
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 |

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| **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** | |

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| **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 |

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| **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** | Online Adaptive Model Reduction with Applications to Rotating Detonation Waves | Benjamin Peherstorfer, Courant Institute of Mathematical Sciences, New York University |
| **14:00** | Higher-Order Approximation Manifolds for Mitigating The Kolmogorov Barrier to Model Reduction | Charbel Farhat, Stanford |
| **14:30** | An Inexact Trust-Region Algorithm for Nonsmooth Nonconvex Optimization | Drew Kouri, Sandia National Laboratories |
| **15:15** | Summary and Next Steps | Charbel Farhat, Stanford |
| **15:25** | Final Remarks | Sarah Popkin (Topic Chief), AFOSR |
| **15:30** | **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<br>-Tonghun Lee, Department of Aerospace Engineering, University of Illinois at Urbana-Champaign<br>-Hai Wang, Department of Mechanical Engineering, Stanford University<br>-Carlo Scalo, Department of Aerospace Engineering, Purdue University |

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| **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<br>-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<br>-Venkat Raman, Department of Aerospace Engineering, University of Michigan<br>-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

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|---|---|---|
| **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** | |