

A Joint Meeting of:

**The 5th “Multifunctional Materials for Defense”
Workshop**

**Theme:
Intelligent Sensing, Learning and Adaptation of
Bio-inspired Systems**

**The 2019 Annual Review for
ONR Program on “Structural Composites &
Non-Destructive Evaluation”**

**The 2019 Annual Grantees’/Contractors’ Meeting for
AFOSR Program on “Mechanics of Multifunctional
Materials & Microsystems”**

**26-30 August 2019
4100 North Fairfax Drive, Suite 450
Basic Research Innovation & Collaboration Center
Arlington, VA 22203**

SPONSORED BY:



Workshop Co-Chairs:

Keith Perkins (Naval Research Lab)
Ajit Roy (Air Force Research Lab)
Gabriel Smith (Army Research Lab)

Joint Organizing Committee:

B.-L. ("Les") Lee (Air Force Office of Scientific Research), **Co-Chair**
Ignacio Perez de Leon (Office of Naval Research), **Co-Chair**
David Stepp (Army Research Office), **Co-Chair**

William Baron (Air Force Research Lab), **ex officio**
Jeffery Baur (Air Force Research Lab), **ex officio**
Michael Durstock (Air Force Research Lab), **ex officio**
James Joo (Air Force Research Lab)
Gregory Reich (Air Force Research Lab), **ex officio**
Ajit Roy (Air Force Research Lab), **Workshop Co-Chair '19**
Richard Vaia (Air Force Research Lab)
Qing Wu (Air Force Research Lab)

Daniel Baechle (Army Research Lab)
Todd Henry (Army Research Lab)
Christopher Kroninger (Army Research Lab)
William Nothwang (Army Research Lab), **ex officio**
Daniel O'Brien (Army Research Lab), **ex officio**
Gabriel Smith (Army Research Lab), **Workshop Co-Chair '19**
Shawn Walsh (Army Futures Command), **ex officio**
Eric Wetzel (Army Research Lab), **ex officio**

Geoffrey Cranch (Naval Research Lab), **ex officio**
Peter Finkel (Naval Research Lab)
Keith Perkins (Naval Research Lab), **Workshop Co-Chair '19**
James Thomas (Naval Research Lab), **ex officio**

Speakers, PI's & Co-PI's (Non-Gov't):

Douglas Altshuler (Univ. of British Columbia)
Andres Arrieta Diaz (Purdue Univ.)
Partha Banerjee (Univ. of Dayton)
Ray Baughman (Univ. of Texas at Dallas)
Jonathan Boreyko (Virginia Polytechnic Inst.)
Fu-Kuo Chang (Stanford Univ.)
Ioannis Chasiotis (Univ. of Illinois)
Yong Chen (Univ. of California, Los Angeles)
Nikolaus Correll (Univ. of Colorado)
Mark Cutkosky (Stanford Univ.)
Martin Dunn (Univ. of Colorado, Denver)
Arvin Ebrahimkhanlou (Univ. of Texas at Austin)
Aaron Esser-Kahn (Univ. of Chicago)
Philippe Geubelle (Univ. of Illinois)
Somnath Ghosh (Johns Hopkins Univ.)
Victor Giurgiutiu (Univ. of South Carolina)
Ming Han (Michigan State Univ.)
Darren Hartl (Texas A&M Univ.)
Lei He (Univ. of California, Los Angeles)
Ximin He (Univ. of California, Los Angeles)
Noel Holbrook (Harvard Univ.)
Jonathan Hopkins (Univ. of California, Los Angeles)
Yuhang Hu (Georgia Inst. of Technology)
Guoliang Huang (Univ. of Missouri)
Haiying Huang (Univ. of Texas at Arlington)
Peter Ifju (Univ. of Florida)
Daniel Inman (Univ. of Michigan)

Sung Kang (Johns Hopkins Univ.)
 Roy Kornbluh (SRI International)
 Nicholas Kotov (Univ. of Michigan)
 Rebecca Kramer-Bottiglio (Yale Univ.)
 Sridhar Krishnaswamy (Northwestern Univ.)
 Jay Kudva (NextGen Aeronautics, Inc.)
 Amrita Kumar (Acellent Technologies)
 David Lentink (Stanford Univ.)
 Liping Liu (Rutgers Univ.)
 Hayk Martirosyan (Skydio, Inc.)
 Jeffery Moore (Univ. of Illinois)
 SungWoo Nam (Univ. of Illinois)
 Gift Nyikayaramba (Acellent Technologies)
 Jason Patrick (North Carolina State Univ.)
 Harry Perkinson (TRI Austin, Inc.)
 Kara Peters (North Carolina State Univ.)
 Shashank Priya (Pennsylvania State Univ.)
 Jerry Qi (Georgia Inst. of Technology)
 Jordan Raney (Univ. of Pennsylvania)
 Salvatore Salamone (Univ. of Texas at Austin)
 S. Andrew Sarles (Univ. of Tennessee, Knoxville)
 Robert Shepherd (Cornell Univ.)
 Henry Sodano (Univ. of Michigan)
 Nancy Sottos (Univ. of Illinois)
 Geoffrey Spedding (Univ. of Southern California)
 Abraham Stroock (Cornell Univ.)
 C. T. Sun (Purdue Univ.)
 Sameh Tawfick (Univ. of Illinois)
 Salvatore Torquato (Princeton Univ.)
 Mikhail Vorontsov (Univ. of Dayton)
 Conor Walsh (Harvard Univ.)
 Stanley Williams (Texas A&M Univ., formerly Hewlett-Packard Labs) – **Keynote**
 Boris Yakobson (Rice Univ.)
 Jianhua (Joshua) Yang (Univ. of Massachusetts, Amherst)
 Jun Zhang (Univ. of Michigan)
 Rayne Zheng (Virginia Polytechnic Inst.)

Speakers, PI's & Co-PI's (Gov't):

Jeffery Baur (Air Force Research Lab - AFRL/RXCCM)
 Philip Beran (Air Force Research Lab - AFRL/RQVC)
 J. Daniel Berrigan (Air Force Research Lab - AFRL/RXMS)
 Philip Buskohl (Air Force Research Lab - AFRL/RXAS)
 Geoffrey Cranch (Naval Research Lab)
 Benjamin Dickinson (Air Force Research Lab - AFRL/RWWN)
 Larry Drummy (Air Force Research Lab - AFRL/RXAS)
 Steven Fairchild (Air Force Research Lab - AFRL/RXAP)
 John Ferguson (Air Force Research Lab - AFRL/RXAN)
 Peter Finkel (Naval Research Lab)
 Sabyasachi Ganguli (Air Force Research Lab - AFRL/RXAN)
 James Joo (Air Force Research Lab - AFRL/RQVS)
 Joseph Lenhart (Army Research Lab - ARL/WMRD)
 Alex Pankonien (Air Force Research Lab - AFRL/RQVC)
 Keith Perkins (Naval Research Lab)
 Francis Phillips (Army Research Lab - ARL/VTD)
 Austin Phoenix (Naval Research Lab) – **Plenary Lecture**
 Brandon Powell (Naval Research Lab) – **Plenary Lecture**
 Ronald Polcawich (Defense Advanced Research Projects Agency - DARPA/MTO) – **Keynote**
 Ajit Roy (Air Force Research Lab - AFRL/RXAN)
 Gregory Reich (Air Force Research Lab - AFRL/RQVC)
 Darin Sharar (Army Research Lab - ARL/SEDD)
 Margo Staruch (Naval Research Lab)

Christopher Tabor (Air Force Research Lab - AFRL/RXAS)
James Thomas (Naval Research Lab)
Carl Thrasher (Air Force Research Lab - AFRL/RXAS)
Richard Vaia (Air Force Research Lab - AFRL/RX)
Qing Wu (Air Force Research Lab - AFRL/RITB)

PI's & Co-PI's (Int'l) (*Not attending*):

Douglas Altshuler (Univ. of British Columbia)
Leif Asp (Chalmers Univ. of Technology)
Richard Bomphrey (Royal Veterinary College)
Emile Greenhalgh (Imperial College London)
Walter Lacarbonara (Univ. of Rome)
Giulia Lanzara (Univ. of Rome)
Jim Usherwood (Royal Veterinary College)
Dan Zenkert (KTH Royal Institute of Technology)

Session Chairs:

Daniel Baechle (Army Research Lab)
Jeffery Baur (Air Force Research Lab)
J. Daniel Berrigan (Air Force Research Lab)
Daniel Cole (Army Research Lab; *Senior Technical Advisor to Army Research Office*)
Geoffrey Cranch (Naval Research Lab)
Benjamin Dickinson (Air Force Research Lab)
Michael Durstock (Air Force Research Lab)
Victor Giurgiutiu (Univ. of South Carolina)
Todd Henry (Army Research Lab)
James Joo (Air Force Research Lab)
William Nothwang (Army Research Lab)
Daniel O'Brien (Army Research Lab)
Keith Perkins (Naval Research Lab)
Shashank Priya (Pennsylvania State Univ.)
Gregory Reich (Air Force Research Lab)
Ajit Roy (Air Force Research Lab)
Gabriel Smith (Army Research Lab)
Robert Smith (Boeing; *Representative to NextFlex Consortium*)
James Thomas (Naval Research Lab)
Qing Wu (Air Force Research Lab)

Special Guest:

Col Jason Mello (Air Force Office of Scientific Research; *Chief Technical Officer/Division Chief*)

Reviewers:

ONR grants -

Michel Digonnet (Stanford Univ.)
James Spicer (Johns Hopkins Univ.)
Ambo Wang (Virginia Polytechnic Inst.)

AFOSR MURI -

Patrick Bradshaw (Air Force Office of Scientific Research)
Jean-Luc Cambier (Air Force Office of Scientific Research)
Fariba Fahroo (Air Force Office of Scientific Research)
Kenneth Goretta (Air Force Office of Scientific Research)
Hal Greenwald (Air Force Office of Scientific Research)
Ignacio Perez de Leon (Office of Naval Research)
Siddiq Qidwai (National Science Foundation)

AGENDA

Monday, August 26

<i>Time</i>	<i>Speaker</i>	<i>Title of Presentation</i>
08:00		<i>Registration</i>
Session Chair: Gabriel Smith (Army Research Lab)		
08:05	Gabriel Smith ARL/SEDD Ajit Roy AFRL/RX Keith Perkins NRL	<i>Opening Remarks</i>
08:15	Ron Polcawich DARPA/MTO	<i>Keynote #1 –</i> Current Research in SHort Range Independent Microrobotic Platforms (SHRIMP) and Functional Materials Deposited via Additive Manufacturing
08:55	Salvatore Torquato Princeton U	Multifunctional Disordered Composites with Novel Properties
09:20	Somnath Ghosh Johns Hopkins U	Integrated Multi-Physics, Multi-scale Computational Modeling Framework for Multifunctional Applications
09:45	Coffee	Break
Session Chair: Daniel Cole (Army Research Lab/Army Research Office)		
10:00	Ray Baughman U Texas Dallas	Knowledge-Driven Design and Optimization of New Types of Yarn and Fiber Artificial Muscles
10:25	Joe Lenhart ARL/WMRD	Dynamically Responsive Polymers and Potential Applications
10:50	Jordan Raney U Pennsylvania	Bifurcation Based Actuation for Autonomous Smart Structures
11:15	Liping Liu Rutgers U	Multifunctional Soft Materials and Structures: Modeling, Design and Validation
11:40	Lunch	Break

Session Chair: Mike Durstock (Air Force Research Lab)		
13:00	Jerry Qi GA Tech Martin Dunn U Colorado	Hybrid 3D Printing: Pick-and-Place Robotics for Additive Fabrication of 4D Composites
13:25	Dan Berrigan Phil Buskohl AFRL/RX	Design, Materials, and Automated 3D Manufacturing of Mechanically Tunable RF Structures
13:50	Rayne Zheng Virginia Tech	Direct Additive Fabrication of Multifunctional Micro-Architectures and Micro-Devices
14:15	Mikhail Vorontsov U Dayton	Metallic Laser Additive Manufacturing Using 2D Arrays of Scanning Laser Power Sources for Advanced Structural Material Processing
14:40	Coffee	Break

Session Chair: Dan Berrigan (Air Force Research Lab)		
14:55	Ioannis Chasiotis U Illinois	Local Multiphysics Studies in Nanostructured Materials
15:20	Ajit Roy John Ferguson Steven Fairchild AFRL/RX	High Temperature Electronics Module Failure Physics and Design
15:45	Rich Vaia Larry Drummy AFRL/RX	Extreme Mechanical Energy Absorption: Plasticity of Polymer-Nanoparticle Solids
16:10	Somnath Ghosh Johns Hopkins U Jim Thomas NRL	Validation of Multiscale Modeling and Design Platform for Protective Hybrid Composite Systems for Aerospace Structures
16:35		<i>Open Discussion</i>
17:00	Adjournment	Adjournment

Tuesday, August 27		
Time	Speaker	Title of Presentation
08:00		<i>Housekeeping</i>
Session Chair: Ajit Roy (Air Force Research Lab)		
08:05	Guoliang Huang U Missouri C. T. Sun Purdue U	Programmable Elastic Metamaterials for Unprecedented Wave and Dynamic Control
08:30	Darin Sharar ARL/SEDD	Reversible Martensitic Transformations: A New Approach to Managing Thermal Transients of Direct Energy Systems
08:55	Jonathan Boreyko VA Tech	(YIP) Planar Bridging-Droplet Thermal Diodes
09:20	Abraham Stroock Cornell U Noel Holbrook Harvard U	Plant-Mimetic Functional Materials for Thermal Management and Suppression of Freezing
09:45	Coffee	Break
Session Chair: Danny O'Brien (Army Research Lab)		
10:00	Nancy Sottos Jeffrey Moore Philippe Geubelle U Illinois Aaron Esser-Kahn U Chicago	(CoE) Self-Healing, Regeneration & Structural Remodeling: (i) Overview; (ii) Processing and Characterization of Autonomic Composites; (iii) Modeling of Rapid Polymerization Fronts; (iv) Transformational Chemistries; (v) 4D Printing for Multifunctional Composites; (vi) Structural Remodeling/Regeneration; (vii) Morphogenic Manufacturing;
11:40	Lunch	Break

Session Chair: Jeff Baur (Air Force Research Lab)		
13:00	Nancy Sottos Ioannis Chasiotis Jeffrey Moore Philippe Geubelle U Illinois Aaron Esser-Kahn U Chicago	(CoE - CII) Self-Healing, Regeneration, and Structural Remodeling: (viii) Self-healing and On-demand Repair in Space Environment
13:25	Ximin He UCLA	(YIP) Bio-inspired Artificial Homeostatic Multifunctional Material Microsystems (AHM3)
13:50	Yuhang Hu GA Tech	(YIP) Tough Gel: A Perfect Platform for Designing Chemo-Mechano-Chemically Responsive Multi-Functional Materials
14:15	Sameh Tawfick U Illinois	(YIP) Polymorphic Hair Material Systems for Multifunctional Reconfiguration and Damage Restoration
14:40	Coffee	Break
Session Chair: William Nothwang (Army Research Lab)		
14:55	Aaron Esser-Kahn U Chicago	(PECASE) Sensing and Modulating Materials Properties Using Piezoelectric Response Elements
15:20	Sung Kang Johns Hopkins U	(YIP) Bioinspired Synthesis of Multifunctional Materials with Self-Adaptable Mechanical Properties and Self-Regeneration
15:45	Jason Patrick North Carolina State U	(YIP) Integrated Self-healing and Self-sensing using Optical Waveguides in Microvascular Fiber-Composites
16:10	Chris Tabor Carl Thrasher AFRL/RX	Responsive Electronics Using Liquid Metal Colloids
16:35		Open Discussion
17:00	Adjournment	Adjournment

Wednesday, August 28		
Time	Speaker	Title of Presentation
08:00		Housekeeping
Session Chair: Keith Perkins (Naval Research Lab)		
08:05	Boris Yakobson Rice U	Fundamentals of Locomotion, Turning the Empirical to Quantitative Science
08:30	Sameh Tawfick U Illinois	High Rate Synthesis of Infinitely Long Core-Shell Nickel Carbon Nanotube Fibers
08:55	Partha Banerjee U Dayton	In-Situ Nondestructive Evaluation of Additive Manufacturing Process
09:20	Keith Perkins NRL	Nanophase Materials as Chemi-Electric or Chemi-Luminescent Environmental Sensors
09:45	Coffee	Break

Session Chair: Geoffrey Cranch (Naval Research Lab)		
10:00	Kara Peters North Carolina State U	Optimization of Structural Lamb Wave Coupling to Fiber Bragg Grating Sensors
10:25	Geoffrey Cranch NRL	Fiber Laser Based Acoustic Emission and Guided-Wave Acoustic Sensing
10:50	Sridhar Krishnaswamy Northwestern U	Mesoscale Integrated Photonic Systems for Structural Health Monitoring
11:15	Ming Han Michigan State U	Fiber-Optic Ultrasonic Generation and Sensing
11:40	Lunch	Break

Session Chair: Victor Giurgiutiu (Univ. of South Carolina)		
13:00	Haiying Huang U Texas Arlington	Wave Coupling between Two Ultrasound Waveguides
13:25	Victor Giurgiutiu U South Carolina	Experimental and Analytical Study of Low Amplitude AE Signals Due to Rubbing/Clapping of Crack Faying Surfaces
13:50	Salvatore Salamone Arvin Ebrahimkhanlou U Texas Austin	Acoustic Emission Monitoring, Localization and Sizing
14:15	Amrita Kumar Gift Nyikayaramba Acellent Technologies Fu-Kuo Chang Stanford U	(STTR Phase II) Flexible Sensor Network and Its Embedded Integrated Circuits for Structural Health Monitoring
14:40	Coffee	Break
Session Chair: Shashank Priya (Pennsylvania State Univ.)		
14:55	SungWoo Nam U Illinois	Energy Harvesting, Structural Monitoring Sensor Based on Corrugated Atomically-thin Semiconductors
15:20	Peter Finkel Margo Staruch NRL	Broad Band Energy Harvesting Utilizing Phase Transitions in Piezoelectric Single Crystals
15:45	Shashank Priya Penn State U	Self-Biased Dual Stimulation (Vibration + Magnetic Field) Energy Harvester
16:10	Nicholas Kotov U Michigan	Nanocomposite Ion Conductors from Branched Aramid Nanofibers for Zn Thin Film Batteries
16:35		Open Discussion
17:00	Adjournment	Adjournment

Thursday, August 29		
Time	Speaker	Title of Presentation
08:00		Housekeeping

Session Chair: Greg Reich (Air Force Research Lab)		
08:05	Les Lee AFOSR Ignacio Perez ONR David Stepp ARO	Welcome Remarks
08:15	Austin Phoenix Brandon Powell NRL	Plenary Lecture – Hypersonic Morphing Waverider: Actuation, Control, and Thermal Management
08:55	James Joo AFRL/RQ	System Level Trade Study of A Variable Camber Morphing Aircraft Design
09:20	Greg Reich Philip Beran Alex Pankonien AFRL/RQ	Bio-inspired Reconfigurable System Design via Topology Optimization
09:45	Coffee	Break
Session Chair: Dan Baechle (Army Research Lab)		
10:00	Conor Walsh Harvard U	Textile-based Wearable Robots for Augmentation and Protection
10:25	Rebecca Kramer-Bottiglio Yale U	(YIP) Robotic Fabrics: Multifunctional Fabrics for Reconfigurable and Wearable Soft Systems
10:50	Rob Shepherd Cornell U Nikolaus Correll U Colorado	Localized and Rapid Variable Compliance Via Phase Changing Matter and Distributed Computation
11:15	Jonathan Hopkins UCLA	Mechanical Neural-network Architecture Materials that Learn
11:40	Lunch	Break

Session Chair: James Joo (Air Force Research Lab)		
13:00	Dan Inman U Michigan David Lentink Stanford U	Briefing on AFOSR Basic Research Initiative ‘16: “Muscular-Skeletal System Inspired Morphing Air Vehicles Using Active Materials” (3 rd Annual Review at AFOSR BRICC on March 25, 2019; U Michigan / Stanford U / UCLA / Texas A&M / U British Columbia / Royal Veterinary College / U Rome) (PI: Daniel Inman ; Co-PIs: Henry Sodano, David Lentink, Fu-Kuo Chang, Yong Chen, Darren Hartl, Douglas Altshuler, Richard Bomphrey, Jim Usherwood, Giulia Lanzara, Walter Lacarbonara) (PM: Les Lee ; Co-PM’s: Gregg Abate, Patrick Bradshaw, David Garner, Shad Reed, Douglas Smith)
13:50	David Lentink Stanford U	Briefing on Defense Enterprise Science Initiative (DESI) ‘19: “Highly Maneuverable Autonomous UAV” (Kick-off at AFOSR BRICC on March 26, 2019; Stanford U / Skydio, Inc.) (PI: David Lentink ; Co-PIs: Mark Cutkosky, Hayk Martirosyan) (PM: Les Lee ; Co-PM’s: Jean-Luc Cambier, Frederick Leve)
14:15	Francis Phillips ARL/VTD	Shape Adaptation of Small UAS for Increased Maneuverability and Extended Range

14:40	Coffee	Break
<i>Session Chair: Todd Henry (Army Research Lab)</i>		
14:55	Harry Perkinson TRI Austin Peter Ifju U Florida	(STTR Phase II) Biomimetic Design of Morphing Micro Air Vehicles
15:20	Jay Kudva Concepts to Systems Geoffrey Spedding U Southern Calif Roy Kornbluh SRI International	(STTR Phase II) Biomimetic Design of Morphing Micro Air Vehicles
15:45	Andres Arrieta Diaz Purdue U	Bioinspired Spring Origami for Morphing Structures: Reconfiguration and Actuation Simplification
16:10	Ben Dickinson AFRL/RW Jeff Baur AFRL/RX	Bio-inspired Morphing Skins for Articulating Head Concepts
16:35		<i>Open Discussion</i>
17:00	Adjournment	Adjournment

(Continuing)

Friday, August 30

Kick-Off Meeting: AFOSR MURI '19

Topic 23: Neuromorphic Networks for Multifunctional Intelligent Systems

“Brain-Inspired Networks for Multifunctional Intelligent Systems in Aerial Vehicles”

UCLA / Stanford U / Texas A&M / U Mass / U Michigan / U Tenn

PI: Yong Chen (UCLA);

PM: Les Lee (AFOSR); Co-PM's: Kenneth Goretta, Patrick Bradshaw, Jean-Luc Cambier

Time	Speaker	Title of Presentation
08:00		Registration
Session Chair: Qing Wu (Air Force Research Lab)		
08:15	Col Jason Mello Chief Technical Officer AFOSR	Opening Remark
08:35	Stanley Williams Texas A&M U (formerly Hewlett-Packard Labs)	Keynote #2 – New Approaches for Computing from Brain-Inspired Dynamics
09:15	Yong Chen UCLA	Overview - MURI'19 “Brain-inspired Networks for Multifunctional Intelligent Systems in Aerial Vehicles”
09:45	Coffee	Break
Session Chair: Ben Dickinson (Air Force Research Lab)		
Thrust A: Devices to emulate synapses and neuron		
Thrust B: Circuits to emulate neural networks		
10:00	Yong Chen UCLA	Synaptic Resistor Networks for Multifunctional Intelligent Systems
10:25	Andy Sarles U Tenn Knoxville	Biomolecular Synapses That Mimic the Composition, Structure, and Transport Properties of Biological Synapses
10:50	Joshua Yang U Mass Amherst	Memristive Devices for Brain-inspired Computing
11:15	Lei He UCLA	Design and Simulation of Synstor Circuits for Intelligent Systems
11:40	Lunch	Break

Session Chair: Robert Smith (Boeing)

Thrust C: Multifunctional intelligent systems in aerial vehicles

Thrust D: Theories about the brain, circuits, and intelligent systems

13:00	Fu-Kuo Chang Stanford U	Intelligent Multifunctional Composite Materials with Sensory Neuron Networks, Neuromorphic Chips and Batteries
13:25	Daniel Inman U Michigan	Towards Self-Piloted UAV (SPUAV) Through Real-Time Learning on Brain-Inspired Circuits

13:50	Stanley Williams Texas A&M U	Quantitative Modeling and Nonlinear Analysis of Neuromorphic Elements and Circuits
14:15	Jun Zhang U Michigan	The Model Connecting Physical Networks with the Brain: The Information Geometric Approach
14:40	Coffee	Break
<i>Session Chair: Jim Thomas (Naval Research Lab)</i>		
14:55	Qing Wu AFRL/RI	Overview of Air Force Research Activities on Brain-Inspired Circuits, Systems and Algorithms
15:20	Sabyasachi Ganguli AFRL/RX	Fundamental Studies of the Changes in Material States for Switching Memory Devices
15:45		<i>Open Discussion</i>
16:25	Yong Chen UCLA	<i>Wrap-up</i>
16:40	Les Lee AFOSR	<i>Closing Remark</i>
16:55	Adjournment	Adjournment

MAIN WEBSITE

<https://community.apan.org/wg/afosr/w/researchareas/24377/2019-multifunctional-materials-for-defense-workshop/>
Including the information on the meeting registration, agenda, hotels and parking

MEETING SITE

Basic Research Innovation & Collaboration Center (BRICC)

4100 North Fairfax Drive, Suite 450
Arlington, VA 22203