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

AUDIO AND VIDEO RECORDING IS PROHIBITED AT ALL DEPS SPONSORED EVENTS
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
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

      Dr. David A. Hardy
      Director, Directed Energy Directorate, Air Force Research Laboratory

1100  DEPS Status and Recognitions
      Dr. Kirk Hackett, DEPS President

1130  Lunch
      Sponsored by Textron Defense Systems

TEXTRON Defense 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 Command

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 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

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

**New Developments in Beam Control Systems & Technology (Limited/Open)**  
Chair: *Dan Herrick*, Air Force Research Laboratory

### Session is Limited

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<tr>
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<tbody>
<tr>
<td>1300</td>
<td>Holographic Adaptive Optics (C)</td>
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<td>Geoff Andersen, HUA Inc.</td>
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<td>1330</td>
<td>Status of HEL Phased Array System (HELPAS) Development (C)</td>
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<td>Kevin Probst, The CORE Group, Inc.</td>
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### Session is now Open

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<th>Time</th>
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<tr>
<td>1400</td>
<td>A New Active Wavefront Optimization Approach to Directed Energy Transfer in Highly Scattering Random Media (A)</td>
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<td>Raj Rao Nadakuditi, University of Michigan</td>
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<td>1430</td>
<td>Break</td>
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**Beam Propagation & Wavefront Control (Limited/Open) (WEBCAST at 1540)**  
Chair: *Paul Berger*, MIT Lincoln Laboratory

### Session is Limited

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<tr>
<td>1500</td>
<td>Propagation of High-Power FEL Beams in Various Environments (C)</td>
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<td></td>
<td>Joseph Penano, Naval Research Laboratory</td>
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<td>1520</td>
<td>Profiling the Atmospheric Channel: Turbulence and Extinction in Maritime Laser Propagation (C)</td>
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<td>Steve Hammel, SPAWAR Systems Center</td>
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<tr>
<td>1540</td>
<td>Thermal Blooming of High-Power, Single-Mode Fiber Lasers (A)</td>
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<td>Richard Fischer, Naval Research Laboratory</td>
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<td>1600</td>
<td>Horizontal Propagation Deep Turbulence Test Bed (A)</td>
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<td>Jae Jun Kim, Naval Postgraduate School</td>
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<td>1620</td>
<td>Beam Combining and Atmospheric Propagation of High Power Lasers</td>
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<td>Philip Sprangle, Naval Research Laboratory</td>
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<td>1640</td>
<td>Simulation of Aero-Optics over Conformal and Flat Window Turrets (A)</td>
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<td>Michael White, Ohio Aerospace Institute</td>
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<td>1730</td>
<td>Exhibitor Reception</td>
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**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)**
Chair: *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

*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

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**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)

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**WEDNESDAY AFTERNOON**

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

Moderater: 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

**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
1000  Advanced COIL Research at AFRL (C)
      *John McCord*, Air Force Research Laboratory/RDLC
1030  Hybrid Catalytic Electric-Discharge Oxygen-Iodine Laser (C)
      *Wilson Rawlins*, Physical Sciences Inc.

**COIL (Limited)**
Chair: *Eugene Bednarz*, Air Force Research Laboratory/RDL
Hilton Scripps Ballroom

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

**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
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## THURSDAY MORNING

### Non-Lethal Directed Energy Weapons (Limited/Open)
**Chair:** *Kelley Hughes and Rick Scott*, Joint Non-Lethal Weapons Directorate

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<tr>
<td>0700</td>
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<tr>
<td>0800</td>
<td>Rapid Transition Demonstration of the Distributed Sound and Light Array (C)</td>
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<td><em>Rick Scott</em>, Joint Non-Lethal Weapons Directorate</td>
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<td>0830</td>
<td>Capability Assessment of the Distributed Sound and Light Array for use as a Hail-and-Warn system (C)</td>
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<td><em>Robert Baran</em>, Naval Surface Warfare Center</td>
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<td>0900</td>
<td>Laser-Based Flow Modification to Achieve Non-Lethal Control of Aircraft Flight Path (C)</td>
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<td><em>Kevin Kremeyer</em>, PM &amp; AM Research</td>
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<td>0930</td>
<td>Break</td>
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<td>1000</td>
<td>Non-Lethal Perimeter Defense Using Laser-Generated Air Breakdown (C)</td>
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<td><em>Stephen Moody</em>, ORCA Photonic Systems, Inc.</td>
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<td>1030</td>
<td>Field Tests of NRL Remote Underwater Laser Acoustic Source (C)</td>
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<td><em>Ted Jones</em>, Naval Research Laboratory</td>
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### Human Effects I (Limited)
**Chair:** *Mary Williams*, American Systems, *Norman Barsalou*, Naval Medical Research Unit and *David Law*, Joint Non-Lethal Weapons Directorate

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<td>1130</td>
<td>Human Effects for Underwater Sound (C)</td>
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<td><em>Edward Cudahy</em>, Naval Submarine Medical Research Laboratory</td>
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<td>1200</td>
<td>Lunch</td>
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### International Session - HEL & HPM (Open) *(WEBCAST at 0800)*
**Chair:** *Kelly McDonald*, Naval Air Warfare Center Weapons Division

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<td>International Cooperation to Transition DE (A)</td>
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<td><em>Kelly McDonald</em>, Naval Air Warfare Center Weapons Division</td>
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<td>0830</td>
<td>High-Energy 2 µm Solid-State Laser Development (A)</td>
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<td><em>Cobus Jacobs</em>, CSIR National Laser Centre</td>
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<td>0900</td>
<td>High Power Thin Disk Lasers</td>
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<td><em>Adolf Giesen</em>, German Aerospace Center</td>
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<td>0930</td>
<td>Resistive Sensor for High Power Microwave Pulse Power Monitoring in Susceptibility Tests (A)</td>
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<td><em>Mindaugas Dagys</em>, Center for Physical Science and Technology</td>
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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

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
Open Poster Session
- Photocathode Drive Laser System for a High-Current Injector  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
- 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
- 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
- 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, Aerius Photonics, LLC

1400  **Investigation of a Diode Pumped Alkali Laser with a Flowing Gain Medium (C)**  
David Hostutler, Air Force Research Laboratory/RDLC

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 2µm 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 Research 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, Service Engineering Company Mark Henderson, Naval Air Warfare Center Weapons Division Joseph Stregack, Consultant John Tatum, Service 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 Beauzoin, 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
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
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 Sihn, University of Dayton
1400  Structured Materials for Active Thermal Control (A) John Ferguson, Air Force Research Laboratory/RXBT

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
FRIDAY

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

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

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

Mr. Mike Deitchman, Chair
Mr. John Albertine, Co-Chair
Ms. Sarwat Chappell, Technical Chair
Ms. Peggy Conner, Technical Co-Chair

Program Committee

Dr. Roger McGinnis
Mr. Peter Morrison
Mr. Quentin Saulter
Mr. Adam Zimet

Topic Area Leads

Harro Ackermann           Tim Andreadis
Norman Barsalou           Paul Berger
Bill Colson               Ron Flatley
Steve Hammel              David Law
John Luginsland           Kelly McDonald
Peter Morrison            Frank Peterkin
Mark Rader                Patrick Schamberger
John Wachs                Adam Zimet

Symposium Program Support

Dave Loomis

Symposium Coordinator

Cynnamon Spain

Registration and Payments

Tiffany Bjelke