Basic Research Innovation Collaboration Center (BRICC)
4100 N Fairfax Drive, Suite 450 | Arlington, VA 22203

Monday, November 28, 2022
AFOSR MURI: Hypersonic Flight in the Turbulent Stratosphere (HYFLITS)

Time	Topic		Speaker
8:00	**BRICC Elevators Open, In-person Check in / Zoomgov login 8:15**		
8:30-8:40	**Welcome & Overview**	Welcome and Opening Remarks	Sarah Popkin
8:40-9:00		AFOSR MURI HYFLITS: Project Overview	Brian Argrow
9:00-9:30	**The High-Altitude Flight Environment**	Understanding the Earth's Atmosphere-Space Interface Environment	Delores Knipp (CU Boulder)
9:30-10:00		Aviation Turbulence Modeling Applied to Stratospheric Forecasting	Greg Wilson (Earthcast)
10:00-10:15	**BREAK**		
10:15-11:15	**Atmospheric & Vehicle Simulations**	High-Fidelity Modeling of Stratospheric Turbulence Cascade from Mesoscale Sources to Centimeter-Scale Turbulence	Dave Fritts
11:15-12:15		Hypersonic Boundary Layer Receptivity to Stratospheric Turbulence and Particulates	Graham Candler
12:15-1:15	**LUNCH**		
1:15-2:00	**Atmospheric In-Situ Measurement Systems**	Balloon-Borne Stratospheric Measurement System	Dale Lawrence
2:00-2:30		Turbulence measurements	Dale Lawrence
2:30-3:00		Particulates Measurements	Joseph Habeck
3:00-3:15	**BREAK**		
3:15-3:45	**Atmospheric In-Situ Measurement Systems**	Optical Turbulence: Measurement, Simulation, Theory	Andreas Muschinski
3:45-4:00	**Conclusions & Future Research**	AFOSR MURI HYFLITS Research: Conclusions, New Directions	Brian Argrow

4:00-5:00	**Conclusions & Future Research**	Future Research Discussion & Wrap-Up	Sarah Popkin
	MEETING ADJOURN		

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Tuesday, November 29, 2022
Particulate and Precipitation Effects on High-speed Flight Vehicles – Schwartzentruber (PI)

Time	Topic	Speaker
8:00	**BRICC Elevators Open, In-person Check in / Zoomgov login 8:15**	
8:35-8:45	Meeting Introduction (Agenda, Rules, Technical intro)	Eric Marineau
8:45-9:00	MURI Year-2 Overview	Tom Schwartzentruber
9:00-9:30	Experiments of High-Speed Particle Collisions with Surfaces	Chris Hogan
9:30-10:00	Modeling Small Particle Interactions with High-speed Flow	Tom Schwartzentruber
10:00-10:15	**BREAK**	
10:15-10:45	CFD Framework and Modeling for Particle/Droplet Flow Interactions	Graham Candler
10:45-11:15	Particle Impact Modeling with the PISALE Code	Alice Koniges
11:15-11:45	Advanced Diagnostics and Imaging of Droplet Demise at High Weber Number	Nick Parziale
11:45-1:00	**LUNCH**	
1:00-1:30	Wind-tunnel and Small Gas-gun Experiments with Droplets and Particulates	Stuart Laurence
1:30-1:55	Numerical Investigations of Particle and Droplet Impingement at Hypersonic Flow Conditions	Christoph Brehm
1:55-2:20	Resolving Shock-Driven Droplet Breakup and Evaporation at Hypersonic Conditions	Dorrin Jarrahbashi

2:20-2:35	**BREAK**	
2:35-3:00	Spatiotemporal Evolution of Hydrometeors and Flow Interactions During Aerobreakup	Sukesh Roy
3:00-3:25	Multiscale Mechanics of Materials under High Velocity Impact	Suraj Ravindran
3:25-3:40	Summary and Next Steps	Tom Schwartzentruber
3:40-4:00	Online discussion	
4:00-5:00	Offline discussion	
5:00	**BRICC Closes**	
6:00	**Happy hour followed by dinner**	

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Wednesday, November 30, 2022

FY2022 AFOSR MURI Kickoff: A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonic Systems Grounded in Rigorous Model Reduction – Farhat (PI)

Time	Topic	Speaker
8:00	**BRICC Elevators Open, In-person Check in / Zoomgov login 8:15**	
8:30	Welcome and Opening Remarks	Sarah Popkin (Topic Chief), AFOSR
8:40	AFOSR MURI Team Overview	Charbel Farhat (PI)
9:00	A Robust Multi-Physics Design Analysis and Optimization Framework for Hypersonic Systems Grounded in Rigorous Model Reduction	Charbel Farhat, Stanford
9:15	Modeling Requirements for a Generic Boost-Glide Vehicle Trajectory	Graham Candler, UMN
9:45	**BREAK**	
10:00	Multi-Fidelity Approaches for Aero-Thermal-Trajectory Analysis and Optimization	Juan Alonso, Stanford

10:30	Control-Oriented Modeling for Hypersonic Systems	Maziar Hemati, UMN
11:00	Integration of ROM Training and Optimization for MDAO	Matthias Heinkenschloss, Rice
11:30	Adaptive Model Reduction for Analysis and Optimization of Shock-Dominated Flows	Matthew Zahr, Notre Dame
12:00	**LUNCH (1hr 15 min)**	
13:15	Higher-Order Approximation Manifolds for Mitigating The Kolmogorov Barrier to Model Reduction	Charbel Farhat, Stanford
13:45	Summary and Next Steps	Charbel Farhat, Stanford
13:55	Online discussion	
14:15	Offline discussion	
14:30	**MEETING ADJOURN**	

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Thursday, December 1, 2022
Turbulence-chemistry Interaction in High-speed Reacting Flows

Time	Topic	Speaker
8:00	**BRICC Elevators Open, In-person Check in / Zoomgov login 8:15**	
8.30	Welcome and overview of topic	Eric Marineau (MURI Topic Chief), ONR
9.00	Overview of MURI project and Year 1 progress	-Venkat Raman, Department of Aerospace Engineering, University of Michigan -Tonghun Lee, Department of Aerospace Engineering, University of Illinois at Urbana-Champaign -Hai Wang, Department of Mechanical Engineering, Stanford University -Carlo Scalo, Department of

		Aerospace Engineering, Purdue University
10.15	**BREAK** for 15 minutes	
10.30	Chemistry for external and internal flows	-Marco Panesi, Department of Aerospace Engineering, University of Illinois at Urbana-Champaign -Hai Wang, Department of Mechanical Engineering, Stanford University
11.30	Data assimilation and uncertainty quantification for hypersonics	-Roger Ghanem, Department of Civil Engineering, University of Southern California -Venkat Raman, Department of Aerospace Engineering, University of Michigan -Marco Panesi, Department of Aerospace Engineering, University of Illinois at Urbana-Champaign
12.30	**LUNCH**	
1.30	**Invited Talk:** Resolvent analysis in compressible and non-equilibrium wall flows	Prof. Beverley Mckeon [Caltech]
2.00	**Invited Talk:** Development of Data Assimilation Methods for Combustion	Dr. Matt Harvazinski [AFRL Edwards]
2.30	**Invited Talk:** In-flow gas measurements using fs/ps CARS for high-speed flows	Prof. Chloe Dedic [UVa]
3.00	**BREAK**	
3.15	**Invited Talk:** High enthalpy external flow experiments	Prof. Anand Veeragavan, University of Queensland
3.45	Summary of project	MURI Team
4.00	Closed discussion with MURI Team and PMs	
5.00	**MEETING ADJOURN**	

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Friday, December 2, 2022

MURI Kickoff Development of Validated Hypersonic Plasma Kinetics Models Including Atomic Excitation

Time	Topic	Speaker
08:00	**BRICC Elevators Open, In-person Check in / Zoomgov login 8:15**	
08:30	Welcome and overview of topic	Eric Marineau (PM), ONR
08:45	Overview of MURI team and Research	Iain Boyd (PI), Colorado
09:00	Molecular Experiments	Tim Minton, Colorado
09:30	Molecular computations	Hua Guo, New Mexico
10:00	Plasma reactor experiments	Igor Adamovich, Ohio State
10:30	**BREAK**	
10:45	Shock tube experiments	Ron Hanson, Stanford
11:15	Expansion tunnel experiments	Matt McGilvray, Oxford
11:45	Reduced order kinetics modeling	Robyn Macdonald, Colorado
12:15	Flow modeling	Iain Boyd, Colorado
12:45	Summary and next steps	Iain Boyd, Colorado
13:00	**LUNCH**	
14:00	Invited talk: Methods to measure the rate constant of $N(^2P) + O(^3P)$ --> NO+ + e- in a flowing afterglow	Dr. Nick Shuman, AFRL RV
14:30	Invited talk: Ab initio associative ionization calculations for Earth atmospheric entry	Dr. Eve Papajak, NASA Ames
15:00	Invited talk: Industry perspective on ionization modeling needs	Dr. John Rhoads, Lockheed Martin
15:30	On-line Discussion	open to all
16:00	Off-line Discussion	open to Government Team and MURI Team
17:00	**MEETING ADJOURN**	