



2021 Annual DE S&T Symposium

March 22 – 26, 2021 | Mountain Daylight Time (MDT)

Monday March 22 (MDT)

0800-1700 MDT

Professional Development Short Courses

1. Introduction to HEL Systems (A) (0800-1200) DEPS Room 1
2. Introduction to HPM Systems (C) (0800-1200) DEPS Room 2
3. Windows & Coatings (A) (0800-1200) DEPS Room 3
4. Digital Holography for DE Applications (A) (0800-1200) Full-day course DEPS Room 4

*See Page 14 for acronyms and their meanings.

Lunch Break 1200-1300 MDT

5. HEL Modeling (1300-1700) **CANCELLED**
6. HPM Directed Energy Weapons and Their Effects (C) (1300-1700) DEPS Room 1
7. Modeling Dynamic Optical Systems (A) (1300-1700) DEPS Room 2
8. Digital Holography for DE Applications (A) (1300-1700) Full-day course DEPS Room 4

1200-1700 MDT Exhibit Hall opens in *Accelevents* (open until 1700 MDT)

Tuesday AM- March 23 (MDT)

Plenary Session with Keynote Speakers

DEPS Room 1

0800- Intro Mark Neice, DEPS, and Iain McKinnie, Raytheon (A)

0810- Directed Energy Weapons Roadmap (Lim Dis D/Export Controlled) Dr. James Trebes - Principal Director, Directed Energy, OUSD R&E

0850- Dr. David Currie, UK Energy Weapons Program Manager – Future Kinetic Effects and Weapons (A)

0930- Directed Energy Intermediate Force Capabilities (A) Col Wendell Leimbach, Jr., USMC – Director, Joint Intermediate Force Capabilities Office (JIFCO)

1000- Break

1020- Directed Energy Futures Summit (C) *Dr. Don Shiffler - Chief Scientist for DE, Air Force Research Laboratory, DE Directorate*

1050- Navy Directed Energy Update (A) *Dr. Frank Peterkin - Senior Scientist for DE, US Navy DEWO*

1120- Directed Energy Overview (A) *Dr. Craig Robin - Deputy Director, DE Project Office, Army Rapid Capabilities & Critical Technology Office (RCCTO)*

1150- DE JTO Remaining Relevant (A) *Dr. Larry Grimes - Director, Joint Directed Energy Transition Office (DE-JTO)*

1220- DEPS Annual Report to the Membership *Dr. Dave Stoudt, President, DEPS BoD* **DEPS Room 1**

1200- Exhibit Hall opens in *Accelevents* (open until 1700 MDT)

Tuesday PM- March 23 (MDT)

HPM Technologies & Effects

(Dr. Daniel Enderich- Open/Lim Dis/Export Controlled)

DEPS Room 1

1400- Obtaining Circular Polarization from HPM-Capable Leaky-Wave Antennas (A) *Robert Koslover, SARA, Inc.*

1430- Microwave Antenna Properties of an Optically Triggered Superconducting Ring (A) *Thomas Bullard, UES Inc. - Air Force Research Laboratory*

1500- PEO STRI High Power Radio Frequency Source Projects (C) *Jeffrey Schleher, American Systems*

1530- BREAK

1600- Sealed Spark Gap Switch Implications for Pulsed Power System Storage Life (D/Export Controlled) *Matt Domonkos, Verus Research*

1630- New Techniques in Time-Reversal-Based Microwave Pulse Compression (D/Export Controlled) *Zachary Drikas, U.S. Naval Research Laboratory*

1700- Solid State HPM Systems: Built, Tested and Ready to Support your C-UAS Missions (D/Export Controlled) *Kenn Todorov and Michael O'Hara, Northrop Grumman and Dr. Bo Marr, CTO Epirus*

Artificial Intelligence/ Machine Learning
(Dr. Matt Leigh- Lim Dis/Export Controlled/ Open)
DEPS Room 2

1400- Deep Learning for Aimpoint Tracking in Turbulence (D/Export Controlled) *Catherine Belley, MIT Lincoln Laboratory*

1430- Predicting Refractivity Turbulence Structure Constant (CN2) Using Machine Learning (D) *Jennifer Jarrell, Radiance Technologies*

1500- Sensor Placement Optimization Using a Greedy Algorithm (D/Export Controlled) *Brooke Johnson, Air Force Research Laboratory*

1530- BREAK

1600- Evolutionary Algorithms for Optimization of Ion Acceleration in Extreme Laser-Plasma Interactions (C/Export Controlled) *Dr. Gregory Ngirmang, Air Force Institute of Technology*

1630- Advanced Processing and Machine Learning for High Energy Laser Weapon Systems (C/Export Controlled) *Omar Aboutalib, Northrop Grumman Aerospace Systems*

1700- Cognitive Laser - Automation, Artificial Intelligence, and Machine Learning for Laser Weapon Systems (A) *Dr. Bonnie Johnson, Naval Postgraduate School*

1730- Atmospheric Turbulence Characterization with Deep Machine Learning (A) *Mikhail Vorontsov, University of Dayton*

Atmospheric Propagation
(Jaclyn Schmidt- Lim Dis/Export Controlled/ /Open)
DEPS Room 3

1430- Maritime Aerosol and Optical Turbulence Measurements During SSL-TM Sea Test II (D/Export Controlled) *Ryan Yamaguchi, NPS*

1500- Global Site Assessment of Meteorological and Optical Parameters for Astronomical Observatories (D/Export Controlled) *Eric Magee, MZA*

1530- BREAK

1600- sUAS DEW Profiler for DE Mission Planning: Field Test and Operations (C/Export Controlled) *Alex Clark, The BlueHalo Group, LLC*

1630- An Analysis of X-Band Transmission for Space-Based Wireless Power Beaming (C/Export Controlled) *Dr. Noah Friz, AFIT*

1700- Effective Segmentation of Sonic Anemometer Data for Meaningful Comparison to Theory and Simulation (A) *Joe Coffaro, University of Central Florida*

Student Workshop- Beam Control

(Open)

DEPS Room 4

1400- Characterization of Atmospheric Optical Turbulence Using Turbulence Flux Measurements (A) *Alex Peralta, United States Naval Academy*

1430- Effects of surface polishing on surface scatter and absorbance in single-crystal sapphire and polycrystalline spinel window materials (A) *Jessica Ma, The Johns Hopkins University*

1500- Image sharpening on the 3D intensity with variable corrective phase screens (A) *Matthias Banet, University of Rochester, The Institute of Optics*

1530- BREAK

1600- Comparison of Aerosol Extinction Measurements Aboard NPS CIRPAS Twin Otter during CA Smoke Mission (A) *Ryan Yamaguchi, Naval Postgraduate School*

1630- Filament Studies at 1 Kilometer (A) *Jessica Pena, University of Central Florida*

Wednesday AM- March 24 (MDT)

Beam Control: Testbed Updates

(Chair: Dr. Mike Steinbock- Lim Dis/Export Controlled)

DEPS Room 1

0800- Overview of the deep-turbulence problem and emerging testbeds (D) *Dr. Mark Spencer, AFRL/RD*

0830- An Update on ARL's FLASK Proof-of-Concept Experiments (D/Export Controlled) *Dr. Christopher Wolfe, DEVCOM Army Research Laboratory*

0900- Beam Control Test Results from the Mobile Beam Control System Integration Laboratory (D/Export Controlled) *Dr. Justin Mansell, MZA Associates Corporation*

0930- Development Status of the Mobile Beam Control System Integration Laboratory (D/Export Controlled) *Dr. Justin Mansell, MZA Associates Corporation*

1000- BREAK

1030- SIREN: System and Results (D/Export Controlled) *Dr. Justin Mansell, MZA Associates Corporation*

1100- Turbulence Adaptive Optics & Phase Array Demonstrators Using Digital Holography (C/Export Controlled) *Dr. Thomas Alley, Lockheed Martin Advanced Technology Center/Coherent Technologies*

DE-IFC
(Dave Law- Open)
DEPS Room 2

- 0800- Updates on JIFCO's DE-IFC Weapon Development Efforts in 2021 (A) *David Law, JIFCO*
- 0830- JIFCO Solid-State Active Denial Technology Update (A) *Simin Feng, JIFCO*
- 0900- JIFCO RF-HPM Vehicle/Vessel Stopping Project Updates (A) *Adam Clark, JIFCO*
- 0930- Scalable Compact Ultra-Short Pulse Laser System (SCUPLS) Demonstrator Development Activities (A) *Brittany Lynn, JIFCO*
- 1000- BREAK
- 1030- DE-IFC Key System/Subsystem Size, Weight, Power Consumption, Thermal Cooling, and system Cost reduction (SWAP/C²) Updates (A) *David Law, JIFCO*
- 1100- Material Analysis of a Nanodielectric Composites for UltraCompact High Voltage Capacitors for Directed Energy Applications (A) *Dr. Randy Curry, University of Missouri at Columbia*
- 1130- Survey of Alternative Laser Applications (A) *Dr. Christopher Duron, US Army SMDC Redstone Arsenal*

High Energy Laser Development
(Dr. Tony Valenzuela- Lim Dis/Export Controlled/ Open)
DEPS Room 3

- 0800- Technical Challenges for Next Gen USAF Airborne HEL Subsystems (D/Export Controlled) *Arthur Hassall, AFRL*
- 0830- Rubidium excited state line shapes from 5P to 5D and 7S collisionally broadened by helium (D/Export Controlled) *Tim True, AFIT*
- 0900- Laser Diode Pump Solutions for DE Laser Systems (C/Export Controlled) *Prabhu Thiagarajan, Leonardo*
- 0930- Linewidth Narrowing of Fiber Amplifiers using Nonlinear Phase Demodulation (C/Export Controlled) *Gregory Goodno, Northrop Grumman*
- 1000- BREAK
- 1030- Role of Temperature Nonuniformity on Longitudinal Current Crowding in High Power Diode Lasers (C/Export Controlled) *Michelle Labrecque, Freedom Photonics*
- 1100- Components and Subsystems for Directed Energy Laser Systems (A) *Alex Rosiewicz, NKT Photonics*

Student Workshop- HPM & Thermal

(Open)

DEPS Room 4

0800- Novel composite based ntl as complete high power microwave system (A) *Andrew Fairbanks, Purdue University*

0830- Material Analysis of a Nanodielectric Composites for UltraCompact High Voltage Capacitors for Directed Energy Applications (A) *Evan Schulte, University of Missouri's Center for Physical and Power Electronics*

0900- Experimental Results on a Coaxial Multipactor Test Cell (A) *Stephen Langellotti, University of Michigan*

0930- Design of a Testbed for Studying Pulsed Charge and Discharge of High Voltage Pulsed Power Capacitors* (A) *Alexander Johnston, University of Texas at Arlington*

Wednesday PM- March 24 (MDT)

1200- Exhibit Hall opens in *Accelevents* (open until 1700 MDT)

1200- Induction of New Fellows and Lunch (DEPS Room 1)

1400 - 1600- Limited Distribution D

Industry Panel moderated by *Mr. Iain McKinnie, Raytheon* in **DEPS Room 1**

“Industry Readiness Level for DE Production: Challenges and Opportunities”

Panelists:

- **Michael Hofle**, *HEL Product Line Director, Raytheon, Electronic Warfare Systems Division*
- **Tyler Griffin**, *Program Director and Site General Manager for Laser and Sensor Systems, Lockheed Martin Rotary and Mission Systems*
- **Brandt Pyles**, *General Manager for Directed Energy, Northrop Grumman Space Systems*
- **Luis Hernandez**, *Directed Energy Weapons Program Manager, BAE Systems*
- **Dr. Michael Perry**, *Vice-President, General Atomics Electromagnetic Systems*
- **Ronald Dauk**, *Site General Manager, Boeing Laser & Electro-Optical Systems*

Thursday AM- March 25 (MDT)

Beam Control: Tracking and Beam Directors
(Dr. Mike Steinbock- Lim Dis/Export Controlled)
DEPS Room 1

0800- 3D Active Ranging and Tracking (3DART) for Laser Weapon Systems (D/Export Controlled) *Jason Stewart, MIT Lincoln Laboratory*

0830- Systems Analysis and Algorithm Development for 3D Tracking (D/Export Controlled) *Dr. Catherine Belley, MIT Lincoln Laboratory*

0900- End-to-End Model (EtEM) Tracker User Friendly Code (ET UFC) (D/Export Controlled) *Dr. Edwin Ahn, AFRL/RD*

0930- Vibration Effects on Laser Optical Train and Beam Shape Characteristics (A) *Jeremy Kolansky, Virginia Tech*

1000- BREAK

1030- Beam Control Analysis for Airborne Laser System (D/Export Controlled) *Benjamin Shaffer, AFRL/RD*

1100- Affordable, In-Production Beam Director Systems for High Energy Lasers (D/Export Controlled) *Liam Skoyles, Raytheon*

1130- Improved Beam Control Pointing with Slotless Motors (C/Export Controlled) *Alex Doig, Cobham Advanced Electronic Systems*

JIFCO DE-IFC
(Adam Clark & Steve Parrish- Lim Dis/Export Controlled)
DEPS Room 2

0830- DARPA DREaM Program - 95 GHz MMICs/PA development work - Update (C) *YK Chen, DARPA*

0900- JIFCO High Power Microwave System Technology Portfolio Update (C) *Steve Parrish, JIFCO*

0930- Advancements of Metamaterial-Enabled Reconfigurable Antennas for High-Power Microwave Applications (C/Export Controlled) *Douglas Werner, Penn State University*

1000- BREAK

1030- Development of Functional Metamaterials Aimed at Implementation into Reconfigurable Antennas for Gigawatt-Class Short Pulse Sources (C/Export Controlled) *Dr. Sawyer D. Campbell, JIFCO -PSU*

1100- Use of M&S to Determine Dwell Time for VIPER at SS3 (C/Export Controlled) *Laura Wessels, NSWCCD*

1130- Exploring CW Lasers for Developing an Intermediate Force Capability for Ground Vehicles (C) *Dr. Laura Vanderhoef, DEVCOM Army Research Lab*

Pulsed Laser Sources

(Dr. Kevin Werner- Open/ Lim Dis/Export Controlled)

DEPS Room 3

0800- Recent Developments in USPL Source Technology Are Closing the Gap with Conventional High Energy Lasers (A) *Dr. Anthony Valenzuela, ARL*

0830- INVITED: Precision high average power ultrashort pulse lasers, applications and plasma accelerators (A) *Dr. Cameron Geddes, LBNL*

0900- *Geddes talk continued.*

0930- High-pressure CO2 laser optically pumped at 4.3 μm (A) *Prof. Sergei Tochitsky, UCLA*

1000- BREAK

1030- Development of an ultra-short pulse mid-infrared laser system for propagation and material damage studies (C/Export Controlled) *Edam Chowdhury, AFIT*

1100- Wavelength-Agile Fiber Lasers: Nonlinear Optics in Gas-Filled Hollow-Core Fibers (D) *Christian Keyser, AFRL*

Atmospheric Propagation

(Dr. Santasri Bose-Pillai- Lim Dis/Export Controlled/Open)

DEPS Room 4

0800- New developments in measurement-focused HEL M&S: SABeR and SEALION (D/Export Controlled) *Dr. Joseph Fiordilino, NSWC Corona*

0830- Modular Atmospheric Sensor Suite (MASS) for Laser Propagation Characterization (D/Export Controlled) *Dr. Matthew Whiteley, MZA*

0900- Volumetric Turbulence Modeling from Weather Observations (D/Export Controlled) *Yakov Diskin, MZA*

0930- Modification of an MZA DELTA PM-02-600 Turbulence Profiler for Use on a Navy Ship (D) *Zachary Braida, NPS*

1000- BREAK

1030- NPS Atmospheric Measurements and Modeling in Support of HELCAP (D) *Sasha Barnett, NPS*

1100- Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets (A) *Dr. Santasri Bose-Pillai, AFIT*

Student Workshop- HEL

(Open)

DEPS Room 5

0800- Performance of Compact Integrated Phase Modulators at 1 μ m (A) *Michael Nickerson, University of California, Santa Barbara Electrical and Computer Engineering*

0830- Materials Mitigation of Optical Nonlinearities for High Power Lasers (A) *Bailey Meehan, Clemson University*

0900- Guided Mode Expansion Analysis of Photonic Crystal Surface Emitting Lasers (A) *Pawel Strzebonski, University of Illinois, Urbana-Champaign*

0930- Suppression of the Brillouin Instability using phase modulation techniques (A) *Josh Young, Baylor University*

1000- BREAK

1030- Adjoint-optimization for high-performance and robust photonic device design (A) *Ray Wambold, University of Wisconsin – Madison*

1100- Molecular Beam Epitaxy for Photonic Crystal Surface Emitting Lasers (A) *Kevin Reilly, The University of New Mexico*

1130- Digital Control of Multiple Plasma Columns in a 2D Plasma Photonic Crystal (A) *Matthew Paliwoda, University of Illinois Urbana-Champaign*

Thursday PM- March 25 (MDT)

1200-1400- Student Poster Session in *Accelevents*

1200- Exhibit Hall opens in *Accelevents* (open until 1700 MDT)

JIFCO DE-IFC

(Adam Clark & Steve Parrish- Lim Dis)

DEPS Room 1

1400- HPM Vehicle Stopping IFC S&T Road Map (D) *Adam Clark, JIFCO*

1430- HPM Vessel Stopping IFC S&T Road Map (D) *Adam Clark, JIFCO*

1500- JIFCO HiPR ACTv Project Updates (D) *Steve Parrish, JIFCO*

1530- BREAK

1600- Wide-Band Frequency Notched HPM Antenna Prototype – MARCORSSYSCOM SBIR Topic Objectives
(D) *Adam Clark, JIFCO*

1630- HPM Component and Subcomponent Ruggedization of for Deployable Vehicle Stopping Prototype
(D) *Robert Barchfield, NSWCCD*

Atmospheric Propagation

(Dr. Stephen Hammel- Lim Dis/Export controlled)

DEPS Room 2

1400- PCS: The Path Characterization System (D) *Dr. Stephen Hammel, NIWC Pacific*

1430- Navy's Path Characterization System for HEL Systems (D/Export Controlled) *Dr. Kyle Drexler, NIWC Pacific*

1500- COAMPS modifications for Directed Energy Applications (D) *Dr. Marcela Ulate, UCAR/NRL*

1530- BREAK

1600- The High Energy Laser Atmospheric Characterization System (HACS) A Multi-LIDAR Tool for Directed Energy Test & Evaluation (C/Export Controlled) *Dr. Christopher Valenta, Georgia Tech Research Institute*

1630- Optical Turbulence Profiling Techniques Using Meteorological Lidar Profiles (C/Export Controlled)
Dr. Leda Sox, Georgia Tech Research Institute

1700- Evaluating the Effectiveness of Adaptive Optics in High Energy Laser Weapon Systems (C/Export Controlled) *Austin West, NPS*

Pulsed Laser Effects

(Dr. Tony Valenzuela- Lim Dis/ Open)

DEPS Room 3

1400- Experimental Characterization of Secondary Emissions and Filamentation Hydrodynamics from an Ultrashort Pulse Laser (D/Export Controlled) *Kevin Werner, BAE Systems*

1430- Filament Propagation at High Altitudes (C) *Jessica Pena, UCF*

1500- Structured USPL Beams: Spatio-Temporal Engineering (C) *Danielle Reyes, UCF*

1530- BREAK

1600- Temporally-Engineered USPL Interactions with Solid Targets (C) *Haley Kerrigan, UCF*

1630- Natural Modes Expansion of Radiated Fields by Ultra Short Laser-Induced Neutralizing Currents (A)
Dr. Andrew Goers, APL

Bio-Effects

(Bennett Ibey- Lim Dis/Open)
DEPS Room 4

1400- HELCAT-Range (C) *Joshua Gibson, SAIC, Inc*

1430- Human Laser Skin Dose-Response Model (C/Export Controlled) *Elharith Ahmed, SAIC*

1500- A Geographic Information System Approach to Modeling Stray Laser Energy Hazards (C) *Chad Oian, 711 HPW/RHDO*

1530- BREAK

1545- High Energy Laser (HEL) Safety Assessments (A) *Dr. Semih Kumru, 711 HPW/RHDO (AFRL)*

1615- Visible Lesion Threshold Modeling of Skin Laser Exposure at 1070 nm (A) *Michael DeLisi, SAIC*

1645- Machine Learning Estimations of Tissue Optical Properties for a Multi-Layered Model (A) *Brett Hokr, Radiance Technologies*

1715- Evaluating the Potential Eye Hazard of the Supercontinuum Generated by Near-Infrared Femtosecond Laser Pulses in Water (A) *Xomalin Peralta, SAIC*

Friday AM- March 26 (MDT)

Beam Control- Cameras and AO

(Dr. Mike Steinbock- Lim Dis/Export Controlled/Open)
DEPS Room 1

0800- Beam Control Sensor Technology Development at MIT Lincoln Laboratory (D) *Dr. Daniel Schuette, MIT Lincoln Laboratory*

0840- SOR C-RED1 Temporal Analysis and Updates (D/Export Controlled) *Dr. Michael Steinbock, Starfire Optical Range*

0910- Overview of Event-Based Sensing Technology for Directed Energy Applications (D) *Joseph Cox, University of Arizona, College of Optical Sciences*

0940- STRAFE Update (D) *Kevin Moore, Northrop Grumman Aerospace Systems*

1010- BREAK

1030- Predictive Adaptive-Optics Compensation for Transonic Aero-Effects Mitigation (D/Export Controlled) *Dr. Adam Smith, MZA Associates Corporation*

1100- Image sharpening on the 3D intensity with variable corrective phase screens (A) *Matthias Banet, University of Rochester, The Institute of Optics*

Atmospheric Propagation

(Jaclyn Schmidt- Lim Dis/Export Controlled/ Open)

DEPS Room 2

0800- Practical Real-time Multiframe Blind Deconvolution on Massively-Parallel Architectures (D/Export Controlled) *Sebastian Liska, Nanohmics, Inc.*

0830- Turbulence Insensitive Measurement of High Energy Laser Transmission (D) *Brett Hokr, Radiance Technologies*

0900- Thermal Blooming Studies with Tunable, High Power, Narrow-Linewidth Fiber Lasers (C/Export Controlled) *Justin Cook, University of Central Florida*

0930- Numerical simulations of the long-range energy delivery and beam breakup of high-power square-aperture CO2 laser pulses in the atmosphere (A) *Paris Panagiotopoulos, College of Optical Sciences University of Arizona*

1000- BREAK

1030- Emerging solutions to the deep-turbulence problem using digital holography and deep learning (A) *Dr. Mark Spencer, AFRL/RDMP*

1100- Simulation of kHz Femtosecond Filamentation in Unperturbed Air using PyCAP (A) *Joshua Issacs, NRL*

HPM Technologies- Effects & Systems

(Brad Hoff- Open/Lim Dis/ Export Controlled)

DEPS Room 3

0800- A Study on Printed Circuit Board Backdoor Coupling and Stackup Considerations (A) *Ryan Tortorich, Louisiana State University*

0830- Comparison of DE HPM and High-altitude Nuclear blast EMP waveforms in Time and Frequency Domains (A) *Plamen Doynov, EMP Shield, Inc.*

0900- Design and Modeling of a High-Power W-Band Beam Collector System for Power Beaming Applications (C/Export Controlled) *Dr. Sameer Hemmady, Verus Research*

Power & Thermal + Other DE Instrumentation
(Mr. Mark Neice- Open/ Lim Dis/Export Controlled)
DEPS Room 4

0800- PCM-Based Thermal Energy Storage Heat Exchangers for Laser Weapons Systems (A) *Daniel Kromer, Mainstream Engineering*

0830- Optimized Hybrid Power/Energy System for High-Energy, Pulsed Power Applications (D/Export Controlled) *Jonathan Presley, Lynntech Inc*

0900- DoD DE measurement confidence (C) *Dr. Subrata Sanyal, NSWC Corona Division*

ACRONYM	STANDS FOR
AF SDPE	<i>Air Force Strategic Development Planning & Experimentation</i>
AFIT	<i>Air Force Institute of Technology</i>
AFIT/ENP	<i>Air Force Institute of Technology/ Department of Engineering Physics</i>
AFRL	<i>Air Force Research Laboratory</i>
AFRL/RDL	<i>Air Force Research Laboratory/ Research and Development Laser Division</i>
AFRL/RDLEM	<i>Air Force Research Laboratory/ Research and Development Laser Weapon Modeling and Simulation</i>
AFRL/RDLTS	<i>Air Force Research Laboratory/ Research and Development Laser Technology</i>
AFRL/RXA	<i>Air Force Research Laboratory/ Materials & Manufacturing Directorate, Functional Materials and Applications</i>
ARL	<i>Army Research Laboratory</i>
ASD R&E	<i>Assistant Secretary of Defense Research & Engineering</i>
DE JTO	<i>Joint Directed Energy Transition Office</i>
JIFCO	<i>Joint Intermediate Force Capabilities Office</i>
JNLW	<i>Joint Non-Lethal Weapons</i>
JNLWD	<i>Joint Non-Lethal Weapons Directorate</i>
MTSI	<i>Modern Technology Solutions Inc.</i>
NAWC CL	<i>Naval Air Warfare Center China Lake</i>
NIWC Pac	<i>Naval Information Warfare Center Pacific</i>
NPS	<i>Naval Postgraduate School</i>
NSWC	<i>Naval Surface Warfare Center</i>
ONR	<i>Office of Naval Research</i>
PSI	<i>Planned Systems International, Inc</i>
RCCTO	<i>Army Rapid Capabilities and Critical Technologies Office</i>
UCAR	<i>University Corporation for Atmospheric Research</i>
US Army CERDEC CP&ID	<i>Communications-Electronics Research, Development and Engineering Center, Command, Power and Integration Directorate</i>
US NRL	<i>United States Naval Research Laboratory</i>
USAFA	<i>United States Air Force Academy</i>
USASMDC	<i>United States Army Space and Missile Defense Command</i>
USASMDC/ARSTRAT	<i>United States Army Space and Missile Defense Command/ Army Forces Strategic Command</i>
USCGA	<i>United States Coast Guard Academy</i>
USMA	<i>United States Military Academy</i>