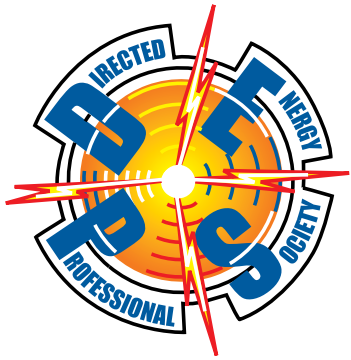


**Eighteenth Annual
Directed Energy
Symposium
Technical Program**



**7 - 11 March 2016
Albuquerque, New Mexico**

General Information

Security

- Attendees will be issued conference specific badges on site and must have valid gov't 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

The offsite location is a 10 to 15 minute drive. Buses will be available to transport to and from each location approximately every 20 min 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:

Monday: 0730 and 1230

Tuesday - Thursday: 0700 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.

SHORT COURSES

MONDAY 7 MARCH

Morning Courses 0800-1200

- 1: Introduction to HEL Systems
Marriott Hotel, Room 1
- 2: Introduction to RF Systems (Secret)
Offsite Location
- 3: Directed Energy Targeting (Secret)
Offsite Location
- 4: HPM Simulation Management Software
Marriott Hotel, Room 2
- 5: Thermal Management
Marriott Hotel, Room 3

FRIDAY 11 MARCH

Morning Courses 0800-1200

- 6: LEEDR and Atmospheric Effects (Limited Dist C)
Marriott Hotel, Room 1
- 7: Laser Propagation
Marriott Hotel, Room 2
- 8: Directed Energy 101
Marriott Hotel, Room 3

Full Day Courses 0800-1700

- 9: Laser Beam Quality Measures
Marriott Hotel, Room 4
- 10: Beam Directors 101
Marriott Hotel, Room 5

DE Systems Symposium

**12-16 September 2016
Portsmouth, Virginia**

**AUDIO AND VIDEO RECORDING IS
PROHIBITED AT ALL DEPS SPONSORED EVENTS**

MONDAY AFTERNOON

Opening Plenary

Marriott Room 4, Open

- 1300 **Welcome**
- 1330 **Annual Symposium Kickoff**
Dr Diana Loree, AFRL
- 1345 **Opening Remarks**
Senator Martin Heinrich
Introduced by *Dr Katie Richardson*
- 1400 **Perspective from the House Armed Services Committee**
Mr Kevin Gates, HASC (VTC)
- 1430 **Perspective from Ass't Secretary of Defense, Research**
Dr Kevin Hewett, DE staff specialist, ASD R&E
- 1500 **Break**
- 1530 **Navy S&T**
Dr Tom Beutner, Director, Code 35, Office of Naval Research (ONR)
- 1600 **Army S&T**
Dr Kip Kendrick, SMDC Technology Center
- 1630 **Air Force S&T**
Col Chuck Ormsby, Military Deputy, Air Force Science Technology & Engineering (SAF/AQR)
- 1730 **Exhibitor Reception**

TUESDAY MORNING

Employment and Testing of DE

Offsite Location, Secret

MC: *Donald Streater, SAIC*

- 0700 **Breakfast and Registration at Marriott**
- 0715 **Buses to Offsite Location**
- 0800 **Special Talk: Naval Laser Roadmap**
- 0830 **Overview of Foreign Directed Energy Technology (F)**
- 0900 **Maritime IED Investigation (MIEDI) Technologies with Transition Potential (F)**
- 0920 **Airborne Directed Energy Study (D)**
- 0940 **A Preliminary Study of Inadvertent Illumination and Damage Risks Posed to Satellite Optical Sensors by Classes of Laser Systems (C)**
- 1000 **Break**
- 1030 **HELLADS Demonstrator Laser Weapon System (DLWS) Field Tests (C)**
- 1100 **Self-Protect High Energy Laser Demonstrator (SHIELD): Pathway to Fielding on Tactical Air Platforms (C)**
- 1130 **Buses Return to Marriott**
- 1200 **Lunch**
- DEPS Annual Business Brief**
Dr. James Horkovich, DEPS President

HPEM Systems and Technologies 1

Marriott Room 1, Limited Distribution C / Open

MC: *Julie Lawrance*, Air Force Research Laboratory

0700 **Breakfast and Registration at Marriott**

0800 **Full HPEM System Simulation Demonstration Using the Galaxy Software (C)**
Nathaniel Lockwood, Air Force Research Laboratory

Session is now Open

0830 **Fabrication and Cold Testing of an S Band Inhomogeneous Slow Wave Structure for Highly Efficient Backward Wave Oscillators (A)**
Ushemadzoro Chipengo, The Ohio State University

0900 **High Power TWT Amplifier Development (A)**
Brad Hoff, Air Force Research Laboratory

0930 **Generation of High-Power Ultrashort Pulse Waveforms in S- to X-bands using Time-Reversal Pulse Compression Techniques (A)**
Victor Mendez, Naval Research Laboratory

1000 **Break**

1030 **A Variable Pulse Width, Voltage, and Repetition Frequency Solid-State High Power Radio Frequency (HPRF) Source Driver (A)**
Timothy Ziemba, Eagle Harbor Technologies, Inc.

1100 **High Energy Density 80KV Capacitors for HPRF Applications (A)**
Quentin Diduck, Ballistic Devices Inc.

1120 **Metamaterial Slow-Wave Structure Design for High Power Microwave Generation (A)**
Sabahattin Yurt, University of New Mexico

1140 **Improvements in Low-Profile HPM-Capable Conformable Leaky-Wave Antennas (A)**
Robert Koslover, SARA, Inc.

1200 **Lunch**

DEPS Annual Business Brief
Dr. James Horkorvich, DEPS President

Laser Sources and Components

Marriott Room 2, Open

MC: *David Gardner*, Sandia National Laboratories

0700 **Breakfast and Registration at Marriott**

0800 **Diode Pumped Alkali Laser Kinetics: Higher Lying Excited States (A)**
Glen Perram, Air Force Institute of Technology

0830 **Characterization of a Diode Pumped Alkali Laser with a Flowing Gain Medium (A)**
David Hostutler, Air Force Research Laboratory

0900 **High Power Nd:YAG Spinning Disk Laser (A)**
Andrew Ongstad, Air Force Research Laboratory

0930 **Optically Pumped Rare Gas Laser Kinetics (A)**
Glen Perram, Air Force Institute of Technology

1000 **Break**

1030 **Theoretical Analysis of Modal Instability in High Power Raman Amplifiers (A)**
Shadi Naderi, Air Force Research Laboratory

1100 **Diamond for High Power Lasers and Beam Combiner Systems (A)**
Richard Mildren, Macquarie University

1130 **Continuous-Wave Laser Particle Conditioning: Thresholds and Time Scales (A)**
Andrew Brown, University of Minnesota

1200 **Lunch**

DEPS Annual Business Brief
Dr. James Horkorvich, DEPS President

TUESDAY MORNING

Biological Effects of DE / Safety

Marriott Room 3, Limited Distribution D

MC: *Barry Goettl*, Air Force Research Laboratory

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Current Efforts at NSRDEC in Microwave Protective Textiles and Laser Eye Protection for the Soldier (C)**
Francisco Aranda, US Army NSRDEC
- 0830 **Directed Energy for Counter Electronics: A Concept of Employment (C)**
Barry Goettl, Air Force Research Laboratory
- 0900 **Bioeffects Support to Active Denial Optimization (C)**
William Voorhees, Air Force Research Laboratory
- 0930 **Empirical and Simulated Bioeffect Levels for Radio Frequency and Millimeter Wave Exposures (C)**
Stephen Sturgeon, Air Force Research Laboratory
- 1000 **Break**
- 1030 **Laser Bioeffect Modeling and Simulation Capabilities (D)**
Richard Vickery, Air Force Research Laboratory
- 1100 **Specific Absorption Rate in the Microwave-Exposed Rat (Export Controlled)**
Michael Jirjis, Air Force Research Laboratory
- 1130 **Pulsed Laser Exposures on Excised Porcine Tissue (C)**
Semih Kumru, Air Force Research Laboratory
- 1200 **Lunch**
DEPS Annual Business Brief
Dr. James Horkorvich, DEPS President

TUESDAY MORNING

ABLE Beam Control Initiative

Marriott Room 4, Limited Distribution D

MC: *Sylvia Dorato*, HEL-JTO

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Advanced Beam Control for Locating and Engagement (ABLE) Overview (C)**
Lawrence Grimes, HEL Joint Technology Office
- 0830 **ABLE Modeling and Simulation (C)**
Michael Steinbock, Schafer Corp
- 0930 **The Advanced Beam Control Locating and Engagement Enhanced Tracking System (ABLE-ETS) (C)**
Robert Pawlak, Naval Surface Warfare Center
- 0900 **Advanced Beam Control Demonstration (ABCD) (C)**
Jeffrey Barchers, Nutronics, Inc.
- 1000 **Break**
- 1030 **1030 nm Illuminator Development for High Energy Laser Weapon Systems (C)**
David Mordaunt, Raytheon Space and Airborne Systems
- 1100 **Advances in Deformable Mirror Technology (C)**
Justin Mansell, MZA Associates Corporation
- 1130 **Design Considerations for Developing a High Energy Laser Beam Expander as a Line Replaceable Unit (F)**
Jeff Maloney, L-3 Brashear
- 1200 **Lunch**
DEPS Annual Business Brief
Dr. James Horkorvich, DEPS President

TUESDAY AFTERNOON

Laser Effects & Analysis

Offsite Location, Secret

Chair: *Jon Determan*, Navy

- 1330 Buses to Offsite Location
- 1400 New Modes of Laser Supersonic Anti-Ship Cruise Missiles Lethality (C)
- 1430 Further Investigation of a HEL Dynamic Engagement Analysis for a Realistic Scenario (D)
- 1500 Break
- 1530 Comparison of Dynamic Metal Penetration Test Data and Results from the Effectiveness ToolBox (ETB) Simulation (D)
- 1600 Ultra Short Pulse Laser-Material Interaction Emissions and Effects (D)

HEL Hardening

Offsite Location, Secret

MC: *Robert Cozzens*, NRL

- 1630 HEL Protection and Testing of UAS Fuel (D)
- 1700 HEL Hardness of UAS Skin: Material Structure and Composition (D)

TUESDAY AFTERNOON

HPM Effects

Marriott Room 1, Open

MC: *Jeffrey Alexander*, Sandia National Laboratories

- 1330 Science of Electronics in Extreme EM Environments: Part I - University of New Mexico Progress on AFRL/AFOSR Center of Excellence (A)
Sameer Hemmady, University of New Mexico
- 1400 Science of Electronics in Extreme EM Environments: Part II- University of Maryland Progress on AFRL/AFOSR Center of Excellence (A)
Steven Anlage, University of Maryland
- 1430 Prediction of Soft Failures in Complex Digital ICs (A)
Daryl Beetner, Missouri University of Science and Technology
- 1500 Break
- 1530 Coupling of External Radiation to a Reverberation Chamber with Apertures: Experiments and the Random Coupling Model (A)
Gabriele Gradoni, University of Nottingham, United Kingdom
- 1600 Validation and Extension of ATHENA for HPEM Effects Prediction (A)
Larry Bacon, Sandia National Laboratories
- 1630 Optical Radiation Sensing with an RF Switching Network (A)
Peter Joyce, U.S. Naval Academy
- 1700 Microwave Interactions with Intense Laser Produced Air-Plasmas and Acoustic Shocks (A)
Mike Helle, US Naval Research Laboratory

TUESDAY AFTERNOON**Counter DEW**

Marriott Room 2, Open

MC: *Ryan Hoffman*, Navy

- 1330 **Scaled Measurements of Realistic Counter-DEW Scenarios (A)**
Steven Anlage, University of Maryland
- 1400 **CMOS Compatible Nanophotonics for HPM Resistant Optical Interconnects (A)**
Edo Waks, University of Maryland
- 1430 **Resonant, Absorbing Microwave Metamaterials (A)**
Dragoslav Grbovic, Naval Postgraduate School
- 1500 **Break**
- 1530 **Recent Advances in Nonlinear Metasurfaces for Suppression of Surface Currents (A)**
Daniel Sievenpiper, University of California, San Diego
- 1600 **Parameter Extraction for Characterization of EM coupling between High Loss Ports in Complex Enclosures (A)**
Bisrat Addissie, University of Maryland
- 1630 **Statistical Topological Approach Using Wave-Chaos for Electromagnetic Effects (STUWEE) (A)**
Ghadeh Hadi, University of New Mexico

TUESDAY AFTERNOON**Beam Control Performance: Turbulence/ Aerosols**

Marriott Room 3, Limited Distribution D

MC: *Mark Spencer*, Air Force Research Laboratory

- 1330 **MWIR Laser Propagation Test (D)**
Shane Johnson, Air Force Research Laboratory /RDLE
- 1355 **A Test of Alternate Tropospheric Cn2 Models with NWP Inputs (D)**
Eric Hallenborg, SPAWAR Systems Center
- 1420 **NPS SE Near Maritime Atmospheric Optical Turbulence Measurements (D)**
Douglas Nelson, Naval Postgraduate School
- 1445 **Break**
- 1510 **Laboratory Generation of Simulated Aero-Optics Turbulence with a Boston Micro-Machine Kilo-DM Membrane Deformable Mirror (C)**
David Dayton, Applied Technology Associates
- 1535 **Deep-Turbulence Simulation in a Scaled-Laboratory Environment Using Five Phase-Only Spatial Light Modulators (C)**
Mark Spencer, Air Force Research Laboratory
- 1600 **First-Time Agreement between Simulation and Experiment for Propagation in Extremely-Strong-Scintillation (C)**
Richard Holmes, Boeing
- 1625 **Initial Results from the Maritime Atmospheric Characterization System Atmospheric Transmission Measurement (MACS ATM) LIDAR (C)**
John Stewart, Georgia Tech Research Institute Electro-Optical Systems Laboratory
- 1650 **A Path-Independent World-Wide CFLOS Calculator (C)**
Steven Fiorino, Air Force Institute of Technology

TUESDAY AFTERNOON

Electrical Power for DEW

Marriott Room 4, Open

MC: *James O'Loughlin*, Air Force Research Laboratory

- 1330 **Advanced Fuel Cell, Battery and Power Electronics Components Out Perform Turbo-Generator APUs for Powering Airborne Weapons (D)**
James O'Loughlin, Air Force Research Laboratory
- 1400 **Turbine Engine Response and Operating Limitations with Rapid Rise Rate Power Impact Loading from a LWS (D)**
Fernando Rodriguez, Air Force Research Laboratory
- 1430 **Lithium-ion Cell and Module Design and Performance for DEW Applications (D)**
Frank Puglia, EaglePicher, Yardney Division
- 1500 **Break**
- 1530 **Operation of an Integrated 400kW Electrical Power System with an Emulated SS HEL Weapon (D)**
Chuck Oberly, UES Inc
- 1600 **Advanced Dual -Mode Pulse Power Generator and Flywheel Energy Storage Unit for Directed Energy Applications (D)**
Joseph Beno, University of Texas Center for Electromechanics
- 1630 **High Power Aircraft Generators for DEW Applications (C)**
Todd Spierling, UTC Aerospace Systems

WEDNESDAY MORNING

HPEM Systems and Technologies 2

Offsite Locations, Secret

MC: *Peter Mardahl*, Air Force Research Laboratory

- 0700 **Breakfast and Registration at Renaissance**
- 0715 **Buses to Offsite Location**
- 0800 **Design of A6-6 GW-class Magnetrons (F)**
- 0830 **Experimental Results for Next Generation High Power Microwave Source (F)**
- 0900 **High Power Microwave Ground Vehicle Integration (F)**
- 0930 **Linear Photonic Switch Status (D)**
- 1000 **Break**
- 1030 **SWaP Reduction in Directed Energy Counter Improvised Explosive Device Systems (C)**
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkorovich, DEPS President

Employment and Testing of DE 2

Marriott Room 1, Open

MC: *Steven Conyne, Aegis; Donald Streater, SAIC*

- 0700 **Breakfast and Registration at Marriott**
- 0800 **A Warfighter's Perspective (A)**
Stephen McFadden, Air Combat Command
- 0830 **A Demonstration using Denali to Provide Precision Tracking and Identification for Homeland Defense (A)**
John-Paul Sena, Air Force Research Laboratory
- 0900 **Advanced Controls for RF and Directed Energy Systems - This Ain't Your Father's Control System (A)**
Sandra Biedron, Colorado State University
- 0930 **Multi-Spectral Targeting System: AFRL Field Tests for Precision Tracking in Contested Environments (A)**
John-Paul Sena, Air Force Research Laboratory
- 1000 **Break**
- 1030 **The Future Directed Energy Test Science and Technology Program (A)**
Trung Nguyen, U.S. Army PEO STRI - PM ITTS
- 1100 **Laser Safety for the F-35 Electro Optical Targeting System (EOTS) on USAF Training Ranges (A)**
Kurt Schuster, Engility Corp.
- 1130 **Fiber Laser Irradiated Graphite and Carbon Fiber Reinforced Polymers using Imaging Fourier Transform Spectroscopy (A)**
Glen Perram, Air Force Institute of Technology
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkorvich, DEPS President

Laser System Concepts / HEL Sources / Space Situational Awareness

Marriott Room 2, Limited Distribution D

MC: *Doug Nelson, Naval Postgraduate School*

- 0700 **Breakfast and Registration at Marriott**
- 0800 **HEL Projects Update at Defence R&D Canada (D)**
Jean-Francois Daigle, Defence R&D Canada
- 0830 **Integrated Optics Based, Compact, CW High Power Laser Concept (D)**
William Nunnally, Applied Physical Electronics, LLC
- 0900 **Designing Better Sodium Guidestar Lasers for Adaptive Optics with Experimental Results and Modeling (D)**
Shawn Hackett, Air Force Research Lab
- 0930 **MW-Class Free-Electron-Laser Technology Development (C)**
Frank Krawczyk, Los Alamos National Laboratory
- 1000 **Break**

Optical Comm, Active Illumination, and Advanced Materials

Marriott Room 2, Limited Distribution D

MC: *Doug Nelson, Naval Postgraduate School*

- 1030 **Quantum Key Distribution Methodology Applied to Evaluating Additional Quantum System (D)**
Alexander Duchane, Air Force Research Laboratory
- 1050 **Synthetic Scene Generation for Active Illumination of Targets (D)**
Jonathan Stohs, Air Force Research Laboratory
- 1110 **Irradiance Collection Readout System (ICRS) HEL Mortar Target Development (C)**
John Le Sage, SemQuest Inc.
- 1130 **Advanced Materials Manufacturing with Superconducting Electron Accelerators (Export Controlled)**
Justin Hill, Mainstream Engineering Corporation
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkorvich, DEPS President

WEDNESDAY MORNING

Beam Control: Tracking & Aimpoint Control

Marriott Room 3, Limited Distribution D

MC: *James Lasche*, Air Force Research Laboratory

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Modeling the Impact of Slow Varying Offsets between HEL Line of Sight (LOS) and Target Aimpoint (D)**
Gamze Erten, Raytheon SAS
- 0830 **Tracking Through Aero-Optics Using Tilt-Estimation (D)**
Issac Thornton, Air Force Research Laboratory
- 0900 **Transitioning From Conventional HEL Fine Tracking To Ladar Solutions (C)**
Joseph Paranto, Applied Research Associates
- 0930 **Laser Beam Control using Beaconless Adaptive-Optics Technique (C)**
Vladimir Markov, Advanced Systems & Technologies, Inc.
- 1000 **Break**
- 1030 **Waveguide Generated Mitigation of Speckle and Scintillation on an Actively Illuminated Target (C)**
Trevor Moore, Air Force Research Laboratory
- 1100 **ATL Aero Induced Jitter Mechanism - Evidence and Future Implications (C)**
Michael Stanek, Air Force Research Laboratory
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkovich, DEPS President

WEDNESDAY MORNING

Counter DEW

Marriott Room 4, Limited Distribution D

MC: *Jacob Walker*, NSWC

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Aircraft HPEM Hardening in the 21st Century (C)**
William Prather, Air Force Research Laboratory
- 0830 **Nonlinear Metasurfaces for Surface Current Suppression (C)**
Phillip Meyerhofer, Naval Research Laboratory
- 0900 **UAV Flight Testing and HEL Engagement of Argus High-Energy Laser Threat Sensor (Export Controlled)**
Mark Lucente, Nanohmics, Inc.
- 0930 **Break**

Power and Thermal Integration for DEW

Marriott Room 4, Limited Distribution D

MC: *Charles Oberly*, UES

- 1030 **MW Aircraft Potential for Powering an LWS on a Fast Flyer (D)**
Fernando Rodriguez, Air Force Research Laboratory
- 1100 **Final Performance Results from an Integrated Power and Thermal Management System (IPTMS) Hardware Demonstration with LWS Laser Emulation (D)**
Fernando Rodriguez, Air Force Research Laboratory
- 1130 **Integration of an IPTMS with an LWS on a C-130 Gunship (D)**
Fernando Rodriguez, Air Force Research Laboratory
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkovich, DEPS President

WEDNESDAY MORNING

DE Education Workshop

Marriott Room 5, Open

MC: *Harro Ackermann*, HEL Joint Technology Office

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Directed Energy Education at Colorado State University (A)**
Sandra Biedron, Colorado State University
- 0825 **The 2015 AFIT Directed Energy Summer Intern Program (A)**
Sara Kraft, Air Force Institute of Technology
- 0850 **A Journey into Directed Energy: for the Next Round of Students (A)**
Michael Steinbock, Schafer Corp.
- 0915 **Measurement and Modeling of High Energy Laser (HEL)-Droplet Interactions (A)**
Timothy Tracey, US Naval Academy
- 0940 **Directed Energy Detection Using Embedded Fiber Bragg Grating Temperature Sensors (A)**
Thomas Hand, US Naval Academy
- 1005 **Break**
- 1035 **Optical Investigation of Large-Scale Boundary-Layer Structure (A)**
Matthew Kemnetz, Notre Dame University
- 1200 **Lunch**
National Photonics Initiative
Dr. James Horkovich, DEPS President

WEDNESDAY AFTERNOON

Beam Control and Laser Technologies

Offsite Locations, Secret

MC: *Albert Ogloza*, Navy

- 1530 **ABC Flight Testing: Optical Data (D)**
- 1600 **ABC Flight Testing: Closed Loop Performance Predictions (D)**
- 1630 **A Highly Sensitive Wavefront Sensor for SSA (C)**
- 1700 **Combined Fiber Laser Development at MIT Lincoln Laboratory (C)**

WEDNESDAY AFTERNOON

USPL

Marriott Room 1, Limited Distribution C / Open
MC: *Charlene Rusnak*, Naval Research Laboratory

1530 **Burst Mode Ultra Short Pulse Laser Development (C)**
George Fischer, US ARMY ARDEC and
Darren Rand, MIT Lincoln Laboratory

Session is now Open

1600 **Tunable Broadband GHz/THz Radiation Generated Via Ultrafast Laser Pulsing of Inductively Charged Superconducting Antennas (A)**
Timothy Haugan, The Air Force Research Laboratory

1630 **Pulse Length Dependence on Filament Guided Discharge in Air: Extension to 10 ps (A)**
Andreas Schmitt-Sody, Air Force Research Laboratory

1700 **Broadband Radiofrequency and Terahertz Emissions from Femtosecond Filaments in Air and Solid Targets (A)**
Alexander Englesbe, University of Michigan

WEDNESDAY AFTERNOON

Beam Control: Subsystems & Components 1

Marriott Room 2, Limited Distribution D
MC: *J. Thomas Schriempf*, Navy

1530 **Development of the Navy High Energy Fiber Laser Helicopter Beam Director System (D)**
Robert Praus, MZA Associates Corporation

1600 **Development, Application, and System Influence of Beam Expander Architectures (D)**
Jeff Maloney, L3 - Brashear

1630 **Field Testing of the Navy High Energy Fiber Laser Helicopter Beam Director System at the AFRL ELTF (D)**
Kirk Powell, MZA Associates Corporation

1700 **Multiple-Modality Technique for Performance Assessment of Deformable Mirrors (C)**
Vladimir Markov, Advanced Systems & Technologies, Inc.

DEW Transitions Challenges Panel

Marriott Room 3, Limited Distribution D
MC: *Scott McPheeters*, Georgia Tech
Research Institute
1530-1730

Thermal Management Components and Approaches for DEW

Marriott Room 4, Limited Distribution D
 MC: *Aleks Shepsis*, Lockheed Martin Aculite Corp.

- 1530 **Advanced Thermal Management System Controls for Laser Weapons Systems (D)**
David Sykes, Mainstream Engineering Corporation
- 1550 **Cooling Laser with 2-Phase Refrigerant (D)**
Aleksandra Shepsis, Lockheed Martin
- 1610 **Multi-Functional Packaging Technology for Thermal Management and Runaway Prevention in Li-ion Battery (F)**
Avijit Bhunia, Teledyne Scientific Company
- 1630 **A Thermal Management System for DE Systems (C)**
Howard Pearlman, Advanced Cooling Technologies, Inc.
- 1700 **Results of Thermal Subsystem Testing Under the Integrated Power and Thermal Management System Effort (C)**
Travis Michalak, Air Force Research Laboratory

DE Education Workshop

Marriott Room 5, Limited Distribution D / Open
 MC: *Harro Ackermann*, HEL Joint Technology Office

- 1530 **Linear Systems in Optics: A DE-Inspired Short course at AFRL (C)**
Mark Spencer, Air Force Research Laboratory
- 1555 **Directed Energy Systems Engineering Education at the Naval Postgraduate School (D)**
Douglas Nelson, Naval Postgraduate School

Session is now Open

- 1620 **Progress on the Thomson Scattering High Energy Laser Diagnostic on the Helicon Plasma Experiment (HPX) (A)**
Royce James, US Coast Guard Academy
- 1645 **The Development of Low Pressure High Density Plasmas with External Magnetic Fields on the Helicon Plasma Experiment (HPX) (A)**
Jackson Karama, US Coast Guard Academy

THURSDAY MORNING

Counter DEW

Offsite Location, Secret

MC: *Ryan Hoffman*, Navy

- 0700 Breakfast and Registration at Marriott
- 0800 Exploring the Relationship Between Target Radar Cross Section and Shielding Effectiveness (D)
- 0830 AFRL Counter-HEL Structural Hardening Overview (D)
- 0900 HEL Blue UAS Vulnerability Assessment, Reduction, and Testing (D)
- 0930 Development and Integration of C-DEW Technology for Structural Materials (D)
- 1000 Break
- 1030 Reflective Particulate CDEW Materials (D)
- 1100 High Energy Laser Testing of Coatings on Conductive and Non-Conductive Substrates (D)
- 1200 Lunch
DEPS Fellows and Recognitions
Dr. James Horkorvich, DEPS President

THURSDAY MORNING

Beam Control Subsystems & Components 2

Marriott Room 1, Open

MC: *J. Thomas Schriempf*, Navy

- 0700 Breakfast and Registration at Marriott
- 0800 Lessons Learned in the Engineering of Dielectric Interference Coatings for Free Electron Lasers and their Impact on Coatings for High Energy Lasers (A)
Carmen Menoni, Colorado State University
- 0830 Rain and Sand Erosion Testing on Silica Windows with Antireflective Surface Structures for High Energy Lasers (A)
Lynda Busse, Naval Research Laboratory
- 0900 Metrology of Deformable Mirror Transient Response (A)
Byron Zollars, Nanohmics, Inc.
- 0930 Efficient Stochastic Gradient Adaptive Optics for Improved Power on Target (A)
Adam Willitsford, JHUAPL
- 1200 Lunch
DEPS Fellows and Recognitions
Dr. James Horkorvich, DEPS President

Fiber Lasers

Marriott Room 2, Open

MC: *Harold Schall*, Boeing

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Compact modular 1.5kW Narrow Linewidth CW Diffraction-Limited Fiber Amplifier with near 40nm Bandwidth (A)**
Mike O'Connor, IPG Photonics
- 0830 **Investigation of a Pulsed 1550 nm Fiber Laser System (A)**
Michael Klopfer, University of New Mexico
- 0900 **30µm-Core Yb-Doped Step-Index Fiber Operating Near Single-Mode Regime (A)**
Fanting Kong, ECE/COMSET, Clemson University
- 0930 **Progress in Development of Clad Single Crystal Fiber Lasers (A)**
Brandon Shaw, Naval Research Laboratory
- 1000 **Break**
- 1030 **All-Fiber Fused Coupler for Vortex Mode Excitation (A)**
Balaji Srinivasan, IIT Madras
- 1100 **Investigation of a Narrow Linewidth 1178 nm Raman Laser System (A)**
Matthew Block, Leidos
- 1130 **A Fiber-C26coupled Module Producing >600W From a 225 Micron Fiber, Weighing Less than 400 grams, with >50% Efficiency (A)**
Christopher Ebert, DILAS, Inc.
- 1200 **Lunch**
DEPS Fellows and Recognitions
Dr. James Horkovich, DEPS President

Employment and Testing of DE 3

Marriott Room 3, Limited Distribution D

MC: *Steven Conyne*, Aegis

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Joint Fiber Laser Mission Engagement (J-FLaME) Joint Test (D)**
Scott Boyd, NSWC DD
- 0830 **Hybrid Defense of Restricted Airspace (HyDRA) (D)**
William Cooper, Air Force Research Laboratory
- 0900 **The Joint Laser Deconfliction System (JLDSS) (D)**
James Latourell, Naval Surface Warfare Center-Dahlgren Division
- 0930 **Lessons Learned for Satellite Safety and Directed Energy System Integration (C)**
Steven Gabriel, Serco, Inc.
- 1000 **Break**
- 1030 **Overview of Boeing's Compact Laser Weapon System and Recent Test Results (C)**
Wade Klennert, Boeing
- 1100 **Experiences and Lessons Learned for High Energy Laser (HEL) Test and Safety Planning at DoD and Non-DoD Facilities (C)**
Teresa Neudecker, Boeing
- 1130 **Re-Issue of the Department of Defense Instruction (DoDI) 3100.11 Management of Laser Illumination of Objects in Space**
Christopher Behre, OSDADS/SP (C)
- 1200 **Lunch**
DEPS Fellows and Recognitions
Dr. James Horkovich, DEPS President

THURSDAY MORNING

HPEM Systems and Technologies 3

Marriott Room 4, Limited Distribution D

MC: *Michael Lambrecht*, Air Force Research Laboratory

- 0700 **Breakfast and Registration at Marriott**
- 0800 **Status of the Compact Hard Tube Viricator (D)**
Steve Calico, Lockheed Martin
- 0830 **ICEPIC Models of GW-Class Resonant Reflector BWOs (D)**
Robert Lloyd, Air Force Research Laboratory
- 0900 **Design and Simulation of a High Power Relativistic Inverted Magnetron (C)**
Timothy Fleming, Air Force Research Laboratory
- 0930 **High Density Capacitors for Multi-Pulse CHAMP (C)**
Kenneth Struve, Sandia National Laboratories
- 1000 Break
- 1030 **W-Band Optics for Matching Beams with Astigmatism and Tilt (WOMBAT) (D)**
Sameer Hemmady, XL Scientific, LLC
- 1100 **Magnetic Non-Linear Transmission Lines for Solid-State High-Power Microwave Generation (C)**
Anton Geiler, Metamagnetics Inc.
- 1130 **Modeling Basic Physics and Features of Inductively Charged Superconducting Antennas (C)**
Timothy Haugan, Air Force Research Laboratory
- 1200 **Lunch**
DEPS Fellows and Recognitions
Dr. James Horkorovich, DEPS President

THURSDAY AFTERNOON

HPEM Effects, M&S

Offsite Locations, Secret

MC: *Traber Smith*, Naval Research Laboratory

- 1330 **Buses to Offsite Location**
- 1400 **Estimating Probability of Effectiveness for a HPRF Vessel Stopping System (C)**
- 1430 **The Random Coupling Model: Past Successes and New Directions (C)**
- 1500 **Break**
- 1530 **High Power Electromagnetic Susceptibility and Vulnerability Toolkit (HPEM-SVT) (F)**
- 1600 **Recent Testing on CHAMP Legacy Test Articles and Refurbishment Efforts (F)**
- 1630 **Optimizing Inductive Coupling for C-IED Pre-Detonation Efforts (C)**

THURSDAY AFTERNOON

Beam Control Performance: Turbulence/ Aerosols

Marriott Room 1, Open

MC: *Mark Spencer*, Air Force Research Laboratory

- 1330 **Laser Illuminator with Turbulence Pre-Correction using Real-Time Digital Holography (A)**
Abbie Watnik, Naval Research Laboratory
- 1400 **Enhanced Maritime Power-in-Bucket Climatology (A)**
Kevin McBryde, SPAWAR Systems Center
- 1430 **Interaction of an HEL Beam with Atmospheric Aerosols (A)**
Richard Fischer, Naval Research Laboratory
- 1500 **Break**

USPL Propagation Control

Marriott Room 1, Limited Distribution D / Open

MC: *Charlene Rusnak*, Naval Research Laboratory

- 1530 **Experimental Demonstration of Self-Guiding of a High-Power Laser Beam through Artificially Generated Atmospheric Turbulence (D)**
Gregory DiComo, Research Support Instruments
- 1600 **Nonlinear Guiding of High-Peak Power Laser Pulses in Atmospheric Turbulence (C)**
Joseph Penano, Naval Research Laboratory

Session is now Open

- 1630 **Breakdown of Reciprocity for High Peak Power Laser Pulses (A)**
John Palastro, Naval Research Laboratory
- 1700 **Collapse of a Powerful Laser Beam in a Turbulent, Dissipative Atmosphere (A)**
Bahman Hafizi, Naval Research Laboratory

THURSDAY AFTERNOON

HEL Apertures, Turrets: Experiments, M&S

Marriott Room 2, Limited Distribution D

MC: *David Loomis*, DNL Consulting

- 1330 **Research Plans For Future Aircraft Apertures (D)**
Michael Stanek, Air Force Research Laboratory
- 1400 **Flight Tests of the Aero-Adaptive/Aero-Optic Beam Control (ABC) Turret System (D)**
James Thordahl, The Aerospace Corporation
- 1430 **Passive Flow Control for Transonic Turret (D)**
Eric Jumper, University of Notre Dame
- 1500 **Break**
- 1530 **CFD Simulation of Canonical Turret Configuration with Flow Control (D)**
David Weston, Air Force Research Laboratory
- 1600 **CFD Support for Aero-Optic Wind-Tunnel Testing in AFRL (D)**
Scott Sherer, Air Force Research Laboratory
- 1630 **Numerical Investigations of Transonic Flow over a Hemisphere using Various Turbulence Models (C)**
Chung-Jen Tam, Air Force Research Laboratory

THURSDAY AFTERNOON

Modeled Employment of DE

Marriott Room 3, Limited Distribution D

MC: *Linda Lamberson*, Air Force Research Laboratory

- 1330 **Directed Acquisition For High Energy Laser (DAFHI) Modeling & Simulation Plan for the Study of Autonomous Target Acquisition in an Aircraft Self-Protect Laser Weapon System Application (D)**
Timothy Wolfe, Air Force Research Laboratory
- 1400 **Modeling the Challenges of Collateral and Behavioral Effects of DE Deployment (D)**
Richard Vickery, Air Force Research Laboratory
- 1430 **Modeling Collaborative Employment of Kinetic and Directed Energy Weapons (C)**
Linda Lamberson, Air Force Research Laboratory
- 1500 **Break**
- 1530 **High Power Radio Frequency (HPRF) Dynamic Surface Engagement Modeling and Simulation Tool (Export Controlled)**
Wesley Krueger, TechFlow Inc., Scientific Division
- 1600 **Development of a Weather Effects Metric Tool for HEL Mission Level Planning and Fire Control (C)**
Steven Fiorino, Air Force Institute of Technology
- 1630 **Conventional Munitions Modeling and Simulation Applied To High Energy Laser (HEL) Aimpoint Determination and Debris Fall-out Prediction (C)**
Charles Needham, Applied Research Associates (ARA)
- 1700 **Modeling High Power Microwave Propagation over Water for Non-Lethal Vessel-to-Vessel Engagement (C)**
Jason Miller, Booz Allen Hamilton

THURSDAY AFTERNOON

HPEM Effects: Measurements/M&S

Marriott Room 4, Limited Distribution D

MC: *Tim Clarke*, Air Force Research Laboratory

- 1330 **High Power Electromagnetic Effects on Electronics (F)**
Timothy Clarke, Air Force Research Laboratory
- 1400 **High Power Radio Frequency (HPRF) Predictive Effects (D)**
Sameer Hemmady, XL Scientific LLC
- 1430 **Directed Energy Models and Effects Repository Overview (C)**
Grady Patterson, XL Scientific
- 1500 **Break**
- 1530 **Updated HPM Effects Testing Methodology (C)**
Grady Patterson, XL Scientific
- 1550 **Developing Predictive Capability for Upset of Digital Systems in HPEM Environments (C)**
Julie Lawrance, Air Force Research Laboratory
- 1610 **Probability of Effect (PoE) Confidence Curves and the Bootstrapping Technique (C)**
Michael Walker, Sandia National Laboratories
- 1630 **Optimizing Inductive Coupling for C-IED Pre-Detonation Efforts (C)**
J. Thomas Camp, NSWC Dahlgren Division
- 1650 **Validation of the Differential-Mode Optically-Based Current Sensor (C)**
Jeffrey Schleher, American Systems
- 1710 **Autonomous Tracking of Directed Energy onto Targets in a Dynamic Environment (Export Controlled)**
Jerry Kim, Naval Research Laboratory

Symposium Organizing Committee

Symposium Chair

Dr. Diana Loree

Program Committee

HPEM Effects - *Tim Andreadis*

DE T&E - *Patrick Cannon, Steve Conyne*

HPM, High Rep Rate - *Mark Henderson*

Counter DEW - *Ryan Hoffman*

Biological Effects of DE - *Stephanie Miller*

Power & Thermal Systems for DE - *Charles Oberly*

Poster Session - *David Price*

HPM, High Rep Rate - *Mark Rader*

HPEM Sys/Components - *Donald Shiffler, Steve Calico*

DE Employment - *Donald Streater*

Beam Control - *David Loomis*

USPL - *Charlene Rusnak*

Symposium Coordinator

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Security, Registration and Payments

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