Basic Research Innovation and Collaboration Center (BRICC)
4075 Wilson Blvd., Suite 350 | Liberty Room
Arlington, VA 22203

Agenda Summary: AFOSR/ARO/NSF basic Combustion Research Review is an annual review meeting covering a wide range of leading edge, on-going efforts in basic combustion research. The reviewed efforts are selected jointly by respective program officers/managers/directors to highlight achievements from their portfolios. Presentations are also invited to provide scientific background and state-summary of special areas of interests to foster innovative ideas and establish new directions.
This year, focal areas are: turbulent combustion, rotational detonation, high-pressure, multi-phase combustion and diagnostics, including a workshop on discussing the current state of and future strategy on studying the turbulence-flame interaction, focusing on: (1) impacts of turbulence on the flame and underlying chemistry; (2) flame-scale turbulence production and its consequence; (3) modeling requirements and data needs; and (4) current states, realistic expectations and gaps of diagnostics for studying turbulence-flame interactions.
Presenters shall avoid obvious, commonly understood and excessive introduction/background to focus on key scientific logics and substantive contents of their research efforts. Normal 25 min slots have the presentation time around 20min, allowing about 5min Q&A/discussion. Extended 40min slots have the presentation time around 30min, allowing about 10min Q&A/discussion. Speakers should prepare their presentations accordingly. Session chairs will strictly enforce the time allocation.

Agenda Day 1 | August 28, 2018

Time	Title	Speaker
0800	**Registration**	
0800 - 0805	Opening Remarks	Ralph Anthenien, ARO, Song-Charng Kong, NSF and Chiping Li, AFOSR
Special Other Combustion Topics (Chairs: Song-Charng Kong)		
0810 - 0835	Plasma-Enhanced Flames at Elevated Pressure	Sally Bane, Purdue
0835 - 0840	Flow/Shock Structure and Dynamics in High-Speed Asymmetric Duct Flow	Tonghun Lee, UIUC and Venkateswaran Narayanaswamy, NC State
0840 – 0925	Analysis and Scaling of Turbulent Combustion	Forman Williams, UCSD
0925 – 0940	**BREAK**	
AFOSR/NSF Joint Turbulent Combustion Initiative (Chairs: Song-Charng Kong)		
0940 - 1020	Experiments and Theory of Non-Equilibrium Processes in Turbulent Combustion	Venkat Raman, Michigan and Noel Clemens, UT Austin

1020 - 1100	Turbulent Flame Structure of Cavity Stabilized Reacting Shear Layers	Harsha Chelliah, UVa, Chris Goyne, UVa, Andrew Cuttler, GWU, and Jack Edward, NCSU, Jackie Chen, Sandia/CRF
1100 - 1140	Spectral Energy Transfer in Turbulent Flames	Guillaume Blanquart, Caltec and Fokion Egolfopoulos, USC
1140 - 1245	**LUNCH**	
Turbulent Flame Propagation, Structure and Dynamics (Chair: Harsha Chelliah)		
1245 - 1310	Understanding the Mechanisms of Wildland Fire Spread: From Bench-Scale Experiments to Field-Scale Wildfires	Michael Gollner, UMD,
1310 - 1335	High-Speed Compressible Turbulent Combustion	Kareem Ahmed, UCF
1335-1400	Spatial-Temporal Behavior of Turbulent Non-Premixed Jet Flames and Auto-Igniting Fuel Jets	James Driscoll, Michigan
1400 - 1425	Rate-Controlling Effects from High-Intensity Turbulence-Flame Interactions	Adam Steinberg, GaTech
1425 - 1450	Characterization of Flames Using High-speed Laser-Diagnostic Techniques	Isaac Box, DLR
1550 - 1520	**BREAK**	
Turbulent Flame Propagation, Structure and Dynamics - Continued (Chair: James Driscoll)		
1520 - 1545	Turbulent Lifted Flame Stabilization in Heated and Vitiated Coflows	Kevin Lyons, NCSU
1545 - 1610	Characterization of Dynamics of Turbulent, Aerodynamically Stabilized Flames	Timothy Lieuwen, GaTech
1610 - 1635	Premixed Flame Structure and Propagation Characteristics in Intense Turbulence and in Compressible Flows	Suresh Menon, GaTech and Robert Pitz, Vanderbilt
1635- 1700	Structure and Dynamics of Highly Turbulent, Interacting Flames	Jacqueline O'Connor, Penn State
1700	**MEETING ADJOURN FOR THE DAY**	

Agenda Day 2 | August 29, 2018		
Time	**Title**	**Speaker**
0800	**Registration**	
0800 – 0805	Daily Announcements	Ralph Anthenien/ARO, Song-Charng Kong, NSF and Chiping Li, AFOSR
Workshop on Turbulence-Flame Interactions,(Workshop Chairs/ Discussion Moderators: Forman Williams/Venke Sankaran)		
0805 - 0950	Impacts of Turbulence on Flames and Underlying Combustion Chemistry: Presenters/Panelists Xinyu Zhao, Hai Wang, Jeff Sutton, Peter Hamlington, Tianfen Lu (tentative) Synopsis: Turbulence can enlarge attainable thermo-chemical states of the pre-flame mixture. Various real-fuel based physical processes leading to the enhanced turbulent flame speed are highlighted in this session, supported by experimental and computational evidences. With the progress in understanding the flame physics, the requirements for constructing suitable chemical kinetic models under turbulent conditions are addressed through case studies.	
0950 - 1000	**BREAK**	
1000 - 1145	Flame-Scale Turbulence Production and its Consequence Presenters/Panelists: Alexei Poludnenko, Kareem Ahmed James Driscoll, Adam Steinberg (tentative) Synopsys: Flame coupling with pressure gradients – externally imposed or directly produced by the flame – can serve as a powerful source of vorticity, capable of generating significant turbulence. Such flame-generated turbulence plays a critical role in the flame dynamics altering the nature of the turbulent cascade, modifying the flame structure and dynamics ultimately changing the burning speed. We explore various possible regimes of the flame-driven turbulence generation and the underlying physical mechanisms and resulting impacts on both the overall turbulent flow field and the flame structure and dynamis. The workshop will aim to summarize the state-of-the-art understanding of this problem along with the outstanding challenges to inform the modelling community and stimulate the development of the next generation of combustion models.	
1145 - 1215	**LUNCH – getting lunch for the working lunch session**	
1215 - 1415	Model Requirements and Data Needs (working lunch session) Presenters/Panelists: Brent Rankin, Jackie Chen, Xinfeng Gao (tentative) Synopsis: Fundamental understanding and proper turbulent combustion models consistent to and representative of key underlying physical phenomena in relevant regimes have critical impacts to current and next-generation aerospace propulsion systems. This session begins by summarizing key physical phenomena in the turbulent combustion, establishing foundational elements for physics-based turbulent combustion	

	models. Data needs for representing key physics and model validation needs, from experiments and direct numerical simulations (DNS), will be discussed with an emphasis on relevant configurations in the relevant regimes. The current state and future strategy for DNS development for this purpose will be discussed, including embedded DNS and adaptive mesh refinement, data assimilation, learning approaches and other advanced data analysis techniques. This session will conclude with an in-depth discussion of model requirements for representing underlying interacting multi-scale physics with proper enabling numeric techniques and model evaluation metrics.
1415 - 1430	**BREAK**
1430 - 1600	Relevant Diagnostics for Studying Turbulence-Flame Interactions: Current State, Realistic Expectations and Gaps Presenters/Panelists: Adam Steinberg, Jeff Sutton, Brent Rankin (tentative more to be added) Synopsis: This session will address the use of laser diagnostics for investigating rate limiting processes in turbulent flame systems with a particular focus on attaining quantifiable information for understanding key physics and chemistry. In particular, this session summarizes measurement needs and the current state of laser diagnostics, including typical approaches, capabilities, and limitations. This will be followed by a discussion on reasonable expectations for future applications including emerging measurement approaches, data analysis, and integrated experimental-computational paradigms.
1600 - 1700	Q&A on AFOSR/ARO/NSF Combustion Research Portfolios
1700	**MEETING ADJOURN FOR THE DAY**

Agenda Day 3 | August 30, 2018		
Time	**Title**	**Speaker**
0800	**Registration**	
0800 - 0805	Daily Announcements	Ralph Anthenien/ARO, Song-Charng Kong, NSF and Chiping Li, AFOSR
Combustion Modeling (Chairs: Ralph Anthenien)		

0805 - 0830	Multi-Modal Turbulent Combustion under Autoignitive Conditions: Separability of Combustion Modes and Implications for Modeling	Michael Mueller, Princeton
0830 - 0855	Modeling of Ablating Reacting Surfaces using Flamelet Generated Manifolds	Paul DesJardin, Buffalo
Combustion Chemistry in Vitiated Flow (Chair, Ralph Anthenien)		
0855 - 0920	Impacts of Vitiated Products on Hydrocarbon Combustion Chemistry	Tom Bowman, Stanford
0920 - 0945	AFOSR-RQR Rotational Detonation Rocket Engine (RDRE) Program	Alex Schumaker, AFRL/RQR
0945 - 1010	Rotational Rocket Detonation Engine Demonstration Experiments	Steve Heister, Purdue
1010 - 1020	**BREAK**	
1020 - 1045	Rotational Detonation Research at University Michigan	Venkat Raman and Mirko Gamba, Michigan
1045 - 1110	Supersonic Combustion and Detonation	Ken Yu, Maryland
1110 - 1135	Influence of Sizing on Rotating Detonation Combustor Performance	Piotr Wolanski, Institute of Aviation, Warsar
1135 - 1245	**LUNCH**	
Combustion Diagnostics (Chair: Chiping Li)		
1245 - 1310	Ultra-Fast Nonlinear Optical Approaches to Explored Potential Energy Surface	James Gord, AFRL/RQT
1310 - 1335	Impact of Ar Dilution on Hydrocarbon Fuel Combustion Chemistry	VanDuin, Penn State
1335 - 1400	Shock Tube Research at Georgia Tech	Wenting Sun, GaTech
1400 - 1425	Chemical Kinetics of Phosphorus-Based Fire Suppressants and Development of a PO2 Laser Absorption Diagnostic	Eric Petersen, TAMU
1425 - 1440	**BREAK**	
Combustion Diagnostics – Continued (Chair: Chiping Li)		
1440 - 1505	1245 - 1310Approaches to Improve the Sensitivity and Precision of Aerosol Phosphor Thermometry	David Rothmer, University of Wisconsin
1505 - 1530	Applications of Frequency Combing in Combustion Diagnostics	Greg Rieker, University of Colorado, Boulder
1530 - 1555	Measurement of Pressure with Stand-Off Spectroscopic Methods	Richard Miles, Princeton/TAMU
1530 - 1555	Diagnostics for High-Speed Propulsion	Cam Carter, AFRL/RQH
1555 - 1620	Recent Developments in Absorption Measurements and Shock-Tube Experiments	Ronald Hanson, Stanford

1620 - 1645	Recent Developments in Absorption/Fluorescence Diagnostics for Gas Dynamic Parameters, High T and P Spectral Databases, and Fuel Kinetics	Ronald Hanson, Stanford
1645 - 1700	**Concluding Remarks**	
1700	**MEETING ADJOURN**	

Registration Website:
https://community.apan.org/wg/afosr/w/researchareas/22007/2018-afosr-aro-nsf-basic-combustion-research-review/
[This link must remain continuous in order to work properly]

Link to registration only:
https://www.surveygizmo.com/s3/4278224/2018-AFOSR-ARO-NSF-Basic-Combustion-Research-Review

The building's elevators unlock promptly at 8:00 AM at which time the BRICC doors open as well. Please don't try and access either before 8:00 AM.