

**Technical Program
2019 UK / US
Directed Energy
Workshop**



**22 - 26 July 2019
Shrivenham, United Kingdom**

A Joint UK-US Symposium

General Information

Security

- UK/US Workshop is SECRET/UK US ONLY
- Attendees will be issued Cranfield ID badges on site and must have valid gov't ID available at all times
- Wireless electronic devices are prohibited in classified sessions
- Classified materials must be processed through security
- Classified discussions must only take place in designated meeting rooms
- Audio and video recording are prohibited
- Security concerns should be addressed to a Security Team member
- Failure to adhere to security standards could result in denied/revoked Workshop registration

Coaches

Coaches will run from the Swindon Marriott Hotel and the Jury's Inn to Shrivenham each morning and back again each evening. Workshop attendees must check in for ID check and loading of the coach each morning at 0730. Please confirm in advance you are on the access list. Do not bring cell phones, laptops, or notebooks to the offsite location. The staff will not be responsible for your items.

Meals

- Monday and Friday breakfast snacks and lunches are available for short course attendees only
- Breakfast is included with the room rate for hotel guests at the Marriott Hotel and the Jury's Inn
- Coffee, tea and pastries will be available at the conference each morning
- Lunch is available Tuesday - Thursday at the University
- Refreshment services will be available throughout the week

Oxford Outing

A evening outing to Oxford is scheduled on Wednesday. A coach will be provided to the historic city, leaving the Marriott Hotel at 1600. See the DEPS staff to sign up. Coaches will depart from Oxford promptly at 2130.

Reception

A light welcome reception will be held at the Marriott Hotel on Tuesday evening at 1800

Workshop Phone Numbers

General Information:

Cynamon Spain +1-505-450-1165

Short Course Information

Cristina Crowson +1-505-980-5560

SHORT COURSES

All courses will be held at the Marriott Hotel

Monday July 22

1200 Lunch, Marriott Dining Room

1300 Short Courses (until 1700)

Course 1: Introduction to High Energy Laser
Systems

Course 2: Introduction to High Power Microwave
Systems

Course 3: Atmospheric Laser Propagation

Friday July 26

0800 Short Courses (until 1200)

Course 4: Laser Deconfliction

Course 5: HPM Effects & Data Collection

Course 6: Intro to the DoD T&E Process

1200 Lunch, Marriott Dining Room

TUESDAY MORNING

Plenary Session

Chair: *Gillian Cooper*

- 0730 **Coach Check-In at Hotel**
- 0800 **On Site Registration Opens**
- 0830 **Conference Called to Order / Welcome**
Matt Cork, MoD
- 0845 **Update on UK Novel Weapons Program**
Matt Speakman, Novel Weapons Team UK MoD
- 0915 **Output of UK/US DE Workshop**
Ivan Jones, UK MoD
- 0945 **DE JTO- The Role of Transition**
Dr. Larry Grimes, Joint Directed Energy Transition Office
- 1015 **Break**
- 1030 **Current Status of US/UK DE Joint Agreements**
LeAnn Brasure, Gryphon Schafer (supporting DE JTO)
- 1100 **Directed Energy European Office of Research and Development Portfolio Overview**
Nate Lockwood, Air Force Office of Scientific Research
- 1130 **Novel Approaches for Laser Directed Energy and Beam Combination in the Continuous-wave and Pulsed Regime**
John Lincoln, University of Southampton
- 1200 **Lunch Break**

TUESDAY AFTERNOON

Laser Weapon Concepts & Military Utility

Chairs: *Adam Aberle & Ian Dibsfall*

- 1300 **SHIELD (Self-protect High Energy Laser Demonstrator) Overview**
- 1320 **UK DragonFire Laser Directed Energy Programme (**
- 1340 **Potential Employment of Army High Energy Laser Weapon Systems (D)**
Adam Aberle, US Army SMDC
- 1400 **A Review of Laser Research and Weapon Development Around the Globe**
- 1420 **High Energy Laser Mobile Test Truck (HELMTT) System Configuration and Results from Joint Improvised-Threat Defeat Organization (JIDO) Hard Kill Challenge (HKC) (D)**
Adam Aberle, US Army SMDC
- 1440 **Break**

Beam Control Technologies

Chairs: *Bob Pawlak & Andrew Scott*

- 1500 **Progress on the Advanced Beam Control Locating and Engagement Enhanced Tracking System (ABLE-ETS) (D)**
Dr. Robert Pawlak, NSWC
- 1520 **Evolution of Event-Based Sensors: A New View for LWS Applications (C)**
Nicholas Morley, AFRL/RD
- 1540 **PAMCUT: A Real Time System for Tracking Aimpoints on Air Targets**
- 1600 **Simulation of a Dual Beacon Hartmann Sensor for Turbulence Profiling (A)**
Jack McCrae, AFIT

HEL Systems Engineering and Integration

Chairs: *Keith Rigby*

- 1620 **UK LDEW Integrating the Dragon**
- 1640 **Session Adjourns**
- 1800 **Evening reception at the Swindon Marriott**

TUESDAY AFTERNOON

RF DEW Technologies

Chairs: *Bucur-Mircea Novac*

- 1300 **UK RF DEW R&T Research Programme (D)**
Peter Leask, MBDA UK
- 1325 **High Power Microwave System Technology (HPMST) Portfolio (A)**
Joshua Pompeii, JNLWD
- 1350 **50 Years of High Power Microwaves and 43 Years of the Relativistic Magnetron (A)**
Edl Shamiloglu, University of New Mexico
- 1415 **High Power Microwave Source Research at the University of Strathclyde (A)**
Kevin Ronald, University of Strathclyde
- 1440 **Update on the new 40MW Super Magnetron (A)**
Michael Duffield, Teledyne e2v
- 1505 **Break**
- 1530 **Unconventional Microwave Source (A)**
Bucur-Mircea Novac, Loughborough University
- 1555 **Enhanced operation from a self-insulating X-band Backward-Wave Oscillator (A)**
Philip MacInnew, University of Strathclyde
- 1620 **Evaluation of Capacitors for Repetitive Pulsed Power Applications (D)**
Susan Heidger, AFRL
- 1645 **Dielectric Strength of High Permittivity Ceramics in Ethylene Glycol (D)**
Tom Sully, MBDA UK
- 1710 **Session Adjourns**
- 1800 **Evening reception at the Swindon Marriott**

WEDNESDAY MORNING

HEL Technologies

Chairs: *Alex Newburgh, Rob Lamb, Ian Elder*

- 0730 **Coach Check-In at Hotel**
- 0800 **On Site Registration Opens**
- 0830 **A Low Power Phased Array Laser System for Atmospheric Compensation and Electronic Beam Steering**
- 0850 **Materials for High Power Lasers (A)**
Jasbinder Sanghera, NRL
- 0910 **Fiber Amplifier Power Scaling to 3kW and Beyond - Challenges, Limitations, and Trades (A)**
Daniel Creeden, Coherent | Nufern
- 0930 **Redetermination of the Spectral Dependence of the Verdet Coefficients of Terbium Gallium Garnet and Potassium Terbium Fluoride (A)**
David Zelmon, AFRL
- 0950 **High Brightness Power Scaling by Spectral Beam Combining of Fiber Lasers (A)**
Eric Honea, Lockheed Martin
- 1010 **Break**
- 1040 **Progress on DPALs and Other Next-gen Lasers at AFRL (D)**
Capt. Nathan Haluska, AFRL
- 1100 **Beam Combinable 1um All-Fiber Amplifiers (C)**
Angel Steve Flores, AFRL
- 1120 **Thulium Doped Amplifiers for Directed Energy Applications (C)**
Brian Anderson, AFRL
- 1140 **JTO Multidisciplinary Research Initiative: Breakthroughs and Opportunities (A)**
Matthew Leigh, DE JTO
- 1200 **Lunch Break**

WEDNESDAY MORNING

RF DEW Modeling, Weapon Concepts, and Military Utility

Chairs: *Jason Hammond & David Ball*

- 0730 Coach Check-In at Hotel
- 0800 On Site Registration Opens
- 0830 **AFSIM Directed Energy Weapon Model Development (C)**
James Sewell, AFRL
- 0850 **Galaxy Software Simulations of Directed Energy: Source Design through Mission Impact (C)**
Jason Hammond, AFRL
- 0910 **Development of an RF Munition Concept**
- 0930 **Example of RFDEW Concept Military Utility**
- 0950 **Picking the Best Target: The Human Contribution to System Resilience (C)**
Richard Farry, QinetiQ
- 1010 **Break**
- 1030 **Development of THREAT (The Human Reliability Effects Assessment Tool)**
- 1050 **RF DEW Engagement Analysis**

RF DEW Effects and Testing [Part 1]

Tim Andreadis & Adrian Grimwood

- 1120 **Target FALT Development for RF DEW**
- 1140 **Developing the Weapon Effectiveness Story for the HIJENKS Program**
- 1200 **Session Adjourns**
- 1200 **Lunch Break**

WEDNESDAY AFTERNOON

JOINT SESSION: Overarching Issues (Safety/Legal/Policy/Doctrine)

Chairs: *Diana Loree & Gillian Cooper*

- 1300 **Overview of Data Collection and Analysis from Relevant RF and Laser Activity**
- 1320 **Satellite Deconfliction Policy (C)**
Heather Witts, CSpOC/SPD Laser Clearinghouse
- 1340 **Joint Laser Deconfliction Safety System (JLDSS) (A)**
Steven Alderete, DE JTO
- 1400 **HEL Safety on a Confined Land Range (C)**
Dr. Phil Tyley, QinetiQ Ltd
- 1420 **The Safety Case for the Use of a LDEW System (C)**
Dr. Keith Youern, Dstl
- 1440 **Above the Horizon Laser Trials Safety Approach**
- 1500 **Session Adjourns**
- 1600 **Tour to Oxford**

THURSDAY MORNING

HEL Effects and Testing

Chairs: *Bob Ulibarri & Ed Dodwell*

- 0730 Coach Check-In at Hotel
- 0800 On Site Registration Opens
- 0830 Overview of the Blue Moon Test Event
- 0850 Bluemoon Trial - ASCM System Response Overview
- 0910 EHELPA AEDC Pretest Efforts (Secret)
- 0930 EHELPA Target Material Test and Modeling
- 0950 Break
- 1030 AFRL/RDLE Laser Effects Testing Capability
- 1050 DragonFire Planned & Conducted Trials
- 1110 MBDA Vulnerability Test Facility Overview
- 1130 Initial Results for Turbulence Measurement Experiment on 149 km Path (A)
Jack McCrae, AFIT
- 1150 UK Propagation 2 High Power Laser Trial Results (A)
David Gommon, Dstl
- 1210 Lunch Break

THURSDAY MORNING

RF DEW Counter-Unmanned Aerial Systems (C-UAS)

Chairs: *Matthew McQuage & Julian Wright*

- 0730 Coach Check-In at Hotel
- 0800 On Site Registration Opens
- 0830 The Need for a Coordinated cUAS System for Base and Port Protection
- 0850 RF DEW CUAS Vignettes and Architectures (D)
Lewis Cletheroe, MBDA UK
- 0910 C-UAS Concepts
- 0930 Concept and Technology Down-selection Process Development (D)
Christine Slater, MBDA UK
- 0950 CUAS Testing Methodology (D)
Phillip Meyerhofer, NRL
- 1010 Break
- 1030 C-UAS Effects Testing
- 1050 Short Pulse, High Repetition Rate Source Development for C-UAS Applications (D)
Peter Leask, MBDA UK

RF DEW Effects and Testing [Part 2]

Chairs: *Tim Andreadis & Adrian Grimwood*

- 1110 The Development of a Methodology for Hazard and Safety Assessment for Trials of High Power Radio Frequency Systems (C)
Timothy Rees, QinetiQ
- 1130 The Development of a UK and NATO High Power Radio Frequency Directed Energy Electromagnetic Environment and Immunity Test Methods (C)
Richard Hoad, QinetiQ
- 1200 Lunch Break

THURSDAY AFTERNOON

HEL Effects and Testing

Chairs: *Bob Ulibarri & Ed Dodwell*

- 1300 **LaserFX Tool Suite Update (D)**
Dr. Michael Sheyka, AFRL
- 1320 **FLIP Model Development for HEL Effects Simulations (D)**
Dr. Darren Luke, AFRL/RDLE
- 1340 **Multi-Spectral Transmission and Extinction Quantification for HEL Test and Evaluation (C)**
Dr. Steven Fiorino, AFIT

HEL Modeling and Simulation

Chair: *Sanjit Matharu & Bryan Knott*

- 1400 **Expected HEL Performance Quantification for EHEL PA using Weather Cubes (C)**
Steven Fiorino, AFIT
- 1420 **Modelling, Simulation & Analysis (MS&A), The Critical Enabler to Master Laser DEW Integration across Land, Sea & Air Platforms (D)**
Sanjit Matharu, BAE Systems
- 1440 **An Overview of the Effectiveness ToolBox (ETB) Lethality and Engagement Simulation (C)**
Bryan Knott, NSWCCD
- 1500 **Break**
- 1520 **LDEW L&V Modelling - Laser Directed Energy Weapon Target Lethality / Vulnerability Effectiveness Predictions**
- 1540 **C-ASCM Engagement Analysis**
- 1600 **LDEW User Experimentation**
- 1620 **LDEW Approach to System Performance Modelling**
- 1640 **Session adjourns**
- 1740 **Conference Adjourns**

THURSDAY AFTERNOON

RF DEW Effects and Testing [Part 3]

Chairs: *Tim Andreadis & Adrian Grimwood*

- 1300 **Novel Application of the Random Coupling Model to Directed Energy Waveforms (A)**
Bisrat Addissie, NRL
- 1320 **Ultra-wideband (UWB) Effects on Electronics: Sources and Methods**

RF Systems Engineering & Integration

Chair: *Matt Webster*

- 1340 **Specification of Mission Effects and Targeting Process**
- 1400 **Test Rigs for Cost-effective RF DEW Effects Testing**
- 1420 **Development of RF System Metrics**
- 1440 **General Atomics Concept for a High Power Microwave Airborne System Integration Lab (A)**
Robert Peterkin, General Atomics
- 1500 **Scaling of Susceptibility Testing Results to Facility Level (D)**
Lewis Cletheroe, MBDA UK
- 1520 **Break**

RF DEW Vehicle Stopping

Chair: *James Schrock*

- 1540 **Radio Frequency Vehicle Stopping (A)**
Yeong-Jer Chen, NSWCCD
- 1600 **Pre-emplaced Electric Vehicle Stopper (PEVS) (A)**
Joshua Pompeii, JNLWD
- 1620 **Update on RF Safe Stop™: A Directed Energy Capability (A)** *Michael Duffield, Teledyne e2v*
- 1640 **In-depth Investigations into the Effects of DE Weapons on Vehicle Electronics (A)**
Anthony Martin, HORIBA MIRA
- 1700 **High Power Microwave UK/US Collaboration (A)**
Yeong-Jer Chen, NSWCCD
- 1720 **Non-Lethal Vessel Stopping (A)**
Matthew McQuage, NSWCCD
- 1740 **Conference Adjourns**

RF DEW Co-Chairs:

Martin Hubbard, Dstl

Brad Hoff, AFRL

Laser DEW Co-Chairs:

Kevin Burrett, Dstl

Walter Fink, DE JTO

Committee:

Gillian Cooper, Dstl

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