

## **Annual Directed Energy Science & Technology Symposium**



### **Technical Program**

**9 – 13 March 2020  
West Point, New York**

# 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.

## MONDAY

### SHORT COURSES

#### All Courses at Thayer Hotel

##### Morning Courses 0800–1200

- Introduction to HEL Systems
- Introduction to HPM Systems (*Distro C*)
- Windows & Coatings for HEL Systems
- DE Warfighter 101
- Combat Systems Engineering for DE Systems (*Distro D*)

##### All Day Course 0800–1700

- HEL Lethality Science (*Distro C*)

##### Afternoon Courses 1300–1700

- HPM Directed Energy Weapons and Their Effects (*Distro C*)
- Atmospheric Laser Propagation (*Distro C*)
- DE Bio-Effects (*Distro D*)
- Introduction to Counter DE (*Distro D*)

##### Evening Course 1730–2130

- Beam Control for Laser Weapon Systems

## TUESDAY MORNING

### Plenary Session (Open)

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0800 **Welcome**  
*COL John Hartke, Symposium Chair and  
 LTG Darryl Williams, USMA Superintendent*
- 0820 **OSD Laser Scaling**  
*Dr. Thomas Karr, OSD R&E, Director for  
 Directed Energy*
- 0900 **UK Novel Weapons**  
*Professor Martin Hubbard, Novel Weapons,  
 DSTL UK*
- 0940 **Army DE Activity**  
*Dr. Craig Robin, Army Rapid Capabilities &  
 Critical Technology Office*
- 1010 **Break**
- 1030 **Air Force DE Activity**  
*Dr. Nick Morley, Senior Scientist for Laser  
 Technology, Air Force Research Laboratory*
- 1100 **US Navy DE Activity**  
*Dr. Frank Peterkin, Senior Scientist for  
 Directed Energy, US Navy DEWO*
- 1130 **DE-JTO Transitions**  
*Dr. Larry Grimes, Director, Joint Directed  
 Energy Transition Office*
- 1200 **Lunch**

## TUESDAY AFTERNOON

### Student Workshop I (Open)

Chair: *Steven Alderete*

- 1330 **Welcome to the DE Student Workshop (A)**  
*Steven Alderete, DE-JTO*
- 1335 **DEPS Educational Initiative (A)**  
*Mark Neice, DEPS*
- 1345 **AFIT Directed Energy Summer Intern Program (A)**  
*Sara Topp, AFIT Center for Directed Energy*
- 1400 **High Energy Laser Detection through  
 Thermoelectric Generators (A)**  
*MIDN Joey Merkel, US Naval Academy*
- 1420 **Additive Manufacturing of Optical  
 Components (A)**  
*MIDN Ethan Delannoy, US Naval Academy*
- 1440 **Integrated Phase Modulators for Compact  
 Optical Phased Arrays (A)**  
*Michael Nickerson, University of California*
- 1500 **Break**
- 1530 **Filtering of Acoustic Disturbances from  
 Aero-Optical Measurements (A)**  
*Brian Catron, University of Notre Dame*
- 1550 **Observed Aberration-Induced Spectral  
 Changes in Optical Cavities: Applications  
 to Turbulence Sensing (A)**  
*John Hunt, University of Minnesota*
- 1610 **Weak Absorption and Scattering Losses in  
 Single-crystal Sapphire Windows due to  
 Bulk and Surface Defects (A)**  
*Jessica Ma, The Johns Hopkins University*
- 1630 **Impedance Probe Development for Coast  
 Guard Academy Plasma Lab (CGAPL)  
 ThinSats (A)**  
*Brian Kay, AFIT*
- 1650 **Characterizing Vertical Profile of Cn2 from  
 SODAR Backscatter Measurements (A)**  
*Ryan Yamaguchi, Naval Postgraduate School*
- 1710 **Session Adjourns**
- 1730 **Reception in Cullum Hall, Bld 605, 2nd Fl**

## TUESDAY AFTERNOON

### Atmospheric Propagation I/Beam Control I

(Open/Limited Distribution)

Chairs: *Dr. Steve Fiorino/COL John Hartke*

- 1330 **Seed Source for Long Wavelength Pulse Compression in Plasma (A)**  
*Daniel Gordon, Naval Research Laboratory*
- 1350 **Atmospheric Propagation of High-peak, High-average Power Laser Pulses (A)**  
*Joseph Penano, Naval Research Laboratory*
- 1410 **Dynamic Sheath Formation and sub-THz Radiation Emission from Laser-Metal Interactions (A)**  
*Asher Davidson, Naval Research Laboratory*
- 1430 **Performance Gains in Low Latency Adaptive Optics with a Pyramid Wavefront Sensor (A)**  
*Stephen Ammons, LLNL*
- 1450 **Break**
- 1520 **Aero-Optical Jitter Analysis of Natural Shear Layers Using the Differential Stitching Method (D)**  
*Matthew Kemnetz, AFRL (RDLT)*
- 1540 **Ultrashort Pulse Lasers and Adaptive Optics: Experimental Campaign and Results (C)**  
*Gregory DiComo, Naval Research Laboratory*
- 1600 **Modeling and Simulation of USPL Propagation through Turbulent Atmosphere using PyCAP (D)**  
*Joshua Isaacs, US Naval Research Laboratory*
- 1620 **Expanded Atmospheric Measurement Capabilities from Turbulence Profilers (D)**  
*Matthew Whiteley, MZA Associates Corp*
- 1640 **Measuring Phase and Amplitude at the Aperture with a Big Aperture Shack Hartmann (D)**  
*Brett Hokr, Radiance Technologies*
- 1700 **Supersonic Aero-Effects Mitigation Simulations for Aircraft Laser Pods (D)**  
*Matthew Whiteley, MZA Associates Corp*
- 1720 **Session Adjourns**
- 1730 **Reception in Cullum Hall, Bld 605, 2nd Fl**

## TUESDAY AFTERNOON

### Laser Sources I (Limited Distribution/Open)

Chair: *COL Kirk Ingold*

- 1330 **RF Emission from Ultra-short Pulse Laser-water Interaction (D)**  
*Andreas Schmitt-Sody, Air Force Research Lab*
- 1350 **Spectral and Spatial Characteristics of Multi-filamentation and Frequency Conversion of Mid-wave Infrared Ultrashort Pulse Lasers in Transparent Solid Media (D)**  
*Tony Valenzuela, CCDC-Army Research Lab*
- 1410 **Broadband Microwave Generation from USPL Filament-Solid Interactions (C)**  
*Alexander Englesbe, Naval Research Lab*
- 1430 **Power Scaling of Directed Energy Amplifiers (C)**  
*Clifford Headley, OFS Laboratories*
- 1450 **Break**
- 1520 **Engineering Filament Plasma Channels (A)**  
*Jessica Pena, University of Central Florida*
- 1540 **Pulsed Hybrid (Fiber-Bulk) MOPA for Track Illuminator Laser (A)**  
*Mark Dubinskii, US Army Research Laboratory*
- 1600 **The Next Generation of Laser Diode Pump Sources for Directed Energy Lasers (A)**  
*John Goings, Leonardo Electronics, Inc.*
- 1620 **Session Adjourns**
- 1730 **Reception in Cullum Hall, Bld 605, 2nd Fl**

## TUESDAY AFTERNOON

### Counter DE Weapons I

(Limited Distribution/Open)

Chairs: *Keith Slinker/John McElhenny*

- 1330 **Preliminary Anchoring of SHIELD Flight Test Data (D)**  
*Craig Smith, Air Force Research Labs / DE Directorate / Ball Aerospace*
- 1350 **Sensitivity Analysis of Inflow Conditions for Numerical Simulations (C)**  
*Chung-Jen Tam, AFRL/RDLEM*
- 1410 **M&S of Blue Aircraft Survivability to HEL Irradiation (MSAS) - Model and Test Update (C)**  
*Ron Dexter, SURVICE*
- 1430 **Counter Directed Energy Weapons and the Defense of Naval Unmanned Aerial Vehicles (D)**  
*Bonnie Johnson, Naval Postgraduate School*
- 1450 **End-To-End Cloud-Based Laser Weapon System Modeling, Simulation, & Analysis Suite (D)**  
*Daniel Cargill, Lockheed Martin*
- 1510 **Break**
- 1540 **Current Research at CCDC-Soldier Center in Vision Protection and Microwave Reflective Materials for the Dismounted Soldier (C)**  
*Francisco Aranda, US Army CCDC-Soldier Center*
- 1600 **Propagation and Interactions of RF-Modulated Electron Beams (C)**  
*Joseph Connelly, Air Force Research Laboratory Directed Energy Directorate*
- 1620 **Conductive 2D flakes for Electromagnetic Interference Shielding (C)**  
*David Lioi, AFRL*
- 1640 **Reflective Limiters Based on EP Degeneracies (A)**  
*Tsampikos Kottos, Wesleyan University*
- 1700 **Understanding the Electromagnetic Response in Complex Topologies (A)**  
*Steven Anlage, University of Maryland*
- 1720 **Session Adjourns**
- 1730 **Reception in Cullum Hall, Bld 605, 2nd Fl**

## TUESDAY AFTERNOON

### HPM Technologies & Effects I

(Classified)

Chair: *Ryan Hoffman*

- 1330 **Free-Flight UAV HPM Live-Fire Testing Considerations and Analysis (Secret)**
- 1350 **Impact of Sensor and Actuator-level Disruptions on UAV Flight Performance (Secret)**
- 1410 **Comparing UAV Platform Susceptibility to HPM Illumination (Secret)**
- 1430 **Far Future Naval Directed Energy (Secret/NF)**
- 1450 **Break**
- 1520 **HPM Protection of RF Apertures (Secret/NF)**
- 1540 **HPM-based Hunter-Killers: A DOTMLPF-P Assessment (D)**  
*Anthony Caruso, University of Missouri - KC*
- 1600 **Simulation Driven Statistical Characterization of Electromagnetic Coupling to UAVs (C)**  
*Daryl Beetner, Missouri University of Science & Technology*
- 1620 **Session Adjourns**
- 1730 **Reception in Cullum Hall, Bld 605, 2nd Fl**

## Exhibitor Reception

### 1730 Tuesday

**Sponsored by**



*A Furukawa Company* 7

## Poster Session (Open)

1000 -1200 **Poster Sessions**

**U.S. National Committee proposed revision to the ISO Laser Damage Standard**

*Jonathan Arenberg, Northrop Grumman Space*

**A New, Flexible Framework for Simulating Naval Battle Scenarios Involving Directed Energy Weapons**

*Joseph Blau, Physics Dept Naval Postgraduate School*

**Studies of Low-Phonon Er<sup>3+</sup> and Ho<sup>3+</sup> doped BaF<sub>2</sub> Single Crystals for Directly Diode Pumped Mid-IR Laser Applications**

*Ei Ei Brown, ARL Combat Capabilities Development Com*

**Agile Optical Filters using Dynamic Plasmonic Pixels**

*Nicholas Greybush, U.S. Naval Research Laboratory*

**Secondary Microwave Radiation from Laser-Solid Interactions**

*Patrick Grugan, Naval Research Laboratory*

**A Machine Learning Model for Prediction of Optical Turbulence in Near-Maritime Environments**

*Christopher Jellen, United States Naval Academy*

**Efficient Visible to Infrared Light Extinction with Plasmonic Nanorods**

*Paul Johns, US Naval Research Laboratory*

**Propagation of High Power Partially Coherent Laser Beams**

*Luke Johnson, US Naval Research Laboratory*

**Materials Mitigation of Optical Nonlinearities for High Power Lasers**

*Bailey Meehan, Clemson University*

**Silicon Carbide Thyristor Development to Optimize High-Power System SWaP**

*Heather O'Brien, U.S. Army Research Laboratory*

**Applications of X-ray Radiography generated by Laser Plasma Acceleration**

*Isabella Pagano, University of Texas /LLNL*

**Compact, Low Cost, High Voltage Trigger for Gas-Phase Switches**

*James Prager, Eagle Harbor Technologies Inc*

**Ultra-Short Pulse Laser Filamentation and Non Linear Effects in Optical Materials**

*Zachary Quine, US Army Research Laboratory*

## Poster Session

**Comparison of Solid State Laser Materials and Alternate Wavebands for Pulsed Tracking Illuminator Lasers**

*Steven Rako, Areté*

**Properties of Harmonic Light Generated by Mid-Infrared Ultrashort Pulses in Single-Crystal Chalcogenides**

*Aaron Schweinsberg, CCDC Army Research Laboratory*

**Time Domain Simulation and Analysis of Parallel Plate-to-Coaxial Taper**

*William Spaeth, University of Missouri Kansas City*

**Personal Protective Eyewear, Limits and Novel Solutions**

*Michael Thomas, Spica Technologies Inc.*

**Validation of Electron-Irradiated Si-PCSS for Recovery Time Optimization**

*Anthony Utt, University of Missouri - Kansas City Caruso Research Group*

**Quickly Determining Minimum HPM Source Requirements Using Binary Search**

*Stefan Wagner, University of Missouri at Kansas City*

**Profiling Optical Turbulence using Dual-Camera Time Lapse Imagery**

*Benjamin Wilson, Air Force Institute of Technology*

**20 kV Inductive Adder for Driving Low Impedance Loads**

*Timothy Ziemba, Eagle Harbor Technologies, Inc.*

## Limited Poster Session (Limited Distribution)

**Counter Directed Energy Weapons and the Defense of Naval Unmanned Aerial Vehicles**

*Bonnie Johnson, Naval Postgraduate School*

**Update on Cryogenic/Superconducting Technology for Megawatt-Class Electric Power Systems**

*Timothy Haugan, U.S. Air Force Research Laboratory*

**Optimization of Nanosecond Pulse Driver Based on Drift Step Recovery Diode**

*Dario Labrada, University of Missouri - Kansas City*

**Distributed RF for DE in Multi Domain Operations**

*Ed Shaffer, CCDC Army Research Lab*

## WEDNESDAY MORNING

### Counter DE Weapons II

(Open/Limited Distribution)

Chairs: *Peter Morrison/Joseph Miragliotta*

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0830 **Rapid Detection of High Energy Laser Strikes Using Optical Fiber Sensors (A)**  
*Brian Jenkins, US Naval Academy*
- 0850 **U.S. National Committee proposed revision to the ISO Laser Damage Standard (A)**  
*Jonathan Arenberg, Northrop Grumman Space*
- 0910 **Continuous Wave Laser Induced Damage Threshold of AMTIR-1, AMTIR-2 and AMTIR-5 at 1.07 micronS (A)**  
*John McElhenny, U.S. ARL*
- 0930 **Break**
- 1020 **Continuous-wave, Laser-induced Damage Thresholds for Large Beams or Thin Targets (D)**  
*Keith Slinker, Air Force Research Laboratory*
- 1040 **High Damage Threshold Monolithic Microstructure for High Reflectivity at 1 micron (D)**  
*David Woolf, US Army Research Laboratory*
- 1100 **Defeating Lasers using Passive Electro-Optical Counter Countermeasure Technology (D)**  
*Mitchell Haeri, Reynard Corporation*
- 1120 **Electro-Optical Vulnerability Assessment Facility Capability Overview (D)**  
*Bruce Odom, Army Combat Capabilities Development Command (CCDC)*
- 1140 **Solid-State Counter-HPM Efforts at the Missouri Institute for Defense and Energy (D)**  
*Stephan Young, University of Missouri - KC*
- 1200 **Session Adjourns and Lunch**

## WEDNESDAY MORNING

### Atmospheric Propagation II

(Limited Distribution)

Chairs: *Dr. Steve Fiorino/Ms. Jaclyn Schmidt*

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0830 **Measurements and Analysis of Ship-induced Optical Turbulence on an LPD17-class Ship (D)**  
*John Cowart, Naval Post Graduate School*
- 0850 **Shipborne Atmospheric Extinction Lidar: Performance, Upgrades, and Future Plans (D)**  
*David Sonnenfroh, Physical Sciences Inc.*
- 0910 **Inertial Subrange Spectra in the Marine Atmospheric Surface Layer (A)**  
*Qing Wang, Naval Postgraduate School*
- 0930 **Comparison of Methods for Determining Optical Turbulence for High Energy Laser Applications (D)**  
*Jessica Wright, Naval Postgraduate School*
- 0950 **Break**
- 1020 **Overview of the Deep-turbulence Problem for Beam-control System Design (D)**  
*Mark Spencer, AFRL/RDLTS*
- 1040 **Ground and Elevated Path Turbulence Measurements (D)**  
*Bo Henderson, Scientic Inc.*
- 1100 **Tethered Meteorological and Atmospheric Characterization (T-MAC) (D)**  
*Michael Kranz, Kratos Defense*
- 1120 **Preliminary Investigation of Jitter Induced by the Atmosphere on Laser Beam Propagation from an Airborne Platform (A)**  
*Eric Jumper, University of Notre Dame*
- 1140 **Session Adjourns and Lunch**

## WEDNESDAY MORNING

### HPM Technologies & Effects II

(Limited Distribution)

Chair: *Dr. Lars Voss*

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0830 **Tethered High-power-microwave Recorder and Electronic Attack Target (THREAT) (D)**  
*Michael Kranz, Kratos Defense*
- 0850 **Full-wave Modeling of Ferrite-based Non-Linear Transmission Lines as High-Powered RF Sources (D)**  
*Daniel Enderich, Air Force Research Lab*
- 0910 **Validation of the Differential-Mode Optically-Based Current Sensor (D)**  
*Jeffrey Schleher, American Systems*
- 0930 **Wargaming Counter UAV Scenarios Utilizing Combined Weapon Systems (D)**  
*John Tiller, John Tiller Software*
- 0950 **Break**
- 1020 **Wargaming Counter UAV Sensor/Shooter Issues (C)**  
*John Luginsland, Confluent Sciences, LLC*
- 1040 **Microwave Antenna Properties of an Optically Triggered Superconducting Ring (C)**  
*Thomas Bullard, UES Inc. - Air Force Research Laboratory*
- 1120 **RF Quality Sensor for HIJENKS Platform**  
*Andrew Sandoval, Sandia National Laboratories (C)*
- 1140 **Session Adjourns and Lunch**

## WEDNESDAY MORNING

### Lethality I (Classified)

Chairs: *David Lyman/Allen Westenhofer*

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0830 **Comparison of Mortar Vulnerability Estimates to Army Field Tests (Secret)**
- 0850 **HEL Lethality Test Results of Rectangular Waveguide (Secret)**
- 0910 **IOC of CRUISE Missiles Model of Directed Infrared Countermeasures (DIRCM) Effects in Imaging Anti-Ship Missiles (Secret)**
- 0930 **Preliminary Analysis of HEL Effects on Warheads (Secret)**
- 0950 **Break**
- 1020 **Burst Filament Interactions and the Modality of Electronic Devices (Secret-NF)**
- 1040 **Methodology for Generating Vulnerability Modules of the ASCM Target Set (Secret-NF)**
- 1100 **A Novel Use of Lasers for Dazzle Countermeasure Against Hardened Systems (D)**  
*Laura Vanderhoef, US Army Research Lab*
- 1120 **Aviation HEL Lethality on Engines (D)**  
*Jesse Croyle, Radiance Technologies*
- 1140 **Session Adjourns and Lunch**

**HELMTT Demo**  
**Remote Viewing**  
**Wednesday**

**Limited Spaces Available**  
**See Registration for Details**





## WEDNESDAY AFTERNOON

### **Student Workshop** (Open)

Chair: *Steven Alderete*

- 1330 **Transparent Alumina Ceramics Fabricated via 3D Printing and Vacuum Sintering (A)**  
*David Carloni, Alfred University*
- 1350 **Epitaxial Regrowth and Hole Shape Engineering for Photonic Crystal Surface Emitting Lasers (PCSELs) (A)**  
*Kevin Reilly, University of New Mexico*
- 1410 **THz Double Resonance Spectroscopy (A)**  
*Daniel Thul, University of Central Florida*
- 1430 **Implications of Electrode Geometry on Electron Emission and Microscale Gas Breakdown (A)**  
*Amanda Loveless, Purdue University*
- 1450 **Break**
- 1520 **Electron Emission Behavior as a Function of Electrode Topology at Nanoscale (A)**  
*Russell Brayfield, Purdue University*
- 1540 **Experimental and Simulation Evaluation of Composite Materials for NLTL System Design (A)**  
*Andrew Fairbanks, Purdue University*
- 1600 **Experimental Investigations of High Power Microwave Sources at the University of Michigan (A)**  
*Drew Packard, University of Michigan*
- 1620 **Periodic Filamentary Plasma Reconfigurable Metamaterial (A)**  
*Matthew Paliwoda, University of Illinois*
- 1700 **Session Adjourns**

## WEDNESDAY AFTERNOON

### **Power and Thermal** (Limited Distribution)

Chair: *Dr. Michael Pfenning*

- 1330 **Thermal and Power Integration and Test Progress for the AFRL Laser Pod Research and Development (LPRD) Program (D)**  
*Matthew Fisher, Lockheed Martin Missiles and Fire Control*
- 1350 **Demonstration of Direct Vapor Compression Cooled Fiber Laser Module (C)**  
*David Sykes, Mainstream Engineering Corporation*
- 1410 **Update on Cryogenic/Superconducting Technology for Megawatt-Class Electric Power Systems (C)**  
*Dr. Timothy John Haugan, AFRL*
- 1430 **Session Adjourns**

*Students and Early  
Career Professionals:*

Join us for a  
**Roundtable Reception**

**Wednesday, 1730-1900**

Appetizers and 1 drink ticket\* will be provided  
(\*Must be 21 or older)

## WEDNESDAY AFTERNOON

### Beam Control II

(Limited Distribution/Open)

Chair: *COL John Hartke*

- 1330 **Assessment of Emerging Technologies for Tracking Sensors (C)**  
*Greg Finney, IERUS Technologies*
- 1350 **Passive Launch Detection and Automated Beam Direction for Anti-Tank Guided Missile Laser Dazzle Countermeasure (D)**  
*Christopher Wolfe, Army Research Laboratory*
- 1410 **Application of Event-Based Sensors for Target Acquisition in Cluttered Environments (C)**  
*Joseph Cox, University of Arizona*
- 1430 **Fabric: SOR's Beam Control Data and Electronics Infrastructure (C)**  
*Michael Steinbock, AFRL*
- 1450 **Break**
- 1520 **Overview of the Beam Control Lab (D)**  
*Cameron Radosevich, AFRL*
- 1540 **Material Characterization of Production Additively Manufactured SiC for Multifunction Application (A)**  
*Jonathan Arenberg, Northrop Grumman*
- 1600 **Prospects for Higher Dispersion Nonpolarizing Spectral Beam Combining Gratings (A)**  
*Turan Erdogan, Plymouth Grating LaB Inc.*
- 1620 **Impact of Contamination Density on Optical Damage of Directed Energy Optics (A)**  
*Joseph Talghader, University of Minnesota*
- 1640 **Session Adjourns**

## WEDNESDAY AFTERNOON

### Atmospheric Propagation III

(Limited Distribution/Open)

Chairs: *Dr. Santasri Bose-Pillai / 1Lt Dan Jagoda*

- 1330 **High Speed Hartmann Turbulence Sensor-Static Test Results (C)**  
*Jay Land, US Army-SMDC*
- 1350 **Validation of HTS Optical Turbulence Profiling via Sonic Anemometry (C)**  
*Alexander Boeckenstedt, AFIT*
- 1410 **Wave-optics Investigation of Turbulence Thermal Blooming interaction (C)**  
*Mark Spencer, AFRL/RDLTI*
- 1430 **Atmospheric Turbulence Profiling with Dual Camera Time-Lapse Imagery and Validation with Sonic Anemometers (C)**  
*Santasri Bose-Pillai, AFIT*
- 1450 **Break**
- 1520 **A Method for Routine PM2.5 Observation and Incorporation Into Numerical Weather Prediction (C)**  
*Daniel Jagoda, AFIT*
- 1540 **Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data (C)**  
*Jaclyn Schmidt, AFIT*
- 1600 **Development of a 3-Category Weather Effects Assessment Tool for DEW Test and/or Employment (C)**  
*Steven Fiorino, AFIT/ENP*
- 1620 **Optical Turbulence Comparisons between Operational Mesoscale Numerical Weather Prediction and Measurements (D)**  
*Matt Wilbanks, Naval Surface Warfare Center*
- 1640 **Thermal Blooming due to Atmospheric Aerosols (A)**  
*Richard Fischer, NRL*
- 1700 **Generation of RF Radiation by Femtosecond Atmospheric Filaments (A)**  
*Travis Garrett, Air Force Research Lab*
- 1720 **Session Adjourns**

## WEDNESDAY AFTERNOON

### Counter DE Weapons III

(Classified)

Chairs: *Jonathan Arenberg/John McElhenny*

- 1330 **Threat Brief (Secret/NF)**
- 1430 **Metasurfaces for Frequency Selective Diffraction and Transmission (D)**  
*Joseph Miragliotta, JHU/APL*
- 1450 **Break**
- 1520 **The Promise of Large Area Metasurfaces (Secret)**
- 1540 **Diffusely Reflecting Non-Charring Laser Hardening Coating (Secret/NF)**
- 1600 **Plasmonic Aerosols to Counter Directed Energy Weapons (Secret/NF)**
- 1620 **Field Tests with a High Energy Laser Weapon Assessing C-DEW Technology (Secret)**
- 1640 **Next-Generation Particles for Broadband Energy Rejection (Secret)**
- 1700 **Progress in Protecting Ground Vehicle Sensors Against Low-Power Visible Pulsed and Continuous-Wave Lasers: A Summary of RD&E Accomplishments to Date (Secret/NF)**
- 1720 **Session Adjourns**

### DEPS SURVEY

Fill out our DEPS membership survey to be entered to win a discounted conference registration for our 2020 DE Systems Symposium!  
Look for an email link mid-March.  
Your feedback is greatly appreciated!

## WEDNESDAY AFTERNOON

### Lethality II

(Classified)

Chairs: *Bryan Knott/Chris Lloyd*

- 1330 **UAV Tailboom Model on Generic Group 1 UAS (D)**  
*Danny Duffin, Radiance*
- 1350 **Analysis of Directed Energy Engagements of UAV Targets using Modeling & Simulation Tools (D)**  
*Glenn Romanczuk, U.S. Army CCDC AVMC/SMDC*
- 1410 **UAV Categorization & Character-driven Grouping (D)**  
*Allen Westenhofer, Gundlach Aerospace LLC*
- 1430 **Results of the Army Space and Missile Defense Command's High Energy Laser Counter-RAM (Rocket, Artillery, Mortar) Lethality Program (D)**  
*Jay Willis, MTSI*
- 1450 **Break**
- 1520 **Further Analysis of Dynamic Engagement Tests (D)**  
*Jaquelyn Williamson, NSWC DD*
- 1540 **Subsonic and Supersonic Wind Tunnel Material Test (D)**  
*Chris Lloyd, NSWC Dahlgren Division*
- 1600 **Measurement and Modeling of Convection Effects in Recent LASER Penetration Tests (D)**  
*Brian Myruski, NSWC DD*
- 1620 **Analysis of Vulnerability Modules (VMs) for Dynamic Engagements (C)**  
*Bryan Knott, NSWCDD*
- 1640 **Protecting Satellites from Inadvertent Laser Effects with Decentralized Deconfliction (C)**  
*John Dewsnap, CSPOC/SPD Laser Clearinghouse*
- 1700 **Session Adjourns**

## THURSDAY MORNING

### Bio-Effects I (Open/Limited Distribution)

Chair: *Gordon Hengst*

0630 **Breakfast and Registration at Thayer Hotel**  
Sponsored by OFS

0830 **Retinal Hemorrhage Thresholds for Q-Switched Nd:YAG Lasers in a Porcine Model (A)**  
*Morgan Schmidt, 711th Human Performance Wing*

0850 **Supra-Threshold Epidermis Injury from Near-Infrared Laser Radiation Exposure Prior to Ablation Onset (A)**  
*Michael DeLisi, SAIC*

0910 **Biomedical Effects, Management, and Diagnosis of High Power Microwave Overexposure (A)**  
*Bianca Cerqueira, KBR / 711HPW/USAF SAM-FES*

0930 **Nominal Ocular Dazzle Distance (NODD) Framework for Non-Lethal Weapons and Threats (A)**  
*Emily Purcell, 711th Human Performance Wing*

0950 **Break**

1020 **Multi-Physics Models for Directed Energy Bioeffects (C)**  
*Chad Oian, 711th Human Performance Wing*

1040 **Advancements in Digital Human Phantoms for RF Bioeffects Simulations (D)**  
*Joseph Butterworth, 711th Human Performance Wing*

1100 **Dose Response Models for Directed Energy (DE) Bioeffects at the Engineering Level & for Applications (C)**  
*Semih Kumru, 711th Human Performance Wing*

1120 **The Path to Probabilistic Risk Assessment for Battlefield Radio Frequency (RF) Exposure Standards (D)**  
*William Voorhees, 711th Human Performance Wing*

1140 **Session Adjourns and Lunch**

## THURSDAY MORNING

### Atmospheric Propagation IV

Chair: *Maj Julie Grossnickle / 2Lt Alex Boeckenstedt*

0630 **Breakfast and Registration at Thayer Hotel**  
Sponsored by OFS

0830 **HEL Performance Estimation Test Technology (HEL-PETT) (C)**  
*Thomas Tumolillo, II-VI Aerospace & Defense*

0850 **Nodal Atmospheric Characterization Payload and Ground Sensors for Directed Energy Testing Development and Results (C)**  
*Alex Clark, IERUS Technologies*

0910 **Determining Bulk Aerosol Absorption from Off-Axis Backscattering Using Rayleigh Beacon Laser Pulses (C)**  
*Julie Grossnickle, Air Force institute of Technology*

0930 **Lagrangian Scaling Law for Atmospheric Propagation (A)**  
*Daniel Cargill, Lockheed Martin*

0950 **Break**

1020 **Phase-based Techniques for Volumetric Atmospheric Characterization (A)**  
*Daniel Thul, University of Central Florida*

1040 **SeaRay: Multi-Model GPU-Accelerated Laser Propagation Code (A)**  
*Daniel Gordon, Naval Research Laboratory*

1100 **Propagation of High Power Partially Coherent Laser Beams (A)**  
*Luke Johnson, US Naval Research Laboratory*

1120 **Session Adjourns**

1140 **Lunch**

## THURSDAY MORNING

### HPM Technologies & Effects III

(Limited Distribution/Open)

Chair: *Prof. Tony Caruso*

- 0630 **Breakfast and Registration at Thayer Hotel**  
**Sponsored by OFS**
- 0830 **Distributed RF for DE in Multi Domain**  
**Operations (D)**  
*Ed Shaffer, CCDC Army Research Lab*
- 0850 **Electron Irradiation of Si-PCSS for Reduced**  
**Recovery Time (C)**  
*Jay Eifler, University of Missouri - KC*
- 0910 **Solid-state Sub-nanosecond High-power**  
**Microwave Generators (C)**  
*Plamen Doynov, University of Missouri - KC*
- 0930 **Break**
- 1020 **Concepts for Generating Circular**  
**Polarization via HPM-Capable Leaky-Wave**  
**Antennas (A)**  
*Robert Koslover, SARA, Inc.*
- 1040 **Electromagnetic Pulse Generation from**  
**Ultra Short Pulse Laser Induced Plasma (A)**  
*Michael Ross, Naval Information Warfare*  
*Center*
- 1100 **Additive Manufacturing for Multi-Mission**  
**Antenna (A)**  
*Dr. Steven Weiss, ARL*
- 1120 **Session Adjourns**
- 1140 **Lunch**

## THURSDAY MORNING

### Lethality III (Limited Distribution/Open)

Chairs: *Glenn Romanczuk/Steve Baird*

- 0630 **Breakfast and Registration at Thayer Hotel**  
**Sponsored by OFS**
- 0830 **Mobile Laboratory for Long-Distance**  
**Ultrashort Pulse Laser Propagation and**  
**Interaction Studies (D)**  
*Michael Helle, US Naval Research Lab*
- 0850 **Atmospheric Turbulence Sensitivity Study**  
**for High Energy Laser Engagements (D)**  
*Kevin Smith, NSWCCD*
- 0910 **Material Failure Analysis in Aluminum Test**  
**Articles after Exposure to a HEL Beam (C)**  
*Carl Carney, NSWCCD*
- 0930 **Reaction Modeling for Defense**  
**Applications: Case Studies (A)**  
*Stephen Jimenez, Corvid Technologies*
- 0950 **Session Adjourns**
- 1140 **Lunch**

JOIN US FOR THESE UPCOMING EVENTS

## **DIRECTED ENERGY OUTREACH**

### **Directed Energy to DC (DE2DC)**

### **and**

### **Directed Energy Summit**

Washington, D.C.

30 March- 2 April, 2020



## **DIRECTED ENERGY SYSTEMS SYMPOSIUM**

28 SEPTEMBER – 2 OCTOBER, 2020 IN WASHINGTON DC

## **ANNUAL DE S&T SYMPOSIUM**

22–26 March 2021 IN MOBILE, ALABAMA

## THURSDAY AFTERNOON

### **Student Workshop** (Limited Distribution)

Chair: *Steven Alderete*

- 1330 **Image Sharpening on the 3D Intensity in the Presence of Scintillation (D)**  
*Matthias Banet*, University of Rochester
- 1350 **Measuring Modeling Parameters of an Electron Beam (D)**  
*Zachary Olson*, AFRL, 711th Human Performance Wing
- 1410 **High Power Microwave Directed Energy Protection for USCG Vessels: Design Research (C)**  
*Chance Baxter*, AFIT
- 1430 **USCG Boat-Stopping in S-Band: Design Research (C)**  
*Justin Moll*, AFIT
- 1450 **Optically Pumped Carbon Monoxide Cascade Laser in a Hollow Core Fiber (D)**  
*Daniel Parra*, AFRL
- 1510 **Investigating High Power Beam Delivery in a Kagome Hypocycloidal Hollow-Core Fiber (D)**  
*Samuel Bingham*, AFRL/RDLT
- 1530 **Session Adjourns**

## THURSDAY AFTERNOON

### **LASER Sources II** (Open)

Chairs: *COL Kirk Ingold*

- 1330 **High Power Diode Laser Development at Freedom Photonics (A)**  
*Jenna Campbell*, Freedom Photonics
- 1350 **Hollow Core Fibers for High Power Directed Energy Laser Systems (A)**  
*Alex Rosiewicz*, NKT Photonics Inc
- 1410 **Background Gas Species and Pressure Dependence of RF Emissions Generated by Laser-produced Filament Plasmas (A)**  
*Jennifer Elle*, AFRL
- 1430 **Coherent Beam Combining of Tapered Amplifiers (A)**  
*Martin Heimbeck*, Space and Missile Defense Command Technical Center
- 1450 **Break**
- 1520 **A Compact CO<sub>2</sub> Laser Source for Ultrafast Applications at 10  $\mu$ m (A)**  
*Daniel Thul*, University of Central Florida
- 1540 **Two Filament Interaction with a Single Aerosol (A)**  
*Jessica Pena*, University of Central Florida
- 1600 **Kinetics of Optical Gain for Optically-pumped Rare-gas Metastables (A)**  
*W. Rawlins*, Physical Sciences Inc.
- 1620 **80 W Narrow Linewidth Continuously Tunable All-fiber Thulium Laser (A)**  
*Patrick Roumayah*, University of Central Florida
- 1640 **Session Adjourns**

## THURSDAY AFTERNOON

### **Artificial Intelligence/ Machine Learning**

(Limited Distribution/Open)

Chair: *Dr. David Kashinski*

- 1330 **Algorithm Suite for Acquisition and Tracking in Clutter (D)**  
*Yakov Diskin, MZA Associates Corporation*
- 1350 **Enhanced Surface-Level Turbulence Modeling and Forecasting (D)**  
*Yakov Diskin, MZA Associates Corporation*
- 1410 **Utilizing RGB Phase Encoding in Machine Learning for Optical Propagation (C)**  
*Kyle Drexler, Naval Information Warfare Center Pacific*
- 1430 **Turbulence-Tolerant Shack-Hartmann Wavefront Reconstruction by Deep Convolutional Networks (A)**  
*Theodore DuBose, Naval Research Laboratory*
- 1450 **Break**
- 1520 **Machine Learning for Prediction and Control of High-Power Laser Propagation Through the Atmosphere (A)**  
*Joshua Isaacs, Naval Research Laboratory*
- 1540 **Session Adjourns**

## THURSDAY AFTERNOON

### **Bio-Effects II** (Limited Distribution/Open)

Chair: *Gordon Hengst*

- 1330 **High Energy Laser Collateral Effects M&S: MFIX 20 Experimentation Missions (C)**  
*Matthew Piper, 711th Human Performance Wing*
- 1350 **Risk Assessment for Friendly and Threat HPM systems (D)**  
*Noel Montgomery, 711th Human Performance Wing*
- 1410 **Laser Eye Protection Visual Effects (LVUE) Model (C)**  
*Brenda Novar, 711th Human Performance Wing*
- 1430 **Evaluation of Nighttime LEP Prototype with Laser Glare (A)**  
*Barry Goettl, 711th Human Performance Wing*
- 1450 **Break**
- 1520 **Cranial High Pressure Induced by Radiofrequency Pulses (D)**  
*Gordon Hengst, 711th Human Performance Wing*
- 1540 **Thermal Effects of the Active Denial System (A)**  
*Hong Zhou, Naval Postgraduate School*
- 1600 **Session Adjourns**

## FRIDAY MORNING

### **Outbriefs and Closing Remarks** (Open)

- 0630 **Breakfast and Registration at Thayer Hotel**
- 0800 **Outbriefs Begin**
- 1200 **Symposium Adjourns**



## **Symposium Chair**

*Col. John Hartke*

## **Program Committee**

### **General Sessions**

*COL Kirk Ingold*

*Dr. Dave Kashinski*

*Dr. Michael Pfenning*

### **Atmospheric Propagation**

*Dr. Steve Fiorino*

### **Bio-Effects**

*Dr. Stephanie Miller*

*Dr. Gordon Hengst*

### **Counter DEW**

*John McElhenny*

*Keith Slinker*

### **HEL Lethality and Effects**

*Dr. Chuck Lamar*

*Steve Baird*

### **HPM Technologies and Effects**

*Adam Conway*

### **Student Workshop**

*Steven Alderete*

### **Symposium Coordinator**

*Cynnamon Spain*

### **Registration Coordinator**

*Dawn Gutierrez*

### **Security Officer**

*Kat Gonzales*

### **Technical Program Coordinator and Short Courses**

*Cristina Crowson*

### **Presentations and Releases**

*Carolyn Bowman*

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