2.2 mi
3.	Take exit 135 for CO-83 S	0.3 mi
4.	Merge onto S Academy Blvd.	1.8 mi
5.	Take State Highway 115 South Pass the Ft Carson Gate #2 exit. After approximately two miles, Ft Carson Gate #1 will be on the left	2.0 mi
6.	Turn left at Nelson Blvd.	0.3 mi
7.	Slight right to stay on Nelson Blvd.	292 ft
8.	Continue onto Harr Ave.	0.2 mi
9.	Turn left at Prussman Ave.	0.2 mi
10.	Turn right at Mekong St.	0.4 mi
11.	Turn left at Woodfill Rd.	

Note: In order to gain access to Ft Carson, all attendees should report to Gate #1 (Nelson Blvd.) on Highway 115 for a vehicle pass. You must show a valid driver's license, vehicle registration, proof of insurance (required) and valid photographic identification to gain access.

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NOTES

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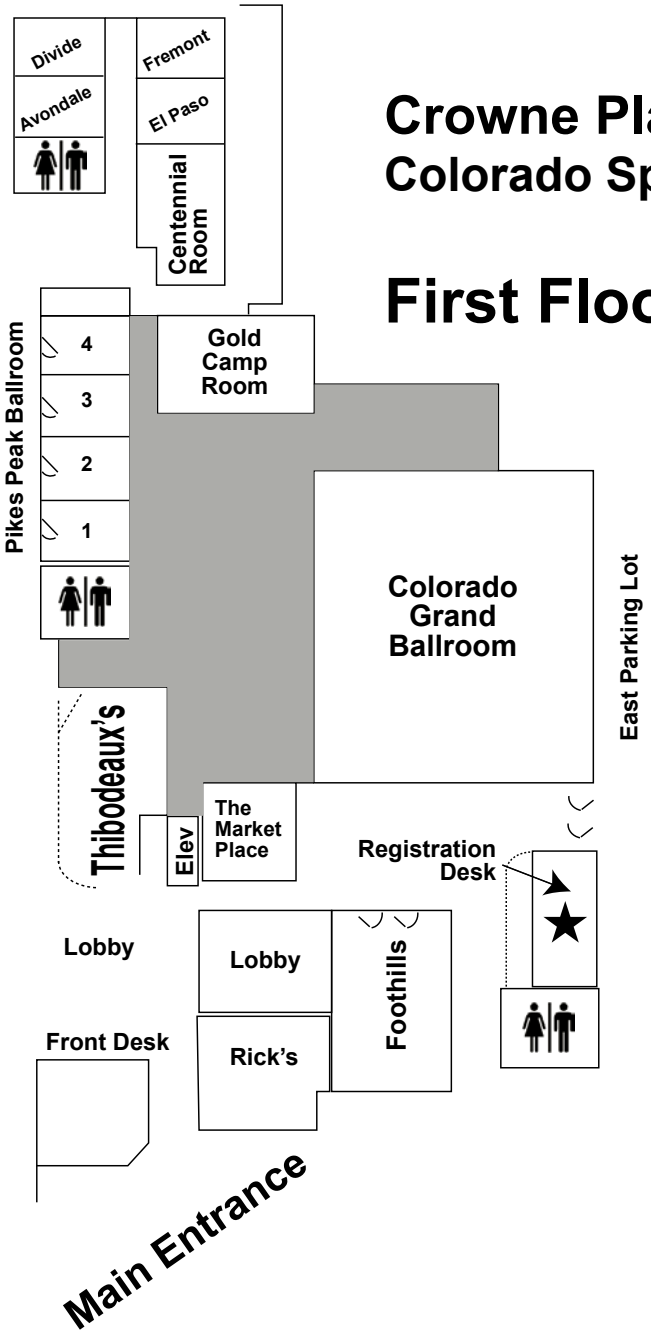
First Floor Layout



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