

Technical Program



Directed Energy Systems Symposium

18 - 22 November 2019
La Jolla, California

General Information

Security

- DE Systems Symposium is SECRET/ NOFORN
- 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
- All presentations must be processed through DEPS security
- 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
- Limited distribution sessions: Attendees must power off all computers and phones
- 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

MONDAY

Short Courses

All short courses are at the Hilton Hotel

Morning Courses 0800-1200

- 1: Introduction to HEL Systems
- 2: Introduction to HPM Systems
- 3: Systems Engineering for Directed Energy Systems
- 4: Introduction to High-Power Diode Lasers - Back-End Packaging (Part 1)

All Day Course 0800-1700

- 5: Beam Control for Laser Weapon Systems

Afternoon Courses 1300-1700

- 6: Introduction to High-Power Diode Lasers - Back-End Packaging (Part 2)
- 7: Design of Tests for Transitioning DE Weapon Systems to Acquisition Programs for Warfighter Fielding
- 8: HPM DE Weapons and their Effects
- 9: HPM M&S Tools for T&E

Afternoon Courses 1730-2130

- 10: Introduction to Counter Directed Energy

TUESDAY

Plenary Session: Service & Agency Perspectives on DE Capabilities and Opportunities

Secondary Location

- 0630 **Breakfast and Registration at Hilton**
- 0800 **DEPS Introduction and Welcoming Remarks**
Capt. Andrew Gainer, NIWC XO
- 0815 *LTG Neil Thurgood, Army Rapid Capabilities & Critical Technology Office (RCCTO)*
- 0900 *CAPT (Ret.) David Kiel, Director, US Navy Directed Energy Weapons Office, NSWC Dahlgren*
- 0945 **Break**
- 1015 *Dr. Nick Morley, Senior Scientist for Lasers, Air Force Research Laboratory*
- 1100 *Dr. James Trebes, Principal Physicist for Directed Energy, OUSD (R&E)*
- 1200 **Lunch**
- 1330 *Dr. Tom Nelson, Sandia National Laboratories, USPL*
- 1415 **Secretary of Defense Electromagnetic Spectrum Operations Cross-Functional Team**
Mr. Greg Huson, U.S. Department of Defense, EMSO CFT
- 1500 **Updates on Intermediate Force Capabilities with Non-Lethal Directed Energy Weapons**
Col. Wendell Leimbach and David Law, JNL-
- WD
- 1545 **Session Adjourns**
- 1730 **Reception at the Hilton La Jolla Torrey Pines Hotel**

POSTER SESSION

Wednesday 1500 - 1700

Limited Distribution poster session in Scrips I

WEDNESDAY MORNING

RF - HPM System Enablers & SWAP-C2 Subsystems: Non-Lethal Directed Energy Weapons

Hilton Hotel, Ballroom B

Chair: *Josh Pompeii*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **Metamaterial-Enabled Reconfigurable Reflect Array Antennas for High-Power Microwave Applications (C)**
Dr. Sawyer Campbell, Penn State University
- 0830 **High Density Prime Power Solutions for Directed Energy Weapon (DEW) Systems (C)**
Hernando Munevar, Candent Technologies
- 0900 **Next-Gen NL DEW Advanced Thermal Management Design (C)**
Thadius Baxter, Durbin Group
- 0930 **Micro Tube Heat Exchangers for Directed Energy Applications (C)**
Kevin Kelly, Mezzo Technologies Inc
- 1000 **Break**
- 1030 **Next Generation of Ultra-High Voltage, 500 kV Capacitor Prototypes for Further Reduction in Weight and Volume (C)**
Dr. Randy Curry, Univ. of Missouri - Columbia

Sound & Light Technologies for Long Range Hail and Warn: Non-Lethal Directed Energy Weapons

Chair: *Dave Law*

- 1100 **USCG HALLTS Evaluation - Utility Assessment Update (C)**
LT Michael A Rauch, USCG HQ Washington DC
- 1130 **Next-Gen Distributed Sound & Light Array (DSL) Technologies (Air-Cooled Large Spot-Size Green Dazzlers & Focused Low-Frequency High Output Acoustic Drivers) (C)**
Dave Law, JNLWD
- 1200 **Session Adjourns**
- 1200 **Lunch**

WEDNESDAY MORNING

HPM Counter UAS

Secondary Location

Chairs: *Ryan Hoffman / Mike Lambrecht*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **Tactical High Power Microwave Operational Responder (THOR)**
- 0825 **THOR Payload Design and Testing (C)**
Michael Lambrecht, Air Force Research Laboratory DE Directorate
- 0850 **THOR Field Test Methodology and Data Collection (C)**
Jeremy McConaha, AFRL
- 0915 **HPM Effects on UAS & Application to THOR**
- 0940 **Compact Software Defined Directed Energy Weapons (C)**
Bo Marr, Epirus, Inc
- 1005 **Break**
- 1030 **SWATR Program Overview and At-Sea Demonstration**
- 1055 **SWATR Effects Summary**
- 1120 **SWATR NSWCCD Field Test Results and Comparison**
- 1145 **SWATR Field Test Results and Comparison**
- 1210 **Session Adjourns**
- 1200 **Lunch**

WEDNESDAY MORNING

Radio Frequency - High Power Microwave Vehicle/Vessel Stopper Prototype Testing: Non-Lethal Directed Energy Weapons

Hilton Hotel, Ballroom D

Chairs: *Adam Clark / Scott Griffiths*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **JNLWP RF-HPM Vessel Stopper (VIPER) (D)**
Clark/Griffiths, NSWC Dahlgren
- 0830 **HI-POM Update (D)**
Dr. Jack Chen, NSWC Dahlgren
- 0900 **Test Bed Development for Relativistic Magnetrons (D)**
Dr. Jack Chen, NSWC Dahlgren
- 0930 **Optimized Higher Power Microwave System for Vehicle/Vessel Stopping Applications - USMC/JNLWD STTR (D)**
Matthew T. Domonkus, Versus Research
- 1000 **High-fidelity Modeling and Optimization of Gyromagnetic Nonlinear Transmission Lines Using the Finite Difference Time Domain Method - USMC/JNLWD Short Pulse Source - STTR (D)**
Anton Geiler, Metamagnetics
- 1030 **Session Adjourns**
- 1200 **Lunch**

WEDNESDAY MORNING

Technology Demonstrator Systems 1

Secondary Location

Chair: *Millay Petersen*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **HADES Field Test Results (D)**
Jeffrey Barchers, Nutronics, Inc.
- 0825 **Advanced Beam Control Locating and Engagement Enhanced Tracking System (ABLE-ETS) Progress and Plans (D)**
Robert Pawlak, NSWG
- 0850 **ABCD Results (D)**
Darren Forman, Nutronics, Inc.
- 0915 **HELCAP: S&T Path to future US Navy Missions (D)**
Matthew Ketner, Air Force Research Laboratory
- 0940 **Handheld 1.5 kW Laser EOD System Test Results (C)**
Joseph Paranto, ARA
- 1005 **Break**
- 1030 **HELMTT Image Simulation and Data Results (D)**
Dr. Theodore Schuler, Applied Technology Associates
- 1055 **USASMDC High Energy Laser Mobile Test Truck Knowledge Point Completion (D)**
Adam Aberle, USASMDC
- 1120 **Air Force Development of High Energy Lasers for Airborne Applications**
- 1145 **Session Adjourns**
- 1200 **Lunch**

WEDNESDAY MORNING

Operational Requirements and Mission Level Analysis

Secondary Location

Chair: *Dave Kiel*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **High Energy Lasers in an Evolving Naval Strategy: Opportunities and Challenges**
- 0830 **SHiELD Analysis and Results**
- 0900 **Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites (C)**
Steven Fiorino, AFIT/ENP
- 0930 **Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes (C)**
Jaclyn Schmidt, AFIT
- 1000 **Break**
- 1030 **Numerical and Theoretical Aspects of a METCAL-Focused M&S Effort for HEL Propagation (C)**
Dr. Joseph A Fiordilino, Naval Surface Warfare Center Corona Division
- 1100 **Session Adjourns**
- 1200 **Lunch**

WEDNESDAY AFTERNOON

Industry Panel

Hilton Hotel, Ballroom C

- 1300 **Customer HEL Industry Base Overview**
Jenny Niles, US Army Space and Missile Defense Command
- 1320 **Prime HEL Industry Base Challenges**
- 1415 **Service Funded Efforts**
Fiber-Coupled Pump Laser Diodes
Manoj Kanskar, nLight
Grinding and Polishing of Large HEL Optics
Brandon Light, Optimax
Laser Quality Spinel for Optics
John Gannon, CeraNova
- 1515 **Break**
- 1545 **Panel Questions and Answers (Discussions)**
Industry Panel Members:
Mike Perry, General Atomics
Rob Afzal, Lockheed Martin
Till Liepmann, Northrup Grumman
Justin Martin, Raytheon
- 1715 **Session Adjourns**

WEDNESDAY AFTERNOON

Poster Session

Hilton Hotel, Scripts I

- 1500 **Poster Session Begins**
- 1700 **Poster Session Adjourns**

THURSDAY MORNING

HIJENKS

Secondary Location

Chairs: *Matt McQuage/ Sam Gutierrez*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **HIJENKS Payload Development and Systems Engineering Overview**
- 0825 **HIJENKS Test and Evaluation**
- 0850 **HIJENKS Payload Controls Overview and Navy Payload Controller Design**
- 0915 **HIJENKS Energy Storage and High Voltage Conversion**
- 0940 **HIJENKS Pulsed Power Design**
- 1005 **Break**
- 1030 **Capacitor Development for Compact High Power Systems (D)**
Mark Schneider, General Atomics-EMS
- 1055 **Status Update for HIJENK RF Quality Sensor**
- 1120 **Battle Damage Assessment for High Power Microwave Weapons**
- 1145 **Session Adjourns**
- 1200 **Lunch**

Join Us for the

Joint Conference on T&E Support to Prototyping and Experimentation

A Joint DEPS - ITEA Event

**27-30 January 2020
Hotel Albuquerque**

THURSDAY MORNING

Operational Employment

Hilton Hotel, Ballroom B

Chair: *LTC Tracey Smith*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **Metrology & Calibration for Navy/DoD Electric Weapons (C)**
Dr. Subrata Sanyal, NSWC Corona Division
- 0830 **HEL Atmospheric Characterization Efforts: METCAL Support (C)**
Dr. Joseph Fiordilino, NSWC Corona Division
- 0900 **Measurement of Optical Turbulence at the New Outdoor High Energy Laser Laboratory at West Point, NY (A)**
Isaac Ferrell, United States Military Academy
- 0930 **Analysis of Turbulence Data Collected on the USS SPRUANCE and Modeling its Effects on Laser Weapon System Performance (D)**
LT Erin Haacke, Naval Postgraduate School
- 1000 **Break**
- 1030 **Comparison of Point Sensor Systems for Above Deck Measurements of Turbulence on Navy Ships (A)**
Keith Cohn, Naval Postgraduate School
- 1100 **SDPE Overview (D)**
Dion Smith, Booz Allen Hamilton
- 1130 **Session Adjourns**
- 1200 **Lunch**

THURSDAY MORNING

Non-Lethal Laser Induced Plasma Effects (NL LIPE) System Prototypes: Non-Lethal Directed Energy Weapons

Hilton Hotel, Ballroom C

Chair: *Brittany Lynn*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **JNLWP LIPE Program Overview (C)**
Britany Lynn, NIWC Pacific (San Diego)
- 0830 **Scalable Compact Ultrashort Pulse Laser at 2 micron (D)**
Arturo Chavez-Pirson, NP Photonics Inc.
- 0900 **Scalable Compact Ultra-short Pulse Laser Systems (SCUPLS) Concept for Accelerated Deployment (D)**
John Vetrovec, AQ West LLC
- 0930 **Long-Range Plasma Generation in Tactical Environments (D)**
Anthony Gleckler, GEOST Inc.
- 1000 **Break**
- 1030 **Scalable Compact Ultra-Short Pulsed Laser System (C)**
Jeremy S. Nevins, AURA Technologies Inc.

Pre-Emplaced Electrical Vehicle Stopper (PEVS) Pilot Program

Chair: *Josh Pompeii*

- 1100 **PEVS Pilot Program Update and Future Improvements (C)**
Josh Pompeii, JNLWD/NSWC Dahlgren
- 1200 **Session Adjourns**
- 1200 **Lunch**

THURSDAY MORNING

Radio Frequency - High Power Microwave Vehicle/ Vessel Stopper Prototype Testing: Non-Lethal DE Weapons

Secondary Location

Chair: *Scott Griffiths*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **Booz Allen Hamilton's High Powered Microwave Modeling and Simulation Capabilities (D)**
Kevin Bartas, Booz Allen Hamilton
- 0830 **HPM S-Band System (D)**
Alexandra Ortiz, Raytheon
- 0900 **High Peak Power Radio Frequency Assessment & Capability Development (HIPR ACTV) Raytheon Engineering Development Unit's (REDU) OBM Effectiveness**
- 0930 **Effects of the 5 MW E2V source on 11 Outboard Motor (OBM) Targets**
- 1000 **Break**
- 1030 **Vessel Stopping Incident Angle Dependencies and Testing**
- 1100 **JNLWP RF-HPM Vehicle Stopper**
- 1130 **CUAS at 95 GHz Study Results**
- 1200 **Session Adjourns**
- 1200 **Lunch**

THURSDAY MORNING

Technology Demonstrator Systems 2

Secondary Location

Chair: *Millay Petersen*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **Solid State Laser Technology Maturation Program Overview (D)**
Ron Flatley, Naval Surface Warfare Center Dahlgren Division
- 0825 **A Review of the ODIN Optical and Alignment Control Systems**
- 0850 **Most Recent SHIELD Study**
- 0915 **Jitter Control for the Self-Protect High Energy Laser Demonstration (SHIELD) (D)**
Arthur Hassall, AFRL/RDLA
- 0940 **Near Term Ultra-Short Pulse Military Effectiveness and Research Strategy (C)**
Dr. Matthew Leigh, Directed Energy Joint Transition Office
- 1005 **Break**
- 1030 **Multifunction Digital Holography Applications (C)**
Philip Gatt, Lockheed Martin Coherent Technologies
- 1055 **Deep TAO Demonstrator Using Digital Holography (C)**
Thomas Alley, Lockheed Martin Coherent Technologies
- 1120 **Digital Holography PHASTAHR Transceiver (D)**
Christopher Ryan, Lockheed Martin Coherent Technologies
- 1145 **Integrating Digital-Holographic Detection into a Laser-Weapon System: An Update (D)**
Dr. Mark Spencer, AFRL/RDLTS
- 1210 **Session Adjourns**
- 1210 **Lunch**

THURSDAY MORNING

HEL for CUAS

Hilton Hotel, Ballroom D

Chair: *Ryan Hoffman/ Mike Lambrecht*

- 0700 **Breakfast and Registration at Hilton**
- 0800 **ATP for CISR vs HEL Systems (C)**
Bryan Kelchner, Teknicare, Inc.
- 0830 **Multi-Effector System, including HEL, for Counter-UAS Applications (A)**
David O'Brien, Applied Technology Associates
- 0900 **Leveraging Decades of HEL Domain Knowledge for Counter-UAS Mission (A)**
David O'Brien, Applied Technology Associates
- 0930 **Establishing Drop Time as an Objective Measurement of Laser Effectiveness (A)**
Jarrod Broussard, United States Military Academy
- 1000 **Break**
- 1030 **GBAD DE OTM System Integration and HELSTF Test Results (D)**
Christopher Cork, Naval Surface Warfare Center Dahlgren Division
- 1100 **Session Adjourns**
- 1200 **Lunch**

THURSDAY MORNING

AIAA/ DEPS DE Systems Integration Committee (DESIC) Status

Hilton Hotel, Scrips II

- 0800 **Airborne DESIC Overview, Status, Plan**
Daniel Miller, Lockheed Martin & Donald Wittich, AFRL
- 0830 **Systems Engineering Focus Area**
Wesley Green, DoD SETA & Gary Christie, Boeing
- 0900 **Design & Integration Focus Area**
Joshua Peters, BAH & David Leggett, AFRL
- 0930 **Aero-Effects/Modeling & Simulation Focus Area**
Donald Wittich, AFRL & Scott Sherer, AFRL
- 1000 **Break**
- 1030 **Test & Evaluation Focus Area**
Bryan Kelchner, Teknicare & Sean Ross, AFRL
- 1100 **Education & Outreach Focus Area**
Mark Neice, DEPS & Daniel Miller, Lockheed Martin
- 1130 **Session Adjourns**
- 1200 **Lunch**

THURSDAY AFTERNOON

Operational Employment

Secondary Location

Chair: *LTC Tracey Smith*

- 1330 **Sensor Effects System (C)**
Robin Ritter, Tau Technologies
- 1400 **Directed Energy Weapon Approval Process, Policies and Procedures**
- 1430 **Probabilistic Monte Carlo Investigation of Non-Combatant Laser Exposure Due to Aerial Target Overspill (D)**
John Burton, NSWC Dahlgren
- 1500 **Break**
- 1530 **SMWDC Efforts to support Deployment of Surface Navy Laser Weapon Systems**
- 1600 **Joint Laser Weaponing Software (JLaWS) (C)**
Jezreel Bassett, Tau Technologies
- 1630 **Joint Laser Systems Effectiveness (JLaSE) (A)**
LTC Tracey Smith, Joint Test and Evaluation - Suffolk
- 1700 **DARPA Endurance Test Results**
- 1730 **Session Adjourns**

THURSDAY AFTERNOON

HIJENKS

Secondary Location

Chairs: *Matt McQuage/ Sam Gutierrez*

- 1330 **HIJENKS Payload Packaging, Assembly, and Integration**
- 1355 **HIJENKS RF Subsystem: Experimental Results of Early Prototypes Part 1**
- 1420 **HIJENKS RF Subsystem: Experimental Results of Early Prototypes Part 2**
- 1445 **HIJENKS Pulsed Power Environmental Testing and Results (D)**
Chris Grabowski, Sandia National Laboratories
- 1510 **Break**
- 1535 **Wave Propagation and Effects in Enclosures for DE Counter-facility Missions**
- 1600 **Target Selection and Vulnerability Testing for HIJENKS**
- 1625 **HPM Fragility Methodology for Assessing Target Vulnerability**
- 1650 **Failure Analysis Logic Tree (FALT) Applications for Predicting HPM Lethality and Effectiveness**
- 1715 **Session Adjourns**

THURSDAY AFTERNOON

Radio Frequency - High Power Microwave Vehicle/ Vessel Stopper Key Subsystems: Non-Lethal DE Weapons

Hilton Hotel, Ballroom B

Chairs: *Scott Griffiths / Josh Pompeii*

- 1330 **An Update on Ultra-High Voltage Nano Dielectric Capacitor Development, With Test Validation (A)**
Dr. Randy Curry, University of Missouri - Columbia
- 1400 **Energy Dense Capacitors for High Voltage Pulsed Power Applications (C)**
Kirk Slenes, TPL Inc.
- 1430 **High Power Phased Array (HPPA) (C)**
Dr. Hoon Ahn, Wireless Technology Associates, Inc.
- 1500 **Session Adjourns**

THURSDAY AFTERNOON

Next-Generation Active Denial Technologies - Non-Lethal Directed Energy Weapons

Hilton Hotel, Ballroom C

Chairs: *Jonathan Yi / Dave Law*

- 1330 **JNLWP ADT Portfolio Update (A)**
Jonathan Yi, JNLWD
- 1355 **High Efficiency W-band MMIC Power Amplifiers (D)**
Nick Koliass, Raytheon
- 1420 **DARPA's High Power Electronics for Sub-millimeter Wave Phase Array Applications (D)**
Dr. YK Chen, DARPA
- 1445 **SS-ADT 95 GHz Armor/Ballistic Head Window (D)**
Kenneth Herrle, ARA
- 1510 **Break**
- 1535 **SS-ADT Thermal Management (C)**
Robert Hardesty, Peregrine Falcon Corporation
- 1600 **Non-Cyro Magnet Design Optimization with Integration into a High Power 95 Ghz Gyrotron (A)**
Jerry Foshage, RCT Systems, Inc.
- 1625 **Universal High Power Green Wave Vessel/ Vehicle Stopper Antenna System (A)**
Dr. Dan Gonzales, Pacific Antenna Systems
- 1650 **GaN Wafer MMIC-based Solid State Active Denial Technology Skid-Plate (D)**
Hooman Kazemi, Raytheon
- 1715 **Session Adjourns**

DE2DC

The Directed Energy to DC Exhibition

**Pentagon Courtyard Exhibit
30 - 31 March 2020**

**Rayburn Foyer Exhibit / Reception
1 April 2020**

THURSDAY AFTERNOON

HPM for CUAS

Secondary Location

Chairs: *Ryan Hoffman/ Mike Lambrecht*

- 1330 **Heuristically Driven cUAS Requirements for Defensive Counterair (DCA): A Technologist Viewpoint (D)**
Anthony Caruso, University of Missouri - Kansas City
- 1355 **ONR Short Pulse Research and Evaluation for sUAS (OSPRE): Drivers and Effects Status Update (D)**
Anthony Caruso, University of Missouri - Kansas City
- 1445 **SiC PCSS based HPM Directed Energy for Countering Small Unmanned Aerial Systems**
- 1510 **Break**
- 1530 **Overview of a VTOL Capable UAV with Integrated HPM for CUAS Applications (D)**
Richard Shone, Lockheed Martin Missiles and Fire Control
- 1555 **Ultra-Wideband Effects on Electronics: Sources and Methods**
- 1620 **Novel Solid-State UWB Radiators for cUAS (A)**
Joseph Croman, Naval Research Laboratory
- 1645 **Effects on Small Unmanned Aerial Systems and Vehicles by Systems with Ultra-Wideband Emitting Output**
- 1710 **A CUAS Solution**
- 1735 **Session Adjourns**

THURSDAY AFTERNOON

Technology Demonstrator Systems 3

Hilton Hotel, Ballroom D

Chairs: *Millay Petersen*

- 1330 **System Optimization for Rapid Fielding and Affordability (D)**
Benjamin Tritt, NSWC Dahlgren
- 1400 **Directed Energy Test Science and Technology Development Projects 2019-2020 (A)**
Jeffrey Schleher, PEO-STRI
- 1430 **Hybrid Aperture Development for Integration on Air Vehicles (D)**
Scott Sherer, AFRL/RQVA
- 1500 **Break**
- 1530 **High Brightness, High Efficiency and Low SWaP 976 nm Diode Laser Pumps for Directed Energy Fiber Amplifiers (A)**
Manoj Kanskar, nLight, Inc.
- 1600 **SHiELD CFD Aero-Effects: Anchoring and Predictions (D)**
Craig William Smith, AFRL DE Directorate
- 1630 **Session Adjourns**

DE Systems Symposium Outbriefs

Join us for overviews of each
technical session from this year's
Directed Energy Systems Symposium

0800- 1030
Secondary Location

Symposium Organizing Committee

Symposium Chairs

Chris Behre

Dan Marker

Symposium Committee

Scott Boyd

Mike Lambrecht

Andrea Foster

Dave Law

Sam Gutierrez

Matt McQuage

Ryan Hoffman

Millay Petersen

Dave Kiel

LTC Tracey Smith

Symposium Coordinator

Cynnamon Spain

Security

Kat Gonzales

Registration and Receipts

Dawn Gutierrez

Technical Program Coordinator / Short Courses

Cristina Crowson

Presentations / Release Forms

Carolyn Bowman

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