

## Technical Program



## Fourteenth Annual Directed Energy Symposium

14-18 November 2011  
La Jolla, California

and

Directed Energy Education  
Workshop

18 November 2011

SPONSORED BY: HEL JTO

## **Symposium Information**

### **Locations of Symposium Events**

Symposium sessions will be held at the Hilton Torrey Pines. The Tuesday evening reception will be at the San Diego Maritime Museum and bus transportation will be provided.

### **Breakfasts**

Breakfast will be served every morning at the Hilton starting at 0630. Speakers are encouraged to eat breakfast with their session chairs on the day of their presentation. Look for table tents to designate your session's breakfast table.

### **Lunches and Breaks**

Lunch will be served Tuesday - Friday at the Hilton. Limited coffee and snacks during breaks will be available Tuesday - Friday.

### **Directed Energy Education Workshop**

The DE Education Workshop is a separate event from the Symposium, scheduled for Friday, 18 November, at the hotel. Any Symposium registrant may attend the Workshop.

### **Webcasts**

Several portions of the Annual Symposium will be webcast. Webcasting will be synchronous, that is, available only in real time. Portions expected to be webcast are noted throughout the agenda.

### **SECURITY NOTE:**

Letters listed in this agenda after presentation titles indicate distribution statements as follows:

**A - information is open, public release**

**C - information is limited to U.S. citizens who are employees of the U.S. Federal Government or its contractors**

**D - information is limited to U.S. citizens who are employees of the U.S. Department of Defense or its contractors**

## MONDAY

### Short Courses

- 0700 Registration at Hilton Hotel  
0800 Morning and all day short courses begin

#### MORNING COURSES

1. Introduction to High Energy Laser Systems  
(*WEBCAST at 0800*)
2. Introduction to High Power Microwave Systems
3. Windows, Substrates, and Coatings for HEL Applications
4. Optical Turbulence

#### ALL DAY COURSES

5. Introduction to Free Electron Laser Systems
  6. Physics of High Energy Lasers (Limited)
  7. Improved Concurrent Electromagnetic Particle-in-Cell (Limited)
- 1200 Break for Lunch  
1300 Afternoon short courses begin and all day courses resume

#### AFTERNOON COURSES

8. Thermal Management
9. Introduction to Beam Quality Measures
10. Cancelled
11. Maritime Atmospheric Propagation

## TUESDAY MORNING

### Plenary Session (Open) (*WEBCAST at 0800*)

- 0815 Call to Order, Administrative Remarks  
0830 **KEYNOTE:**  
**Naval Aviation and Directed Energy Weapons**  
*Rear Admiral Mathias W. Winter*  
Commander, Naval Air Warfare Center  
Weapons Division, NAVAIR Asst Commander  
for Test and Evaluation
- 0915 **JIEDDO Overview and IED Pre-Detonation Requirements**  
*Captain Douglas Borrebach*  
Deputy Director, Resources & Requirements
- 0945 **Break**
- 1030 **Air Force Directed Energy S&T Vision**  
*Dr. Jennifer Ricklin*  
Chief Technologist for the Air Force  
Research Laboratory
- 1100 *Dr. David A. Hardy*  
Director, Directed Energy Directorate,  
Air Force Research Laboratory
- 1130 **DEPS Status and Recognitions**  
*Dr. Kirk Hackett*, DEPS President
- 1200 **Lunch**  
*Sponsored by Textron Defense Systems*

**TEXTRON** Defense Systems // TEXTRON Systems

## TUESDAY AFTERNOON

### Large Industry Panel (Open) (*WEBCAST at 1300*)

Moderator: *Adam Zimet*, Office of Naval Research

1300 **Panel Members:**

*Jim Davis*, General Atomics  
*Ed Pogue*, The Boeing Company  
*Paul Shattuck*, Lockheed Martin  
*Dan Wildt*, Northrop Grumman Aerospace Systems

## TUESDAY AFTERNOON

### DE Effects Modeling & Simulation Panel (Limited)

Moderator: *Robert Peterkin*, Air Force Research Laboratory/RD

1300 **Panel Members:**

*James Keith*, 46th Test Group  
*Charles LaMar*, Space & Missile Defense Command  
*Mathew McQuage*, Naval Surface Warfare Center  
*Mark Neice*, HEL Joint Technology Office  
*David Robie*, USAF Air Combat Command

## TUESDAY AFTERNOON

### Integrated Air / Missile Defense Panel (Secret)

Moderator: *Marc Magdinec*, Navy Air and Missile Defense (USN)

1300 **Panel Members:**

*Mark Magdenic*, Naval Air and Missile Defense Command  
*William McCarthy*, Operational T&E Force  
*David Stoudt*, Naval Surface Warfare Center Dahlgren  
*Mathias Winter*, Naval Air Warfare Center

1600 **Evening Reception at the  
4 San Diego Maritime Museum**

## WEDNESDAY MORNING

### New Developments in Atmospheric Measurement Systems (Limited/Open) (*WEBCAST at 0830*)

Chair: *Steve Hammel*, SPAWAR Systems Center

0700 **Registration and Breakfast at Hilton  
Session is Limited**

0800 **Design of a Differential Image Motion  
Monitor for Measurement of Optical  
Turbulence in Support of Maritime Laser  
Demonstration (D)**  
*Kevin Johnson*, Naval Air Warfare Center

**Session is now Open**

0830 **Development of the Integrated Atmospheric  
Characterization System (IACS) (A)**  
*David Roberts*, Georgia Tech Research Institute

0900 **Development of New Imaging Systems for  
Extinction Measurements along Extended  
Paths (A)**  
*Janet E. Shields*, University of California

0930 **Break**

### Acquisition, Tracking and Jitter Control (Open) (*WEBCAST at 1000*)

Chair: *Bob Pawiak*, Naval Surface Warfare Center

1000 **Beam Jitter Mitigation using a Line-of-Sight  
Reference Frame and Robust Control (A)**  
*Richard O'Brien*, United States Naval Academy

1030 **Optical Beam Jitter Control for NPS HEL  
Beam Control Testbed (A)**  
*Jae Jun Kim*, Naval Postgraduate School

1100 **Passive Ranging of Rocket and Engine  
Plumes: Flight Test of MPR Instruments (A)**  
*Glen Perram*, Air Force Institute of Technology

1200 **Lunch**

## WEDNESDAY MORNING

### Small Industry Panel (Open)

Moderator: *Adam Zimet*, Office of Naval Research

#### 0800 Panel Members:

*Jerry Hollister*, Niowave

*Viswanath Krishnamoorthy*, Qynergy

*Laird Moffet*, Envisioneering

*Leo Volfson*, Torrey Pines Logic

### HPM Technology and Effects (Limited/Open)

Chair: *Matthew McQuage*, Naval Surface Warfare Center

#### Session is Limited

1000 Vehicle-Borne IEDs Directed Energy  
Neutralization System Acceptance Test (D)  
*Tom Hartmann*, US Army RDECOM-ARDEC

#### Session is now Open

1030 Progress in First Principles Modeling of  
HPM Effects (A)  
*Larry Bacon*, Sandia National Laboratories

1100 Cycling of Electrochemical Energy Storage  
Devices at Elevated Rates (A)  
*David Wetz*, University of Texas at Arlington

1130 Charge Pulse Power Modulator for Directed  
Energy Systems (A)  
*Richard Thomas*, Army Research Laboratory

1200 Lunch

## WEDNESDAY MORNING

### Vehicle / Vessel Stopping I (Limited)

Chairs: *Scott Griffiths* and *David Law*, Joint  
Non-Lethal Weapons Directorate

0700 Registration and Breakfast at Hilton

0800 Effects Based High Power Microwave  
Weapon Design Methodology (C)  
*Cynthia Ropiak*, Consultant

0830 Radio Frequency Vessel Stopper Program  
Update (C)  
*Matthew McQuage*, Naval Surface Warfare  
Center

0900 Non-Lethal UAV (NLUAV) High Power  
Microwave Payload Program Overview (C)  
*Adam Clark*, Naval Surface Warfare Center

0930 Break

1000 The Use of Modeling and Simulation Tools to  
Address Propagation and Attenuation Issues  
Associated with Propagating RF to and  
Through a Target Boat Structure (C)  
*Cynthia Ropiak*, Consultant

1030 Experimental Results Investigating  
Dielectric Loaded Non-Linear Transmission  
Lines as Microwave Sources for HPM  
Applications (C)  
*Steven Russell*, Los Alamos National  
Laboratory

1100 Design of a Non-Circular Linear Transformer  
Driver (C)  
*Brian Hilko*, Envisioneering, Inc.

1200 Lunch

## WEDNESDAY MORNING

### Student Session (Open)

Chair: *Don Seeley*, HEL Joint Technology Office

- 0700 **Registration and Breakfast at Hilton**
- 0820 **Rejection of Jitter Induced Disturbances Using an Adaptive H-Infinity Control Algorithm (A)**  
*Shane Moran*, United States Naval Academy
- 0840 **Strapdown Inertial Reference Unit for NPS Beam Control Testbed (A)**  
*Kristi Ivy Irgens*, University of California - Davis and *Jay Roldan*, University of California-Santa Cruz
- 0900 **Damage Tolerance of Laser Irradiated Composite Sandwich Structures (A)**  
*Joseph Puishys*, United States Naval Academy
- 0920 **Break**
- 1000 **Testing and Analysis of Optical Fibers Embedded in Composite Materials (A)**  
*Kyle Milden*, United States Naval Academy
- 1020 **Characterizing Emission from a Gridded Thermionic Electron Gun (A)**  
*Paul Hogan*, Dartmouth College
- 1040 **Low Work Function Cs:Nb Surfaces (A)**  
*Blake Riddick*, University of Maryland
- 1200 **Lunch**

### Student Poster Session (Open)

Chair: *Jeanne Podracky*, Office of Naval Research

#### 1200 Posters Presented

- **Nonlinear Transmission Line Performance Under Various Magnetic Bias Environments**  
*J.-W. Braxton Bragg*, Texas Tech University
- **Verification of the ITRAL Thermal-Ablation Code Using Abaqus**  
*Kevin Conner*, Air Force Research Laboratory
- **Numerical Methods for Modeling the Surface Evolution of Cesium Atoms on Dispenser Photocathodes (A)**  
*Zhigang Pan*, University of Maryland
- **Rechargeable Lithium Power Source for High Energy Fiber Laser**  
*Zhi Yang*, Army Research Laboratory (and Hunter College)

## WEDNESDAY MORNING

### HPM Systems I (Secret)

Chair: *Tim Andreadis*, Naval Research Laboratory

- 0700 **Registration and Breakfast at Hilton**
- 0800 **NATO SCI -227 Summary: Near, Mid, and Long Term Prospects of Directed Energy Weapons (DEW) Capabilities (D)**
- 0830 **High Power RF Susceptibility of Radar Front End Components (C)**
- 0900 **Electro-Static Discharge Testing (C)**
- 0930 **Break**
- 1000 **High Power Microwave System for Counter Electronics Applications (F)**
- 1030 **USV Mounted HPM Small Vessel Stopper (C)**

### HEL System Demonstrators (Secret)

Chair: *John Wachs*, Schafer Corporation

- 1100 **FEL R&D Progress (C)**
- 1130 **Optimizing Performance of High Average Power Free Electron Lasers (C)**
- 1200 **Lunch**

## WEDNESDAY MORNING

### Maritime Laser Demonstration T&E (Secret)

Chair: *Adam Aberle*, Space and Missile Defense  
Technology Center

- 0700 Registration and Breakfast at Hilton
- 0800 Maritime Laser Demonstration Phase I-IIA  
Program Overview (D)
- 0830 MLD Phase 2A Test Execution (D)
- 0900 Dynamic Range Atmospheric Turbulence  
Measurements in Support of MLD (D)
- 0930 Break
- 1000 Maritime Atmospheric Measurements over  
Zunica Shoals (C)
- 1030 MLD Ship Integration (D)
- 1100 Performance Prediction and Results  
- Benchmarking Through MLD Multi-Site  
Testing (C)
- 1130 Measurement Results of the Maritime Laser  
Demonstration Phase I-IIA (D)
- 1200 Lunch

## WEDNESDAY AFTERNOON

### New Developments in Beam Control Systems & Technology (Limited/Open)

Chair: *Dan Herrick*, Air Force Research Laboratory

#### Session is Limited

- 1300 Holographic Adaptive Optics (C)  
*Geoff Andersen*, HUA Inc.
- 1330 Status of HEL Phased Array System  
(HELPA) Development (C)  
*Kevin Probst*, The CORE Group, Inc.

#### Session is now Open

- 1400 A New Active Wavefront Optimization  
Approach to Directed Energy Transfer in  
Highly Scattering Random Media (A)  
*Raj Rao Nadakuditi*, University of Michigan
- 1430 Break

### Beam Propagation & Wavefront Control (Limited/Open)

**(WEBCAST at 1540)**

Chair: *Paul Berger*, MIT Lincoln Laboratory

#### Session is Limited

- 1500 Propagation of High-Power FEL Beams in  
Various Environments (C)  
*Joseph Penano*, Naval Research Laboratory
- 1520 Profiling the Atmospheric Channel:  
Turbulence and Extinction in Maritime  
Laser Propagation (C)  
*Steve Hammel*, SPAWAR Systems Center

#### Session is now Open

- 1540 Thermal Blooming of High-Power,  
Single-Mode Fiber Lasers (A)  
*Richard Fischer*, Naval Research Laboratory
- 1600 Horizontal Propagation Deep Turbulence  
Test Bed (A)  
*Jae Jun Kim*, Naval Postgraduate School
- 1620 Beam Combining and Atmospheric  
Propagation of High Power Lasers  
*Philip Sprangle*, Naval Research Laboratory
- 1640 Simulation of Aero-Optics over Conformal  
and Flat Window Turrets (A)  
*Michael White*, Ohio Aerospace Institute
- 1730 Exhibitor Reception

## WEDNESDAY AFTERNOON

### HPM Testing I (Open)

Chair: *Frank Peterkin*, Naval Surface Warfare Center

- 1300 **LPM Methodology Bridge to HPM Testing (A)**  
*Jose Reza*, Army Research Laboratory/SLAD
- 1330 **Directed Energy Test Science & Technology Sensor Program (A)**  
*Jeffrey Schleher*, Directed Energy Test and Evaluation Capability
- 1400 **Importance of Ground RF Safety, Effectiveness, and Spectrum Management (A)**  
*Jeffrey Schleher*, Directed Energy Test and Evaluation Capability
- 1430 **Break**

### HPM Sources I (Limited/Open)

Chair: *Tim Andreadis*, Naval Research Laboratory

#### Session is Limited

- 1500 **NLTL Development at Sandia National Laboratories (C)**  
*Jeff Alexander*, Sandia National Laboratories
- 1530 **Driving an Accelerator Cavity with the A66HH Relativistic Magnetron (C)**  
*Peter Mardahl*, Air Force Research Laboratory

#### Session is now Open

- 1600 **Testing HPM WB and NB Threat Sources for National Test Ranges (A)**  
*Jeff Schleher*, Science Applications International Corporation
- 1730 **Exhibitor Reception**

## WEDNESDAY AFTERNOON

### Thermal Management for RF & Laser Systems (Limited/Open)

Chairs: *Patrick Shamberger*, Air Force Research Laboratory/RXBT and *David Law*, Joint Non-Lethal Weapons Directorate

#### Session is Limited

- 1300 **Vapor Absorption Refrigeration System for Thermal Manager Applications (C)**  
*Gene Tu*, Allcomp
- 1330 **Development of An Advanced Vapor Compression System for the Thermal Management of The Radio Frequency Vehicle Stopper System (C)**  
*Greg Troszak*, Advanced Cooling Technologies
- 1400 **Compact, Lightweight, Highly Efficient Thermal Management Pump and Systems Development for Directed Energy Weapon Systems (C)**  
*John Durbin*, The Durbin Group, LLC
- 1430 **Break**
- 1500 **Micro Tube Heat Exchangers for Improved Thermal Management of Directed Energy Systems (C)**  
*Kevin Kelly*, International Mezzo Technologies
- 1530 **Microchannel and Non-Isotropic Fin Heat Exchanger Structures for DEW Thermal Management Systems (C)**  
*John Kelly*, Altex Technologies Corporation

#### Session is now Open

- 1600 **Numerical Simulation of Thermal Transport in Microscale-Foam/Paraffin-Based Phase Change Material for Thermal Energy Storage for Cooling Directed Energy Weapons (A)**  
*Soumya Patnaik*, Air Force Research Laboratory/RZPS
- 1630 **Phase Change-Based Thermal Energy Storage for High Power Lasers and Microwaves (A)**  
*Patrick Shamberger*, Air Force Research Laboratory/RXBT
- 1730 **Exhibitor Reception**



## WEDNESDAY AFTERNOON

### Student Session (Open)

Chair: *Don Seeley*, HEL Joint Technology Office

- 1300 **Erbium Doped Glasses as Potential Fiber Gain Media (A)**  
*Nana Asare*, Army Research Laboratory (and University of Maryland)
- 1320 **Photoionization in a Rubidium Alkali Lasers (A)**  
*Keith Wyman*, US Air Force Academy
- 1340 **Implementation of the Spatially Varying Distortion Imaging Model (A)**  
*Madison Kretzler*, Center for Directed Energy
- 1400 **High Sensitivity Uncooled Microbolometers for THz Imaging (A)**  
*Brian Kearney*, Naval Postgraduate School
- 1420 **THz Optical Properties Using the 250 GHz Imaging System (A)**  
*Markus Novak*, Center for Directed Energy
- 1730 **Exhibitor Reception**

## WEDNESDAY AFTERNOON

### HEL - System Demonstrators (Secret)

Chair: *John Wachs*, Schafer Corporation

- 1300 **Laser Weapon System (LaWS) (C)**
- 1330 **MK-38 Tactical Laser System Surrogate Testing FY11 (D)**
- 1400 **100 kW Class Laser Weapon Lethality Against ASCMs (C)**
- 1430 **Break**
- 1500 **An Update on the High Energy Laser Technology Demonstrator (HEL TD) (C)**
- 1530 **Maritime Laser Demonstration Weapon System Overview (C)**
- 1600 **Beam Quality: A Multiplying Factor on Weapon System Performance (A)**
- 1630 **Maritime Laser Weapon System Scalability (C)**

## WEDNESDAY AFTERNOON

### Policy, Legal and Safety Panel (Secret)

Moderator: *W. Mark Henderson*, Naval Air Warfare Center

- 1300 **Panel Members:**  
*Sheri Sauer*, USSOCOM J39-CIDO  
*Dave Stoudt*, Naval Surface Warfare Center  
*Eli Zimet*, National Defense University  
Emeritus

### Featured Speaker (Secret)

Chair: *John Albertine*, Consultant

- 1600 **Directed Energy Force Protection Enabling Concept**  
*David Robie*, Air Combat Command

## THURSDAY MORNING

### HEL Interoperability (Limited)

Chair: *Charles LaMar*, Space & Missile Defense Command

- 0700 **Registration and Breakfast at Hilton**  
0800 **Surface Navy Combat System Integration of DE Weapons- Transitioning to a Tactical Maritime Environment (D)**  
*Feri Weller*, Northrop Grumman Corporation  
0830 **High Energy Laser Tactical Decision Aid (HELTDA) (C)**  
*Jerred Burley*, Air Force Institute of Technology  
0900 **HEL-Enabled UAV Keep Out Zone Analysis (C)**  
*Richard Bartell*, Air Force Institute of Technology  
0930 **Break**  
1000 **Laser Weapon System Ship Integration Assessment (C)**  
*E. Wyatt Brigham*, Northrop Grumman Aerospace Systems  
1030 **Weapon System Safety of Laser Based Systems (C)**  
*Lewis Proudfoot*, Northrop Grumman Corporation  
1130 **Poster Session**  
1200 **Lunch**

## THURSDAY MORNING

### Electric Lasers (Limited)

Chair: *Walter Fink*, High Energy Laser Joint Technology Office

- 0700 **Registration and Breakfast at Hilton**  
0830 **A Packaged and Ruggedized Multi Kilowatt, High Brightness, Solid State Laser Brassboard (C)**  
*James Zamel*, Northrop Grumman Aerospace Systems  
0900 **Lasers Based on Highly Doped Lu2O3 Ceramics (A)**  
*Jas Sanghera*, Naval Research Laboratory  
0930 **Break**  
**COIL (Limited)**  
Chair: *Eugene Bednarz*, Air Force Research Laboratory/RDL  
Hilton Scripps Ballroom  
1000 **Advanced COIL Research at AFRL (C)**  
*John McCord*, Air Force Research Laboratory/RDL  
1030 **Hybrid Catalytic Electric-Discharge Oxygen-Iodine Laser (C)**  
*Wilson Rawlins*, Physical Sciences Inc.

### Fiber Laser I (Limited)

Chair: *Walter Fink*, HEL Joint Technology Office

- 1100 **All-Fiber Isolator for 1 Micron Fiber Lasers (C)**  
*Shibin Jiang*, AdValue Photonics Inc  
1130 **Observation and Theory of Mode-Locked Dark Solitons in Passively Phased Fiber Laser Array (C)**  
*Erik Bochove*, Air Force Research Laboratory/RDLAF  
1130 **Poster Session**  
1200 **Lunch**

# Concurrent Sessions by Room and Time

OPEN

LIMITED

LIMITED AND  
OPEN

SECRET

Tuesday 1300	Large Industry Panel <b>WEBCAST</b> Page 4	DE Effects M&S Panel Page 4			Integrated Air / Missile Defense Panel Page 4	
Wednesday 0800	New Developments in Atmospheric Measurement Sys <b>WEBCAST</b> Acquisition, Tracking and Jitter Control <b>WEBCAST</b> Page 5	Small Industry Panel HPM Technology and Effects Page 6	Vehicle / Vessel Stopping Session I Page 7	Student Session Page 8	HPM Systems I HEL System Demonstrators Page 9	Maritime Laser Demonstration T&E Page 10
Wednesday 1300	New Developments in BC Sys & Tech Beam Prop & Wavefront Control <b>WEBCAST</b> Page 11	HPM Testing I HPM Sources I Page 12	Thermal Management for RF & Laser Systems Page 13	Student Session Page 14	HEL System Demonstrators Page 15	Policy, Legal and Safety Panel DE Systems - Featured Speaker Page 15
Thursday 0800	HEL Interoperability Page 16	Electric Lasers COIL Fiber Laser I Page 17	Non-Lethal DE Weapons Human Effects I Page 20	International Session HEL & HPM <b>WEBCAST</b> Page 21	Vehicle / Vessel Stopping Session II Page 22	HPM Systems II HPM Sources II HPM Testing II Page 23
Thursday 1300	DPALs Page 26	Fiber Laser II <b>WEBCAST</b> Page 27	Human Effects II Page 28		Counter DEW Panel Compact Antennas and Advanced Power Systems Page 29	Beam Physics Page 30
Friday 0800	FEL Systems Counter HPM Effects Page 31	Fiber Laser III High Power DEW Thermal Management Page 32	HEL Threat Detection, Avoidance & Propagation Materials for CDEW <b>WEBCAST</b> Page 33	HEL Material Effects Page 34	Cathode Physics <b>WEBCAST</b> Page 35	Active Denial Technologies Page 36
Friday 1300	Counter HPM Effects Page 31	High Power DEW Thermal Management Page 32	Materials for CDEW <b>WEBCAST</b> Page 33	DE Education Workshop Page 37		

## THURSDAY MORNING

### Non-Lethal Directed Energy Weapons (Limited/Open)

Chair: *Kelley Hughes and Rick Scott*, Joint Non-Lethal Weapons Directorate

0700 Registration and Breakfast at Hilton

#### Session is Limited

0800 Rapid Transition Demonstration of the Distributed Sound and Light Array (C)

*Rick Scott*, Joint Non-Lethal Weapons Directorate

0830 Capability Assessment of the Distributed Sound and Light Array for use as a Hail-and-Warn system (C)

*Robert Baran*, Naval Surface Warfare Center

0900 Laser-Based Flow Modification to Achieve Non-Lethal Control of Aircraft Flight Path (C)

*Kevin Kremeyer*, PM & AM Research

0930 Break

1000 Non-Lethal Perimeter Defense Using Laser-Generated Air Breakdown (C)

*Stephen Moody*, ORCA Photonic Systems, Inc.

1030 Field Tests of NRL Remote Underwater Laser Acoustic Source (C)

*Ted Jones*, Naval Research Laboratory

#### Session is now Open

1100 Communication Strategies for Non-Lethal Directed Energy Weapons (A)

*Kelley Hughes*, Joint Non-Lethal Weapons Directorate

### Human Effects I (Limited)

Chair: *Mary Williams*, American Systems, *Norman Barsalou*, Naval Medical Research Unit and *David Law*, Joint Non-Lethal Weapons Directorate

1130 Human Effects for Underwater Sound (C)

*Edward Cudahy*, Naval Submarine Medical Research Laboratory

1200 Lunch

## THURSDAY MORNING

### International Session - HEL & HPM (Open) (WEBCAST at 0800)

Chair: *Kelly McDonald*, Naval Air Warfare Center Weapons Division

0800 International Cooperation to Transition DE (A)

*Kelly McDonald*, Naval Air Warfare Center Weapons Division

0830 High-Energy 2  $\mu$ m Solid-State Laser Development (A)

*Cobus Jacobs*, CSIR National Laser Centre

0900 High Power Thin Disk Lasers

*Adolf Giesen*, German Aerospace Center

0930 Resistive Sensor for High Power Microwave Pulse Power Monitoring in Susceptibility Tests (A)

*Mindaugas Dagys*, Center for Physical Science and Technology

## THURSDAY MORNING

### Vehicle / Vessel Stopping II (Secret)

Chair: *Scott Griffiths and David Law*, Joint Non-Lethal Weapons Directorate

- 0700 Registration and Breakfast at Hilton
- 0800 Development and Evaluation of Field-Capable Pre-Emplaced Vehicle Stopping Prototype (C)
- 0830 Multi-Frequency RF Vehicle Stopper (RFVS), an Effects Based HPM Weapon Design (C)
- 0900 Radio Frequency Vehicle Stopper System Overview (C)
- 0930 Break
- 1000 Vehicle Stopper Radio Frequency Safety Modeling Effort (C)
- 1030 Statistical Analysis and Modeling of RF Vessel Stopper Effects Data (C)
- 1100 Non-Lethal UAV (NLUAV) High Power Microwave Payload Program Overview (C)
- 1130 Non-Lethal UAV (NLUAV), an Effects Based HPM Weapon Design (C)
- 1200 Lunch

## THURSDAY MORNING

### HPM Systems II (Secret)

Chair: *Frank Peterkin*, Naval Surface Warfare Center

- 0700 Registration and Breakfast at Hilton
- 0800 Update on the Operational Deployment of Directed Energy Counter-IED Weapon Systems (C)
- 0830 Counter-IED System using Radio Frequency Detection and Neutralization in Support of Marine Corps Route Clearance and Convoy Protection Missions (C)
- 0900 RF Directed Energy IED Neutralizer (RDIN) Update (C)
- 0930 Break
- 1000 Laboratory Counter-IED Effectiveness Testing with the Banshee System (C)

### HPM Sources II (Secret)

Chair: *Tim Andreadis*, Naval Research Laboratory

- 1030 Direct Digital Synthesis (DDS) Controller Adds Frequency Diversity to High Power Microwave (HPM) Directed Energy (DE) System (D)

### HPM Testing II (Secret)

Chair: *Frank Peterkin*, Naval Surface Warfare Center

- 1100 Test and Modeling Methodology for Evaluating RF Coupling to Victim-Activated IEDs (C)
- 1200 Lunch

**Poster Sessions 1130 - 1330**

Chair: *Jeanne Podracky*, Office of Naval Research

**Open Poster Session**

- Photocathode Drive Laser System for a High-Current Injector *Heather Andrews*, LANL
- Gating and Emission Enhancement of Diamond Field-Emitter Arrays *Heather Andrews*, LANL
- Progress in First Principles Modeling of HPM Effects *Larry Bacon*, SNL
- Maritime Atmospheric Measurements over Zunica Shoals *Paul Berger*, MIT LL
- Nonlinear Transmission Line Performance Under Various Magnetic Bias Environments  
*J.W. Braxton Bragg*, Texas Tech
- Continuation of Radar Cn2 to Optical Cn2 Study  
*Matt Buchanan*, AFIT
- Numerical and Experimental Study on the Thermal Cracking of Silicon Irradiated by CW Laser Beam *Sung Ho Choi*, Hanyang University
- 10 W Single-Frequency Polarization-Maintaining Raman Fiber Amplifier with Multi-Step Temperature Gradient *Iyad Dajani*, AFRL
- Three-Dimensional Analysis of Pre-Bunched Electron Beams in an X-Ray Free-Electron Laser  
*Henry Freund*, LANL
- Lens Heating by High Power Laser Beams  
*Bahman Hafizi*, Icarus Research, Inc
- High Power 1.5kW CW Optical Pumping Source Suitable for Diode Pumped Alkali Lasers  
*F. William Hersman*, Xemed LLC
- Strapdown Inertial Reference Unit for NPS Beam Control Testbed *Kristi Ivy Irgens*, Univ of CA
- Implementation of the Spatially Varying Distortion Imaging Model *Madison Kretzler*, AFIT
- Psychophysical Assessment of the Effects of Visor Laser Eye Protection Devices on Visual Function  
*Semih Kumru*, AFRL 711 HPW/RHDO
- THz Optical Properties Using the 250 GHz Imaging System *Markus Novak*, AFIT
- Numerical Methods for Modeling the Surface Evolution of Cesium Atoms on Dispenser Photocathodes (A)  
*Zhigang Pan*, University of Maryland

**Open Poster Session (continued)**

- Three Dimensional ESTD PIC Simulations of RF Density-Modulated Electron Sources with  
*MICHELLE John Petillo*, SAIC
- Indirect Photography *Nathan Powell*, AFIT
- Damage Tolerance of Laser Irradiated Composite Sandwich Structures *Joseph Puishys*, USNA
- HPM Wideband and Narrowband Threat Sources for National Test Ranges *Jeff Schleher*, DETEC
- Chaos in a Transmission Line Connected to Nonlinear Circuits *Ioana Triandaf*, NRL
- Rechargeable Lithium Power Source for High Energy Fiber Laser *Zhi Yang*, ARL

**Limited Poster Session**

Chair: *Jeanne Podracky*, Office of Naval Research

- Development of Field-Capable Pre-Emplaced Vehicle Stopping Prototype *Jordan Chaparo*, NSWC DD
- Human Effects Modeling Analysis Program (HE-MAP): Models for Human Effects Characterization  
*Jason DeChancie*, AMERICAN SYSTEMS
- Risk of Significant Injury *Jim Simonds*, AFRL/RHD
- Non-Lethal Weapons Human Effects Center of Excellence: A Joint Effort Between JNLWP and AFRL *Jimmy Fleming*, AFRL/RHD
- High Power Multimode Fiber MOPA with SBS Beam Cleanup and Wavefront Reversal  
*John McElhenny*, U.S. ARL
- Advanced Gas Laser Pressure Recovery System Diffuser *Carrie Noren*, AFRL
- Effects Based High Power Microwave Weapon Design Methodology *Cynthia Ropiak*, Consultant
- Survey of Thermal Management Technologies for High Energy Laser Weapon Systems  
*Sean Ross*, AFRL/RDLAS
- First Light From a Ceramic Yb:YAG Edge-Pumped Solid State Disk Laser for Ultra-Short Pulse Amplification (D) *John Vetrovec*, Aqwest LLC

## THURSDAY AFTERNOON

### DPALs (Limited/Open)

Chair: *Eugene Bednarz*, Air Force Research  
Laboratory/RDL

#### Session is Limited

- 1330 **Large Area, High Power 2-D VCSEL Pump Arrays Optimized for High Energy Lasers (C)**  
*Daniel Renner*, Aeries Photonics, LLC
- 1400 **Investigation of a Diode Pumped Alkali Laser with a Flowing Gain Medium (C)**  
*David Hostutler*, Air Force Research  
Laboratory/RDL
- 1430 **Break**

#### Session is now Open

- 1500 **High Pressure, Non-Lorentzian Lineshapes for DPAL: Theory and Experiment (A)**  
*Glen Perram*, Air Force Institute of  
Technology
- 1530 **Analytic Model for Alkali Metal Vapor Lasers: Broadband Optical Pumping (A)**  
*Glen Perram*, Air Force Institute of  
Technology
- 1600 **Spatially Resolved Optical Gain in Optically Pumped Alkali Atom - Rare Gas Mixtures (A)**  
*Wilson Rawlins*, Physical Sciences Inc.
- 1630 **Computational Model for the Diode Pumped Alkali Laser (A)**  
*Alan Paxton*, Air Force Research  
Laboratory/RDLAS

## THURSDAY AFTERNOON

### Fiber Laser II (Limited/Open) (WEBCAST at 1400)

Chair: *Walter Fink*, HEL Joint Technology Office

#### Session is Limited

- 1300 **Power Scaling in 2 $\mu$ m Fiber Laser/Amplifier Systems: Overview and Recent Results (X)**  
*Imtiaz Majid*, Nufern
- 1330 **Progress in Eye-Safer, Large Mode Area, Photonic Crystal Fiber Lasers and Arrays (C)**  
*Chad Carlson*, US Air Force Academy

#### Session is now Open

- 1400 **Coherent Combining of High Power Yb Fiber Amplifiers (A)**  
*Charles Yu*, MIT Lincoln Laboratory
- 1430 **Break**
- 1500 **Challenges in Making Photonic Crystal Fibers for High Energy Laser Applications (A)**  
*Joe Friebele*, Naval Research Laboratory
- 1530 **Remote Atmospheric Lasing (A)**  
*Joseph Penano*, Naval Reseach Laboratory
- 1600 **Single Mode, High Power, Narrow Line-Width Fiber Amplifiers (A)**  
*John Edgecumbe*, Nufern

## THURSDAY AFTERNOON

### Human Effects II (Limited/Open)

Chair: *Mary Williams*, American Systems,  
*Norman Barsalou*, Naval Medical Research  
Unit and *David Law*, Joint Non-Lethal  
Weapons Directorate

### Session is Limited

- 1300 **Determination of Cellular Effects and Genetic Changes Following Exposure to High Voltage 10 ns Electrical Pulses (C)**  
*Caleb Roth*, General Dynamics
- 1330 **Investigation of Cellular and Genetic Effects of High Peak Power Microwave Pulse Exposures (C)**  
*Bennett Ibey*, AFRL, 711 HPW/RHDR
- 1400 **Nanopore Formation by Nanosecond Electric Pulses: Recovery and Membrane Repair Mechanisms (C)**  
*Danielle Dalzell*, AFRL, 711 HPW/RHDR
- 1430 **Break**

### Session is now Open

- 1500 **Non-Lethal Weapons Human Effects Center of Excellence: A Joint Effort Between JNLWP and AFRL (A)**  
*Jimmy Fleming*, Air Force Research Laboratory/RHD
- 1530 **Human Effects Modeling Analysis Program (HE-MAP): Models for Human Effects Characterization (A)**  
*Jason DeChancie*, American Systems
- 1600 **Risk of Significant Injury (A)**  
*Jim Simonds*, Air Force Research Laboratory/RHD
- 1630 **Experiments in Modelspace: Leveraging Human Effectiveness Models and Statistical Design of Experiments to Estimate Non-Lethal Weapon Performance (A)**  
*Jim Fleming*, Air Force Research Laboratory/RHD
- 1700 **An Effects-Based Design Approach Using Human Effectiveness Modeling and Simulation to Assist in the Definition and Validation of Warfighter Requirements (A)**  
*Allen DeNeve*, Air Force Research Laboratory/RHD

## THURSDAY AFTERNOON

### Counter DEW Panel (Limited)

Moderator: *Peter Morrison*, Office of Naval Research

- 1300 **Panel Members:**  
*Bob Cozzens*, Naval Research Laboratory  
*John Devitt*, Georgia Tech Research Institute  
*Al Kehs*, Survice Engineering Company  
*Mark Henderson*, Naval Air Warfare Center  
Weapons Division  
*Joseph Stregack*, Consultant  
*John Tatum*, Survice Engineering Company  
*Gary Wood*, Army Research Laboratory

### Compact Antennas and Advanced Power Systems (Limited/Open)

Chairs: *Scott Griffiths* and *David Law*, Joint Non-Lethal Weapons Directorate

### Session is Limited

- 1500 **Advanced Battery Systems for Active Denial Applications (C)**  
*Rick Scott*, Joint Non-Lethal Weapons Directorate
- 1530 **High Voltage Generator Development for Radio Frequency Loads (C)**  
*Jacob Walker*, Naval Surface Warfare Center
- 1600 **Development of a Compact, Lightweight, Highly Efficient, High Power Load Following Direct Current Generator (C)**  
*Lance Brown*, Glacier Bay Technology
- 1630 **Design Study for a Dual-Frequency High-Gain L-Band HPM Antenna for Practical DEW Engagements (C)**  
*Robert Koslover*, SARA, Inc.
- 1700 **Review of Different Innovative Techniques for Gain Enhancement of Aperture Antennas (C)**  
*Satish Sharma*, San Diego State University

### Session is now Open

- 1730 **A Fan-Beam Radiator and Other Concepts for Compact High Power Microwave Antennas (A)**  
*Christos Christodoulou*, University of New Mexico



## THURSDAY AFTERNOON

### Beam Physics (Limited/Open)

Chair: *John Harris*, Naval Postgraduate School

#### Session is Limited

- 1330 **Simulation of a High Average Current Electron Gun for High-Power FELs (C)**  
*Chad Mitchell*, National Research Council Fellow
- 1400 **Development of a High Current FEL Injector Using a Gridded Thermionic Electron Gun (C)**  
*Steven Gold*, Naval Research Laboratory

#### Session is now Open

- 1430 **Break**
- 1500 **Intense Electron Beam Physics - Modulations and Halos (A)**  
*Rami Kishek*, University of Maryland
- 1530 **Active Beam Orbit Correction and Longitudinal Relaxation of Space Charge Dominated Beams (A)**  
*Timothy Koeth*, University of Maryland
- 1600 **Longitudinal Control of Intense Beams (A)**  
*Brian Beaudoin*, University of Maryland

## FRIDAY

### FEL Systems (Open/Limited)

Chair: *Joe Blau*, Naval Postgraduate School

0700 **Registration and Breakfast at Hilton**

#### Session is Open

- 0800 **Metal-Oxides for Interference Coatings of High Average Power Mid-Infrared Lasers: New Developments (A)**  
*Carmen Menoni*, Colorado State University
- 0830 **Multiple-Beam Inductive Output Tube Designs for High Average-Power Accelerator Applications (A)**  
*Edward Wright*, Beam Wave Research Inc
- 0900 **Single-Spike Operation from Chirped-Pulsed, Step-Tapered SASE FEL (A)**  
*Dinh Nguyen*, Los Alamos National Laboratory
- 0930 **Break**

#### Session is now Limited

- 1000 **High Average Power Free Electron Laser Amplifier (C)**  
*Philip Sprangle*, Naval Research Laboratory
- 1030 **Study of Shipboard FEL Shielding (C)**  
*Robert Peterson*, Naval Postgraduate School
- 1100 **Study of Shipboard FEL Vibration (C)**  
*Joshua Beauvais*, Naval Postgraduate School

### Counter HPM Effects (Limited/Open)

Chair: *Peter Morrison*, Office of Naval Research

#### Session is Limited

- 1130 **DEW Mitigation Effects on Electronic Circuits by Differential Signaling (C)**  
*Jesus Gil Gil*, Naval Research Laboratory
- 1200 **Lunch**

#### Session is now Open

- 1300 **Application of the Random Coupling Model to the Calculation of Electromagnetic Statistics in Complex Enclosures with Apertures (A)**  
*Zachary Drikas*, Naval Research Laboratory
- 1330 **Application of Miller's Rule for Nonlinear Susceptibilities to Metamaterial Structures and Resulting Effects on Electronic Shielding Models (A)**  
*James Luscombe*, Naval Postgraduate School
- 1400 **Nonlinear and Active Metamaterial Surfaces to Counter HPM DEW (A)**  
*Daniel Sievenpiper*, University of CA

**FRIDAY****Fiber Laser III (Open)**Chair: *Richard Damron*, HEL Joint Technology Office

- 0700 **Registration and Breakfast at Hilton**
- 0830 **Experimental Studies of Segmented Acoustically Tailored (A)**  
*Craig Robin*, Air Force Research Laboratory/RDLAF
- 0900 **Comparison of the SBS Threshold in Optical Fibers using Pseudo-Random-Bit Sequence (PRBS) and White-Noise Phase Modulation Schemes (A)**  
*Clint Zeringue*, Air Force Research Laboratory
- 0930 **Break**

**High Power DEW Thermal Management (Limited/Open)**Chair: *Patrick Shamberger*, Air Force Research Laboratory/RXBT and *David Law*, Joint Non-Lethal Weapons Directorate**Session is Limited**

- 1000 **Survey of Thermal Management Technologies for High Energy Laser Weapon Systems (C)**  
*Sean Ross*, Air Force Research Laboratory
- 1030 **Laboratory Simulation of Power and Thermal Management Systems (PTMS) for Megawatt Solid State Lasers on Aircraft (C)**  
*Charles Oberly*, Air Force Research Laboratory/RZPA
- 1100 **Expendable Thermal Management Materials for Large Heat Fluxes in Weight and Volume Constrained Environments (C)**  
*Douglas Dudis*, Air Force Research Laboratory
- 1200 **Lunch**

**Session is now Open**

- 1300 **Practical Application of High-Heat-Flux Cooling for DEW Systems (A)**  
*Joseph Homitz*, Mainstream Engineering Corporation
- 1330 **Multiphysical Modeling of Metal Hydrides for Energy Storage (A)**  
*Sangwook Sohn*, University of Dayton
- 1400 **Structured Materials for Active Thermal Control (A)**  
*John Ferguson*, Air Force Research Laboratory/RXBT

**FRIDAY****HEL Threat Detection, Avoidance & Propagation (Limited/Open)**Chair: *Peter Morrison*, Office of Naval Research

- 0700 **Registration and Breakfast at Hilton**
- 0800 **Counter-Directed Energy Weapons System (C)**  
*Ryan Franz*, Adsys Controls, Inc.
- 0830 **Off-Axis Detection and Characterization of Laser Beams along General Slant Paths in the Maritime Atmosphere (A)**  
*Frank Hanson*, SSC Pacific
- 0900 **Detection and Identification of Directed Energy Weapons and Their Targeting Systems (A)**  
*Leo Volfson*, Torrey Pines Logic
- 0930 **Break**
- 1000 **Characterization of Laser Beams by Off-Axis Scattering Using Multiple Cameras (A)**  
*Ike Bendall*, SSC Pacific
- 1030 **An Experimental Study of the Probability Density Function of a Turbulence Induced Fluctuating Laser Beam (A)**  
*Reza Malek-Madani*, U.S. Naval Academy

**Materials for CDEW (Limited/Open) (WEBCAST at 1300)**Chair: *Mike Cathcart*, Georgia Tech Research Institute**Session is Limited**

- 1100 **Laser Hardened Materials for Application to UAVs (C)**  
*Robert Cozzens*, Naval Research Laboratory
- 1200 **Lunch**

**Session is now Open**

- 1300 **Counter-DEW Research at Georgia Tech (A)**  
*Michael Cathcart*, Georgia Tech Research Institute
- 1330 **Laser Propagation in Biaxial Liquid Crystal Polymers (A)**  
*Eric Choate*, Naval Postgraduate School
- 1400 **Transient Temperature Distributions Produced in a Two-Layer Finite Structure by a Dithering or Rotating Laser Beam (A)**  
*Hong Zhou*, Naval Postgraduate School
- 1430 **Laser Damage Detection in Composites using Embedded Optical Fiber Sensors (A)**  
*Brian Jenkins*, U.S. Naval Academy

**HEL Material Effects (Limited/Open)**Chair: *Ron Flatley*, Naval Surface Warfare Center

0700 Registration and Breakfast at Hilton

**Session is Limited**

0800 New Applications of the PSI Lethality Algorithm Spreadsheet (D)

*Hartmut Legner*, Physical Sciences Inc

0830 Hyperspectral Imaging of Boundary Layer Gas Plumes During Fiber Laser Irradiation of Plexiglass and Painted Metals (D)

*Roberto Acosta*, Air Force Institute of Technology

0900 Impact of Beam Quality on HEL Lethality in Current Solid State Lasers (D)

*Chuck LaMar*, Space & Missile Defense Command

0930 Break

**Session is now Open**

1000 Laser-Material Interaction Experiments using a Diode Array to Simulate a DE Weapon-Class Source (A)

*Alexander Rubenchik*, Lawrence Livermore National Laboratory

1030 Temperature of HEL-Heated Target Surface by Inverse Heat Conduction Method (A)

*James Griggs*, Directed Energy Test and Evaluation Center

1100 Power Beaming using High-Power, Single-Mode Fiber Lasers (A)

*Richard Fischer*, Naval Research Laboratory

1200 Lunch

**Cathode Physics (Open)****(WEBCAST at 0800)**Chair: *Kevin Jensen*, Naval Research Laboratory

0700 Registration and Breakfast at Hilton

0800 Fabrication and Evaluation of Biased Diamond Current Amplifier (A)

*Joan Yater*, Naval Research Laboratory

0830 Electron Emission Models For Photo And Secondary Emission Processes (A)

*Kevin Jensen*, Naval Research Laboratory

0900 Cesium Auride Photocathodes: Formation and Analysis (A)

*Eric Montgomery*, University of Maryland

0930 Break

1000 Low Work Function Cs:Nb Surfaces (A)

*Blake Riddick*, University of Maryland

1030 Numerical Methods for Modeling the Surface Evolution of Cesium Atoms on Dispenser Photocathodes (A)

*Zhigang Pan*, University of Maryland

1100 Knudsen Flow and the Modeling of Controlled Porosity Dispenser Photocathodes (A)

*Kevin Jensen*, Naval Research Laboratory

1200 Lunch

**FRIDAY****Active Denial Technologies (Limited)**

Chair: *Richard Scott and David Law*, Joint Non-Lethal Weapons Directorate

- 0700 **Registration and Breakfast at Hilton**
- 0800 **ADS Beam Characterization Testing (C)**  
*Matthew McQuage*, Naval Surface Warfare Center
- 0830 **Quasi-Optical W-band Sheet Beam Klystron (QO-WSBK) for Active Denial System (ADS) Applications (C)**  
*Neville Luhmann*, University of California
- 0900 **Solid State Active Denial Technology Demonstrator Program (C)**  
*Ed Robinson*, US Army ARDEC
- 0930 **Break**
- 1000 **High Power 95 GHz Gyro-Device with Permanent or Conventional Solenoid Magnet (C)**  
*Larry Barnett*, University of California
- 1030 **Planar Scanner Antenna for Active Denial Technologies (C)**  
*Daniel Gonzalez*, CPI - Malibu Division
- 1100 **Can 220 GHz Produce Active Denial Effects? (C)**  
*Kenneth Brown*, Raytheon
- 1130 **Shallow-Penetrating Radio Frequency Energy and Behavioral Response (C)**  
*Jeff Whitmore*, Air Force Research Laboratory
- 1200 **HERO Testing of Active Denial Technology( C)**  
*Brian Long*, Joint Non-Lethal Weapons Directorate

**FRIDAY****Directed Energy Education Workshop (Open)**

- 1300 **Opening Remarks**  
*Don Seeley*, HEL JTO and  
*Sam Blankenship*, DEPS
- 1315 **Defense Acquisition University - An Asset for Both Government and Industry**  
*William Decker*, DAU
- 1340 **Developing Optics and Photonics Curriculum for Technologists**  
*Mark Hoffman*, University of Hawaii - Maui
- 1405 **2011 AFIT DE Summer Intern Program**  
*Eric Smith*, AFIT
- 1430 **The Importance of Mentoring and Recruiting Students to Engineering Early On**  
*Carmen Menoni*, Colorado State University
- 1455 **Break**
- 1515 **USNA Directed Energy Program - Successes and Challenges**  
*Joe Watkins*, Naval Academy
- 1540 **Directed Energy and Lasers - Tools for Research and Experiential Education at the U. S. Coast Guard Academy**  
*Royce James*, Coast Guard Academy
- 1605 **Laser Education at West Point**  
*John Hartke*, U.S. Military Academy
- 1630 **DE Education at USAFA**  
*Geoff Andersen*, Air Force Academy

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