Nineteenth Annual Directed Energy Symposium
Technical Program

13 - 16 February 2017
Huntsville, Alabama
General Information

Security
- Attendees will be issued conference specific badges on site and must have valid government ID available at all Symposium events
- Wireless electronic devices are prohibited in classified sessions
- No note taking in any classified facility
- Classified discussions and sensitive unclassified discussions are restricted to designated meeting rooms only
- No cameras or photography allowed
- Audio and video recording is prohibited
- Security concerns should be addressed to a DEPS Security Team member
- Failure to adhere to security standards could result in denied/revoked Symposium registration and your information forwarded to authorities

Buses
Although the offsite location is within walking distance, buses will be available to transport to and from each location approximately every 20 minutes and will end service 15 minutes after the last talk completes. Do not bring cell phones, laptops, or notebooks on the bus. DEPS staff will not be responsible for your items.

Bus schedule:
Wednesday: 0730 to 1730

Please note: The buses will not be able to travel back to the hotel from the offsite facility after the final speaker begins. Drivers are required to remain available for the entire groups departure and cannot be pulled away for just a few. Those that are not on the buses immediately following the last presentation will be responsible for their own taxi ride back to the hotel.

DE Systems Symposium
25 - 29 September 2017
Monterey, California
**TUESDAY MORNING**

**Plenary Session**
Westin Hotel Mediterranean Ballroom (Open)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>0800</td>
<td>Breakfast and Registration at Westin</td>
</tr>
</tbody>
</table>
| 0815  | Welcome Statement
*Dr Brian Strickland*, SMDC and
*Mr Peter Weiland*, Radiance Technologies |
| 0830  | Representative Mo Brooks
5th Congressional District, Alabama                                   |
| 0900  | **RADM Mike Manazir**
US Navy, Chief of Naval Warfare Systems
(OPNAV N9)                                                            |
| 0930  | **Brigadier General Tom Wilcox**
USAF, Chief of Plans & Programs, AF Global Strike Command              |
| 1000  | **Break**                                                              |
| 1020  | **Mr Thomas E. Webber**
Director, Space and Missile Defense Technical Center                  |
| 1050  | **Mr Richard Matlock**
Program Executive for Advanced Technology, Missile Defense Agency     |
| 1120  | **Dr David Burns**
Director of Science & Technology, NASA Marshall Space Flight Center   |
| 1200  | **Lunch**                                                              |
| 1245  | **DEPS Fellows Recognition Ceremony**                                   |

---

**TUESDAY AFTERNOON**

**DE Systems and Programs**
Westin Mediterranean Room III (Limited/Open)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 1300  | **Status of USMC Directed Energy Weapon Review and Approval Process (DE Weapon RAP)** (D)
*Stuart Shoppell*, Naval Surface Warfare Center, DD |
| 1330  | **Ground Based Air Defense (GBAD) Directed Energy (DE) On-the-Move (OTM) Program Overview** (D)
*Jorge Hernandez*, Naval Surface Warfare Center Dahlgren Division |
| 1400  | **Joint Laser Deconfliction and Safety System Test Program** (F)
*James Latourell*, Naval Surface Warfare Center-Dahlgren Division |
| 1430  | **Break**                                                              |
| 1500  | **Integration and System Readiness Level Tools for Technology Transition** (C)
*Sean Ross*, AFRL/RDLA |
| 1530  | **High Energy Laser Mobile Test Truck (HELMTT) Participation in the Maneuver Fires Integration Experiment 2016** (C)
*Adam Aberle*, US Army SMDC/ARSTRAT |
| 1600  | **Military Applications of Laser Power Beaming** (A)
*Tom Nugent*, LaserMotive |
| 1630  | **Fielding Operationally Viable Directed Energy Weapons** (A)
*David Stoudt*, Booz Allen Hamilton, Inc. |
| 1730  | **Exhibitor Reception and Poster Session**                              |

---

Tour of NASA Marshall Space Flight Center
Friday, 17 February 0800-1200
See page 24 for details
HPM Systems, Technologies and Effects
Mediterranean Room IV (Limited/Open)
Chair: Ryan Hoffman, Navy
1300  Miniaturization and Performance Enhancement of Ferrite NLTL HPRF Sources Through Simulation and Measurement (D) Michael Geiler, Metamagnetics Inc.
1330  Order of Magnitude Reduction of the Volume and Weight of a High Power Helical Antenna Array with Dielectric Loading (D) Kevin O’Connor, NanoElectromagnetics LLC
1400  Computational Electromagnetic Modeling and RF Characterization of Broadband Radiation Generation by Excitation of Superconducting and Cu-based Loop Antennas (C) Timothy Haugan, The Air Force Research Laboratory
1430  Break
1500  Solid State Active Denial Technology (SS-ADT) W-Band Demonstration System and Related W-Band Research Initiatives (C) Thomas Shadis, US ARMY RDECOM-ARDEC
1530  Solid State High Power RF Short Pulse Array In-Air Power Combining (C) Shawn Higgins, NAWCWD
1600  Tunable Broadband GHz/THz Electromagnetic Radiation Generated Via Ultrafast Laser Pulsing of Inductively Charged Superconducting Antennas (A) Timothy Haugan, The Air Force Research Laboratory
1630  ICEPIC Simulations of CPI BMD’s S-Band VMS-1143B Magnetron (A) Andrey Andreev, Booz Allen Hamilton
1730  Exhibitor Reception and Poster Session

HEL Effects
Westin Mediterranean Room V (Limited/Open)
Chair: Chuck Lamar, USASMDC/ARSTRAT
1300  Solid State Laser Testbed Dynamic Scoring System: Recent Upgrades and Performance Results (D) Daniel Duffin, Radiance Technologies
1330  Summary of Fiberglass Testing (D) Allan Westenhofer, Radiance Technologies
1400  HEL Lethality of Carbon Fiber Materials (F) Fabiola Lopez, US Army Space and Missile Defense Command
1430  Break
1500  High Energy Laser Weapon Performance Measurement in Dynamic Engagements (C) Charles LaMar, USA SMDC
1530  Generic Small-UAV Lethality Target - the Mallard (C) Allan Westenhofer, Radiance Technologies
1600  Laser Induced Damage Measurements on Silica Windows with Antireflective Surface Structures at 1064 nm (A) Lynda Busse, Naval Research Laboratory
1730  Exhibitor Reception and Poster Session

Book Signing
Laser Weapon Development at Redstone Arsenal, 1960-2015
Author Ronald Miller will sign copies of his book near the DEPS booth during the Exhibitors Reception on Tuesday Evening
### TUESDAY AFTERNOON

#### Student Session

**Mediterranean Room II (Limited/Open)**

- **Chair:** Doug Nelson, USASMDC/ARSTRAT

#### 1300 Objective Architecture for Tactical Energy Management of Directed Energy Weapons (D)

*Bonnie Johnson,* Naval Postgraduate School

#### 1330 A Systems Engineering Approach to the Employment of High Energy Lasers (HELS) in a Multi-Platform Engagement Scenario (D)

*Bonnie Johnson,* Naval Postgraduate School

#### 1400 SBS Investigations of an All-Solid Ytterbium-doped Photonic Bandgap Fiber Amplifier (A)

*Cody Mart,* Air Force Research Laboratory

#### 1430 Break

#### 1500 Novel Concepts for Slow Wave Structures used in High Power Backward Wave Oscillators (A)

*Ushemadzoro Chipengo,* Electroscience Lab, The Ohio State University

#### 1530 Electrical Characterization of Lightweight Nanocarbon Materials for High Energy Laser Positional Sensor (HELS) Applications (A)

*Andrew Jevitt,* United States Naval Academy

#### 1600 Atmospheric Optical Turbulence: Model Comparison and Relative Terrestrial Influence on Diurnal Trends in a Range of Maritime Environments (A)

*William Bourque,* United States Naval Academy

#### 1730 Exhibitor Reception and Poster Session

### TUESDAY EVENING

#### Limited Distribution Poster Session

**Westin Mediterranean Room I (Limited)**

- **ABLE-ETS System Architecture (D)**
  *Robert Pawlak,* NSWC

- **Unmanned Aerial System (UAS) Vulnerabilities to High Power Radio Frequency (HPRF) (D)**
  *Francis Baylon,* U.S. Army RDECOM-ARDEC

- **Thermal Management Challenges in Integrating Laser Weapon Systems (C)**
  *Sean Ross,* AFRL/RDLA

- **Integration and System Readiness Level Tools for Technology Transition (C)**
  *Sean Ross,* AFRL/RDLA

- **Status of Cryogenic/Superconducting Components for MW-Class Electric Power Systems (C)**
  *Timothy Haugan,* The Air Force Research Laboratory

#### Open Poster Session

**Westin Prefunction Area (Open)**

- **Millimeter Wave Radar for Atmospheric Turbulence Characterization and Wind Profiling for Improved Naval Operations (A)**
  *Bahman Hafizi,* Naval Research Laboratory

- **High Strength Microwave Sintered Transparent Ceramics for HEL Systems (A)**
  *Ben Rock,* U.S. Naval Research Laboratory

- **Metrology and Calibration (METCAL) for Navy Laser Weapons: The Need and Importance (A)**
  *Subrata Sanyal,* Naval Surface Warfare Center

- **Metrology and Calibration (METCAL) for Navy Laser Weapons: NSWC Corona Efforts (A)**
  *Subrata Sanyal,* Naval Surface Warfare Center

- **Overview of SiC High-Voltage Switch Development and Evaluation at the U.S. Army Research Laboratory (A)**
  *Heather O’Brien,* U.S. Army Research Laboratory

- **Atmospheric Optical Turbulence: Model Comparison and Relative Terrestrial Influence on Diurnal Trends in a Range of Maritime Environments (A)**
  *William Bourque,* United States Naval Academy
### Beam Control Systems and Technology
Westin Mediterranean Room IV (Limited/Open)
Chair: Jenny Niles, USASMDC/ARSTRAT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700</td>
<td>Breakfast and Registration at Westin</td>
<td></td>
</tr>
<tr>
<td>0800</td>
<td>Synthetic Scene Generation of Actively Illuminated Targets (D)</td>
<td>Jonathan Stohs, Air Force Research Laboratory/RLDL</td>
</tr>
<tr>
<td>0830</td>
<td>DAFHI (Dynamic Acquisition for HEL Integration): Update (D)</td>
<td>Timothy Wolfe, Air Force Research Laboratory, Laser Technology Branch</td>
</tr>
<tr>
<td>0900</td>
<td>Evaluation of Two State-of-the-Art Inertial Reference Units (D)</td>
<td>Evan Threlkeld, Air Force Research Laboratory</td>
</tr>
<tr>
<td>0930</td>
<td>Adaptive Optics Research and Capabilities at the Starfire Optical Range (C)</td>
<td>Michael Steinbock, Air Force Research Laboratory/RDSS - Starfire Optical Range</td>
</tr>
<tr>
<td>1000</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>1030</td>
<td>ABCD Wave-Optics Modeling Progress and Updates (C)</td>
<td>Michael Steinbock, Air Force Research Laboratory/RDSS - Starfire Optical Range</td>
</tr>
<tr>
<td>1100</td>
<td>Modeling Coherence Reduction in a Light Pipe via Coherent Mode Representations (D)</td>
<td>Robert Raynor, Air Force Research Laboratory/RDLT</td>
</tr>
<tr>
<td>1130</td>
<td>Modelling Waveguide Generated Mitigation of Speckle on an Actively Illuminated Target (A)</td>
<td>Trevor Moore, Air Force Research Laboratory</td>
</tr>
<tr>
<td>1200</td>
<td>Lunch</td>
<td></td>
</tr>
</tbody>
</table>

### HEL Technology 1
Westin Mediterranean Room III (Open/Limited)
Chair: Brett Hokr, USASMDC/ARSTRAT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700</td>
<td>Breakfast and Registration at Westin</td>
<td></td>
</tr>
<tr>
<td>0800</td>
<td>Evolution of Super-High Efficiency Fiber-Coupled Sources (SHEFS) for All-Fiber MOPAs (A)</td>
<td>Aland Chin, Somerville Laser Technology, LLC</td>
</tr>
<tr>
<td>0830</td>
<td>Measurement of Critical for Damage Temperatures in Gain Medium of Operating DPAL (A)</td>
<td>Boris Zhdanov, Air Force Academy</td>
</tr>
<tr>
<td>0900</td>
<td>Unstable Resonator Design for Diode Pumped Alkali Lasers (A)</td>
<td>Glen Perram, Air Force Institute of Technology</td>
</tr>
<tr>
<td>0930</td>
<td>Pump-Probe Spectroscopy of Argon in a High Pressure Capacitively Coupled Discharge (A)</td>
<td>Ben Eshel, Air Force Institute of Technology Department of Engineering Physics</td>
</tr>
<tr>
<td>1000</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>1030</td>
<td>Characterization of a Diode Pumped Akali Laser with a Flowing Gain Medium (D)</td>
<td>Paul Moran, Air Force Research Laboratory/RDLTD</td>
</tr>
<tr>
<td>1100</td>
<td>Transient and Steady State Thermal Characterization of High Energy Laser Beam Dissipation in Turbulent Fluid Media (C)</td>
<td>Andrew Hall, Kratos Defense and Security Solutions</td>
</tr>
<tr>
<td>1130</td>
<td>3 kW Single Mode Coherently Combined and Switched All-Fiber Source (D)</td>
<td>Joshua Rothenberg, Northrop Grumman Aerospace Systems</td>
</tr>
<tr>
<td>1200</td>
<td>Lunch</td>
<td></td>
</tr>
</tbody>
</table>
Beam Propagation 1
Westin Mediterranean Room V (Limited/Open)
Chair: Amanda Black, USASMDC/ARSTRAT
0800 CFD Simulations of Advanced Turret Concept at Off-Design Conditions With and Without Flow Control (D)
David Weston, Air Force Research Laboratory - Aerodynamic Technology Branch
0830 Computational Study of Flow Control Techniques for Canonical Turret Configuration with Enhanced Geometric Resolution (D)
Michael Frede, Air Force Research Laboratory/RQVA
0900 Laboratory Generation of Aero-Optics Turbulence to Simulate a Slewing Airborne Turret (C)
David Dayton, Applied Technology Associates
0930 Multiple Aperture Approach to Wavefront Prediction for Adaptive-Optic Applications (A)
Matthew Kemnetz, University of Notre Dame

Power and Thermal for DE 1
Westin Mediterranean Room II (Limited)
Chair: Kenya Lynch, USASMDC/ARSTRAT
0700 Breakfast and Registration at Westin
0800 Experimental Study of Ice Thermal Energy Storage in a High Rate Heat Exchanger (D)
Joshua Sole, Mainstream Engineering Corp.
0830 SWaP-Optimized Liquid Nitrogen Generator Comprised of Commercially Proven Components (F)
Joshua Sole, Mainstream Engineering Corp.
0900 Compact 250 kV Capacitors for Directed Energy Applications: Test Results and Impacts (C)
Randy Curry, University of Missouri
0930 Thermal Management Challenges in Integrating Laser Weapon Systems (C)
Sean Ross, Air Force Research Laboratory/RDLA
1000 Break
1030 Advances in Fuel Cells Power Sources for Directed Energy Applications (C)
William Smith, Infinity Fuel Cell and Hydrogen, Inc.
1100 Evaluation of the Performance of COTS Diode Laser Fiber Pumps Over a Wide Temperature Range and Modeling of the Subsequent Trade-offs in HEL Thermal System Design (C)
George Turner, MIT Lincoln Laboratory
1130 Advantages and Suitability of Utilizing Hydrated Salts for High-Rate Low-SWaP Thermal Energy Storage (C)
Nicholas Maniscalco, Raytheon Company
1200 Lunch
### WEDNESDAY MORNING

**Classified Session**
Offsite Location  
Chair: **David Lyman**, Radiance Technologies, Inc  
0700 **Breakfast and Registration at Westin**  
0715 **Buses to Offsite Location**  
0800 **Counter-Rocket Artillery and Mortar (C-RAM) Laser Lethality Testing by SMDC: Recent Results (D)**  
0830 **Vulnerability of the Passenger Compartment of Ground Vehicles to HEL Weapons (D)**  
0900 **Vulnerability of the Drive Train of Ground Vehicles to HEL Weapons (D)**  
0930 **HPEM Effects on Unmanned Aircraft Systems (UAS) (C)**  
1000 **Break**  
1030 **Air Force Directed Energy Weapons Flight Plan (C)**  
1100 **Electro-Optics Counter-Measures for Counter ISR (C)**  
1130 **Linear Photonic Switch Status (F)**  
1200 **Lunch**

### WEDNESDAY AFTERNOON

**HEL Technology 2**  
Westin Mediterranean Room III (Open)  
Chair: **Adam Aberle**, USASMDC/ARSTRAT  
1300 **Wavelength Agility of a Two-Photon Pumped Alkali Laser (A)**  
*Nathan Haluska*, Air Force Institute of Technology  
1330 **Spectroscopy of Metastable Xenon in High Pressure Plasma Discharges (A)**  
*Carl Sanderson*, University of Alabama in Huntsville  
1400 **Development of All-Crystalline Clad Single Crystal Fiber for High Power Lasers (A)**  
*Brandon Shaw*, Naval Research Laboratory  
1430 **Break**  
1500 **VECSELs as a Fiber Laser Pump Source for Directed Energy Applications (A)**  
*John Joseph*, Optipulse Inc.  
*Stuart (Shizhuo) Yin*, Penn State Univ/General Opto Solutions, LLC  
1600 **Pulsed Discharge - Diode Pumped Ar Laser (A)**  
*Michael Heaven*, Emory University  
1630 **Safety Considerations for Laser Power Beaming (A)**  
*Tom Nugent*, LaserMotive  
1700 **The Self Q-Switched Tm/Ho Doped Co-Axial Fiber Laser (A)**  
*George Newburgh*, Army Research Laboratory
# Beam Propagation 2
Westin Mediterranean Room IV (Limited/Open)
Chair: Amanda Black, USASMDC/ARSTRAT

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1300</td>
<td>Estimation of Atmospheric Parameters from Time-Lapse Imagery</td>
<td>Santasri Bose-Pillai, AFIT</td>
</tr>
<tr>
<td>1330</td>
<td>Opto-Mechanical Sensitivity Analysis for the Integrated Atmospheric</td>
<td>Nathan Meraz, Georgia Tech</td>
</tr>
<tr>
<td></td>
<td>Characterization System Optical Turbulence Profiler (IACS OTP)</td>
<td>Research Institute Electro-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optical Systems Laboratory</td>
</tr>
<tr>
<td>1400</td>
<td>Analysis of Turbulence Anisotropy Measured with a Hartmann Sensor</td>
<td>Jack McCrae, Air Force Institute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of Technology AFIT/ENP</td>
</tr>
<tr>
<td>1430</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>Characterization of Atmospheric Properties with Small Unmanned</td>
<td>Alex Clark, Kratos Defense</td>
</tr>
<tr>
<td></td>
<td>Aircraft Systems (sUAS) (A)</td>
<td></td>
</tr>
<tr>
<td>1530</td>
<td>Tunable Diode Laser Absorption Spectroscopy for DPAL, COIL and SSL</td>
<td>Christopher Rice, Air Force</td>
</tr>
<tr>
<td></td>
<td>Systems in Open Paths (A)</td>
<td>Institute of Technology</td>
</tr>
<tr>
<td>1600</td>
<td>Dual-Beacon Differential Image Motion Monitor for Measuring Atmospheric Turbulence at Horizontal Paths (A)</td>
<td>Daniel Whitley, Kratos Weapons &amp; Defense Solutions</td>
</tr>
</tbody>
</table>
**Education Workshop**
Westin Mediterranean Room II (Open)
Chair:  Harro Ackermann, HEL JTO

1300 Welcome to the Educational Workshop  
Harro Ackermann, HEL JTO
1305 JTO/DEPS Educational Initiative  
Mark Neice, DEPS
1320 The 2016 AFIT Directed Energy Summer Intern Program (A)  
Sara Kraft, Air Force Institute of Technology
1340 Modification of Fine-Structure Collisional Transfer Cross Sections in Dense Inert Buffer Gases (A)  
Jeremiah Wells, US Air Force Academy
1400 The Rare Gas Laser: a Potential HEL System (A)  
Ben Eshel, Air Force Institute of Technology
1420 Verification of BRDF Improvements by Comparisons to Modified Beckmann-Kirchhoff Scatter Theory (A)  
James Ethridge, AFIT-SO Che
1440 Break
1500 The Path to a Career in Directed Energy (A)  
Noah Van Zandt, AF Institute of Technology
1520 Surface Temperature Measurements of a Water Drop during Laser Strike (A)  
Nicholas Payne, USNA
1540 Laser Propagation in a Maritime Environment (A)  
Charles Stabler, US Naval Academy
1600 Characterizing the Response of Embedded Fiber Bragg Grating Sensors to Directed Energy Attacks (A)  
Michael Ross, US Naval Academy
Tyler Galpin, University of New Hampshire
1640 Multiple Aperture Approach to wavefront Prediction for Adaptive-Optic Applications (A)  
Matthew Kemnetz, University of Notre Dame

**Counter DEW**
Offsite Location (Secret)
Chair: Bob Cozzens, Naval Research Laboratory

1300 Cleanly HEL Ablating Camouflage Coatings (D)
1330 Microwave Reflections from Laser Produced Atmospheric-Plasmas and Acoustic Shocks (A)
1400 Protecting Printed Circuit Boards Under High Power Microwave Emissions (C)
1430 Break
1500 Recent Developments at NSRDEC in Microwave Reflective Materials (C)
1530 Thermal Penetration Protection of Carbon Fiber Reinforced Polymer (CFRP) Composite (D)
1600 Development of HEL Hardened UAS Skin Systems (D)
1630 Chaff for Counter High Energy Laser Defense (D)
1700 Simulation of Pulsed Laser-induced Environmental Changes on Laser Propagation (C)
## Non-DoD Applications: Propulsion
Westin Mediterranean Room III (Open)
Chair: *Les Johnson*, NASA Marshall Space Flight Center

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700</td>
<td>Breakfast and Registration at Westin</td>
</tr>
</tbody>
</table>
| 0800  | A Concept for Producing Very Large Propulsive Forces using High-Q Asymmetric High Energy Laser Resonators (A)  
*Travis Taylor*, U.S. Army SMDC |
| 0830  | Solar Sails and Directed Energy: Next Steps toward a Space Propulsion Infrastructure (A)  
*Les Johnson*, NASA Marshall Space Flight Center |
| 0900  | Directed Energy for Small Relativistic Probes to Enable Interstellar Exploration (A)  
*Philip Lubin*, Physics Dept University of California |
| 0930  | Directed Energy Application to Orbital Debris Mitigation (A)  
*Edward Montgomery*, MontTech, LLC |
| 1000  | Break                                                                 |
| 1030  | A Strategic Roadmap for Commercializing Low-Cost Beamed Energy Propulsion Launch Systems (A)  
*Eric Davis*, Institute for Advanced Studies at Austin |
| 1100  | Hybrid Laser-Chemical Rocket Engine and Launch System (A)  
*Thomas Nugent*, LaserMotive |
| 1130  | A Means to Assess and Validate the Effects of Ground Based High Energy Lasers on Small Satellites for Proving Propulsion and Increasing Power Available (A)  
*Peter Weiland*, Radiance Technology |
| 1200  | Lunch                                                                 |
| 1245  | DEPS Annual Report                                                     |

## Modeling & Simulation 1
Westin Mediterranean Room IV (Limited)
Chair: *Doug Nelson*, USASMDC/ARSTRAT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700</td>
<td>Breakfast and Registration at Westin</td>
</tr>
</tbody>
</table>
| 0800  | Development, Incorporation and Testing of an Index-of-Refraction Variance Transport Solver within the NASA FUN3D CFD Model: FUN3D-IRS (D)  
*William Coirier*, Kratos/Digital Fusion Solutions, Inc. |
| 0830  | An Overview of the CFD-AO Model and Recent Upgrades (D)  
*William Coirier*, Kratos/Digital Fusion Solutions, Inc. |
| 0900  | Model for Visualizing HEL - Target Interaction (D)  
*Gamze Erten*, Raytheon SAS |
| 0930  | 711 Human Performance Wing Support to Modeling and Simulation Weapon Concepts (D)  
*Richard Vickery*, 711 Human Performance Wing |
| 1000  | Break                                                                 |
| 1030  | 4D Weather Cubes and CFLOS from Numerical Weather Prediction Data (C)  
*Jarred Burley*, AFIT/ENP |
| 1100  | Evaluation of Probabilistic Climatology as a Determiner for HEL System Performance (C)  
*Jaclyn Schmidt*, AFIT |
| 1130  | Comparison of Polychromatic Wave-Optics Models (C)  
*Noah Van Zandt*, AFIT/Center for Directed Energy |
| 1200  | Lunch                                                                 |
| 1245  | DEPS Annual Report                                                     |
**HEL Technology 3**
Westin Mediterranean Room V (Limited)
Chair: Steve Renfrow, Scientic, Inc.

0800  Irradiance Collection Readout System (ICRS) HEL Mortar Target Testing (D)
David Ward, SemQuest Inc

0830  HELMTT and MEHEL Laser Diagnostics Using LBADS at MFIX 2016 (C)
Theron Henderson, Scientic Inc.

0900  HELMTT Laser Diagnostics Using LBADS at RTC 2.0 & 2.5 (C)
Theron Henderson, Scientic Inc.

0930  Highly Efficient Operation of a Double-Clad Er-Nanoparticle-Doped Fiber Laser (A)
Jun Zhang, U.S. Army Research laboratory

1000  Break

**Ultra Short Pulse Laser 1**
Westin Room 3 (Limited)
Chair: Joseph Penano, US Navy Research Laboratory

1030  Experimental Demonstration of Nonlinear Self-Guiding of a High-Power Laser Beam through Deep Turbulence (D)
Gregory DiComo, Research Support Instruments

1100  AFRL PHEENIX Laser Experiment (C)
Andreas Schmitt-Sody, Air Force Research Lab

1130  High Power Picosecond Carbon Dioxide Laser based on Injection Seeded Unstable Resonator (C)
Joseph Penano, Naval Research Laboratory

1200  Lunch

1245  DEPS Annual Report

**HPM and CDEW**
Westin Mediterranean Room II (Limited)
Chair: Ryan Hoffman, Navy

0800  High-Power Airborne Microwave Optimization Tool (D)
Bonnie Johnson, Naval Postgraduate School

0830  Recent Results of Silicon-based Photoconductive Solid-State Switches for 500-kHz Continuous Pulse-Repetition-Frequency (C)
Noah Kramer, University of Missouri Kansas City

0900  A Measurement System for, and Introduction of Materials with Expected RF Power Dependent Complex Permittivity and Permeability (C)
John Lancaster, University of Missouri Kansas City

0930  Solid-State Material Development for Counter-HPM Applications (C)
Stephan Young, University of Missouri - Kansas City

1000  Break

1030  The Directed Energy Test Science and Technology Non-Intrusive HPM Sensor Program (A)
Jeffrey Schleher, American Systems

1200  Lunch

1245  DEPS Annual Report
Non-DoD Applications: Power Beaming
Westin Mediterranean Room III (Limited/Open)
Chair: Peter Weiland, Radiance Technologies
1330 Directed Energy for Wireless Power Beaming in Space-borne Applications (D)
Hooman Kazemi, Raytheon Space and Airborne Company
1400 Progress in Microwave Power Transmission - W.C. Brown Re-Visited (A)
James McSpadden, Raytheon
1430 Power Beaming to an Energy Storage Air Ship (A)
Daniel O’Neil, National Aeronautics and Space Administration (NASA)
1500 Break
1530 Directed Energy Commercialization: The International Beams-2-Biotech Private-Public Partnership (A)
Paul Shirley, WAVE
1600 Pulse Power for Rock Excavation (A)
Peter Weiland, Radiance Technology
1630 Directed Energy for Planetary Defense and Asteroid Manipulation (A)
Travis Brashears, UCSB Physics Dept.
1700 Directed Energy: Enabler of Human Expansion into the Solar System (A)
Edward (Sandy) Montgomery, MontTech, LLC

Modeling & Simulation 2
Westin Mediterranean Room IV (Limited/Open)
Chair: Susan Johnson, USASMDC/ARSTRAT
1330 Directed Energy Models and Effects Repository Tutorial (C)
Grady Patterson, XL Scientific
1400 Integrated Weapon Concept Analysis: An Iterative Approach to the M&S Pyramid (C)
Linda Lamberson, Air Force Research Laboratory - Directed Energy Directorate
1430 Polarimetric Monte Carlo Modeling of Spherical Particles in the Atmosphere (C)
Brett Hokr, US Army Space and Missile Defense Command
1500 Break
1530 DE Weaponeering: The Road to JMEMs (C)
Linda Lamberson, Air Force Research Laboratory - Directed Energy Directorate
1600 Jittered Uniform Annular Beams (A)
Charles Albers, Radiance Technologies
1630 Predictive Thermal Model for Phase Change within Steel Heated by Laser Energy (A)
Noah Siegel, United States Military Academy
Ultra Short Pulse Laser 2
Westin Mediterranean Room V (Limited/Open)
Chair: Joseph Penano, Navy Research Laboratory
1330 Beaconless AO Technique for Beam Control of the Ultra-Short Pulse Laser (C)
Vladimir Markov, Advanced Systems & Technologies, Inc.
1400 Air Lasing through Femtosecond Filamentation (A)
Pavel Polynkin, College of Optical Sciences, University of Arizona
1430 High Power Picosecond Carbon Dioxide Laser: Modeling and Design (A)
Luke Johnson, Naval Research Laboratory
1500 Break
1530 Scintillation Statistics in Optically Nonlinear, Turbulent Atmosphere (A)
John Palastro, Naval Research Laboratory
1600 Extreme Light Interactions with Liquid Targets at Relativistic Conditions (A)
William Roquemore, Aerospace Systems Directorate AFRL

Education Workshop 2
Westin Mediterranean Room II (Limited/Open)
Chair: Harro Ackerman, HEL JTO
1330 Wavefront Sensor for the Midwave Infrared Region (C)
Thomas Meissner, Rose-Hulman Institute of Technology
1350 Metamaterial-Enhanced Resistive Wall Amplifier (A)
Tyler Rowe, University of Wisconsin-Madison
1410 Bandgap Dependence of Particle Induced CW Laser Damage (A)
Andrew Brown, University of Minnesota
1430 Atomic Vapor Laser Isotope Separation
Thomas Parker, US Military Academy
1450 Modified Wafer-Level Segmented Contact Method (A)
Daniel Lauriola, Rose-Hulman Institute of Technology
1510 Break
1530 Illumination Module for Particle Image Velocimetry (PIV) (A)
Serang Park, Rose-Hulman Institute of Technology
1600 Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX) (A)
Anita Green, US Coast Guard Academy
1620 Implementation of External Magnetic Fields to Create Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX) (A)
Jordon Hopson, US Coast Guard Academy
1640 Spectrometer Development in Support of Thomson Scattering Investigations for the Helicon Plasma Experiment (HPX) (A)
Eva Sandri, US Coast Guard Academy

Tour of NASA Facilities
Please join us for an optional tour of NASA Marshall Space Flight Center on Friday, 17 February from 0830-1130. NASA Marshall has been at the forefront of US Space exploration having launched the first US satellite on the Redstone Rocket in 1958. The tour will highlight the historical significance of Marshall and also cover its current missions such as the Operational Support Center for the International Space Station and the facilities associated with the development and testing of the SLS.

A bus will pick up tour participants at the hotel lobby main entrance at 0800 and should have everyone back to the hotel by noon.
Symposium Organizing Committee

Symposium Chair
Dr. Kip Kendrick

Program Committee
HPM Technical Program - Ryan Hoffman
HPM Technical Program - Donald Shiffler
HEL Technical Program - Brian Strickland
HEL Systems, Tech and Effects - Chuck LaMar
HPM Systems, Tech and Effects - Sterling Beeson
Acquisition, Tracking and Jitter Control - Brett Hokr
BC Systems and Technology - Jenny Niles
Beam Prop and Wavefront Control - Amanda Black
Modeling and Simulation - Doug Nelson
Power and Thermal for DE - Kenya Lynch
Non DoD Applications of DE - Sandy Montgomery

Huntsville Security
Lovett Bennett

Huntsville Coordinator
Di Cochran

Symposium Coordinator
Cynnamon Spain

Security, Registration and Receipts
Tiffany Bjelke

Directed Energy Professional Society
7770 Jefferson Street NE, Suite 440
Albuquerque, NM 87109
Tel: 505-998-4910
Fax: 505-998-4917

www.deps.org