

# 2020 Propulsion and Power Program Review

Dr. Mitat Birkan | October 5-8, 2020 | Virtual

## Agenda Day 1 | Monday, October 5, 2020

Time	Topic	Speaker
11:00-11:30	Zoom Login	
11:30-12:00	<b>INTRODUCTION</b>	
<b>THEME:</b> Low-cost, networked cruise missiles and smart munitions, and propellants (2030 USAF Science and Technology Strategy)		
12:00-13:30	Piezoenergetics Coupled Piezoelectric and Nanoenergetic Materials with Adaptable and Tailorable Reactivity	2018 MURI: Son, Steven (PI-Purdue), Yetter, Wang, Duin (Penn State), Zhou (Georgia Tech), Zacharia (UC-Riverside), Sehirlioglu (Case Western)
13:30-14:00	DISCUSSION	
14:00-14:30	<b>BREAK</b>	
14:30-14:50	More than Piezoelectricity: Harnessing Electroactive Materials for Function	Groven, Lori (SDSMT)
14:50-15:10	Exploratory Study of the Decomposition and Combustion Process of Ionically Conducting Gel and Solid Propellants	Young, Greg (VA Tech)
15:10-15:30	Laser Spectroscopy for Nano- and piezo-energetics	Goldenstein, Christopher (Purdue)
15:30-15:50	DISCUSSION	
15:50-16:20	<b>BREAK</b>	
<b>THEME:</b> Electromagnetic pulse attacks on critical infrastructure (EXECUTIVE OFFICE OF THE PRESIDENT)		
16:20-17:20	Plasma-Based Reconfigurable Photonic Crystals and Metamaterials	2014 MURI: Cappelli, Mark (PI-Stanford), Hopwood (Tufts), Randall (PennState), Raja (UT Austin), Shumlak (Univ. of Washington), Wirz (UCLA)
17:20-17:40	DISCUSSION	
1740	<b>MEETING ADJOURNED FOR THE DAY</b>	

<b>Agenda Day 2   Tuesday, October 6, 2020</b>		
<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
<b>10:30-11:00</b>	<b>Zoom Login</b>	
<b>THEME:</b> Small satellites and low-cost launch (2030 USAF Science and Technology Strategy), cislunar environment to exercise selected space superiority (Future of Space 2060)		
<b>11:00-11:30</b>	AFRL In-Space Propulsion Branch Electric Propulsion Program – Electrospays and High Power EP	Eckhard, Daniel (AFRL / RQRS)
<b>ELECTROSPRAYS</b>		
<b>11:30-11:50</b>	Mass and Charge Evolution in Electro spray Plumes for High Delta-V Thrusters	Wirz, Richard (UCLA)
<b>11:50-12:10</b>	Electro spray Plume Dynamics in the Near-extraction region	Davis, McKenna (NDSEG Fellow, UCLA)
<b>12:10-12:40</b>	<b>BREAK</b>	
<b>12:40-13:10</b>	Designing High Molecular Weight Ionic Liquids for In-Space Propulsion	Ghiassi, Kamran (AFRL / RQRP)
<b>13:10-13:30</b>	Modeling of Ion-Emitting Taylor Cones for Electro spray Propulsion	Gamero-Castano, Manuel (UCI)
<b>13:30-13:50</b>	A New Facility for Electro spray Propulsion Studies with Spatial Resolution of the Full Beam and High-Resolution Mass Analysis	De La Mora, Juan (Yale University)
<b>13:50-14:10</b>	DISCUSSION	
<b>14:10-14:40</b>	<b>BREAK</b>	
<b>14:40-15:00</b>	Electro-Active Polymers for Robust and Flexible Electro spray Propulsion	Lozano. Paulo (MIT)
<b>15:00-15:20</b>	Investigation of Ionic Liquid Monopropellant Plasma using Optical Diagnostics	Lemmer, Kristina (Western Michigan University)
<b>15:20-15:40</b>	Combustion Mechanisms of HAN-based Green Monopropellants	Shafirovich, Evgeny (UTEP)-HBCU
<b>15:40-16:10</b>	<b>DISCUSSION / BREAK</b>	
<b>16:10-16:30</b>	Physics of Beamed-Microwave Plasmas in Supersonic Flows	Micci, Michael; Bilen, Sven (Penn State)
<b>16:30-17:00</b>	<b>DISCUSSION / BREAK</b>	
<b>1700</b>	<b>MEETING ADJOURNED FOR THE DAY</b>	

<b>Agenda Day 3   Wednesday, October 7, 2020</b>		
<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
<b>10:30-11:00</b>	<b>Zoom Login</b>	
<b>THEME:</b> Advanced space-related power and propulsion capabilities (EXECUTIVE OFFICE OF THE PRESIDENT)		
<b>PLASMA PROPULSION</b>		
<b>Airbreathing Electric Propulsion for Very Low Earth Orbit</b>		
<b>11:00-11:30</b>	Tightly Coupled Multi-physics Modeling of High Power Electric Propulsion for Very Low Earth Orbit	Martin, Robert (AFRL / RQRS)
<b>11:30-11:50</b>	Comprehensive Study of Plasma-Wall Sheath Transport Phenomena, and Ionization and Acceleration of N <sub>2</sub> /O <sub>2</sub> Mixtures for Air-Breathing Electric Propulsion	Walker, Mitchell (Georgia Tech)
<b>11:50-12:10</b>	Developing Methods of Control of Self-Organized Plasma Structures in Devices Relevant to Electric Propulsion, and Electron-Beam Generated ExB Plasma for Air-Breathing Propulsion	Raitses, Yevgeny (Princeton University)
<b>12:10-12:30</b>	Hot Magnetized Plasma Acceleration Devices and Modes for Agile Plasma Thrusters	Cappelli, Mark (Stanford University)
<b>12:30-13:00</b>	DISCUSSION	
<b>13:00-13:30</b>	<b>BREAK</b>	
<b>Time-resolved Experimental Observations of the Plasma State Combined with Machine Learning Algorithms</b>		
<b>13:30-13:50</b>	Data-Driven Calibration Model for Hall Effect Thruster Dynamics	Greve, Christine (NDSEG Fellow, TAMU)
<b>13:50-14:10</b>	Data-driven Models for Prediction and Control of Plasma Processes and Applications with Poorly Understood Physics	Jorns, Benjamin (Univ. of Michigan-YIP)
<b>14:10-14:30</b>	Rapid Optimization of Non-Equilibrium Plasmas using New Breakthroughs in Data Science	Little, Justin (Univ. of Washington-YIP)
<b>14:30-14:50</b>	DISCUSSION	
<b>14:50-15:20</b>	<b>BREAK</b>	
<b>15:20-15:40</b>	Experiment, Modeling, and Simulation of Advanced Materials - Plasma Interactions in the Space Environment	Rovey, Joshua (UIUC)

<b>15:40-16:00</b>	Coherent Structures in Magnetized ExB Discharges and Mechanism(s) of the Anomalous Electron Current	Smolyakov, Andrei (University of Saskatchewan)
<b>16:00-16:20</b>	Exploring New Concepts Towards Multi-mode Low-power Robust Electric Propulsion	Keidar, Michael (George Washington University)
<b>16:20-16:40</b>	<b>DISCUSSION / BREAK</b>	
<b>16:40</b>	<b>MEETING ADJOURNED FOR THE DAY</b>	

<b>Agenda Day 4   Thursday, October 8, 2020</b>		
<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
<b>12:30-13:00</b>	<b>Zoom Login</b>	
<b>STRUCTURAL BATTERIES</b>		
<b>13:00-13:40</b>	Morphological and Interfacial Effects in Aramid-Graphene Composites for Structural Energy and Power	
<b>13:40-14:00</b>	Designing Structural Batteries with High Energy Density and Enhanced Safety	
<b>14:00-14:30</b>	<b>DISCUSSION / BREAK</b>	
<b>OTHER</b>		
<b>14:30-14:50</b>	Prediction of Basic Operation of Electro-Spray Thrusters Using High Fidelity Modeling	Boyd, Iain (University of Colorado)
<b>14:50</b>	<b>MEETING ADJOURNED</b>	