PROPULSION ENERGY FORUM

19–22 AUGUST 2019 | INDIANAPOLIS, IN

POWERING
A CHANGING WORLD

What's going on in the HUB

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SHAPING THE FUTURE OF AEROSPACE

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Rolls-Royce pioneers cutting-edge technologies that deliver clean, safe and competitive solutions to meet our planet's vital power needs.

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Pioneering the power that matters.

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AIAA
SHAPING THE FUTURE OF AEROSPACE

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The American Institute of Aeronautics and Astronautics (AIAA) is the world's largest aerospace technical society. With nearly 30,000 individual members from 85 countries, and 95 corporate members, AIAA brings together industry, academia, and government to advance engineering and science in aviation, space, and defense. For more information, visit aiaa.org, or follow us on Twitter @AIAA.

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ITAR

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NUCLEAR AND FUTURE FLIGHT PROPULSION

Jim Cavera, Consultant

PRESSURE GAIN COMBUSTION

Greg Meholic, The Aerospace Corporation

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Venke Sankaran, Air Force Research Laboratory

PROPULSION AND POWER OF UNMANNED AERIAL SYSTEMS

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Robert A. Frederick Jr., University of Alabama in Huntsville

SOLAR AND BEAMED ENERGY SAIL CONCEPTS AND MISSIONS

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Kandyce Goodliff, NASA Langley Research Center

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SPACE TRANSPORTATION

Brian Pomeroy, Sierra Nevada Corporation

Pier Roviera, Virgin Orbit

SPACE SOLAR POWER

Giang Lam, Lockheed Martin Corporation

SPACE SYSTEMS

Patrick Chai, NASA Langley Research Center

John Bloomer, Raytheon Space & Airborne Systems

THERMAL MANAGEMENT TECHNOLOGY

Michael Choi, NASA Goddard Space Flight Center

STUDENT PAPER COMPETITIONS:

Ann Delleur, NASA Glenn Research Center

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WELCOME TO

PROPULSION ENERGY FORUM

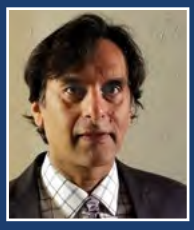
The 2019 AIAA Propulsion and Energy Forum Executive Steering Committee welcomes you to Indianapolis! We have worked hard this past year curating exciting and thought-provoking content around the forum theme, **Powering a Changing World**.

We hope these industry leaders, topics, and discussions inspire you.

Make it a great week!

EXECUTIVE STEERING COMMITTEE

2019 AIAA Propulsion and Energy Forum



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Rolls-Royce Corporation
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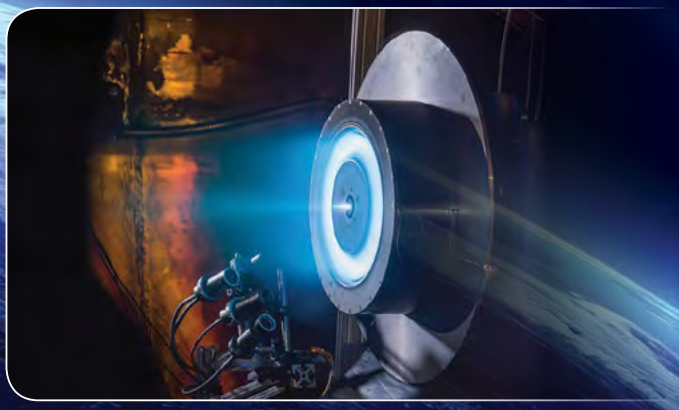
From returning humans to the Moon, to sending Americans to Mars, **Aerojet Rocketdyne** will be there every step of the way, just as we were on Apollo.



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FORUM OVERVIEW

	SAT./SUN. 17–18		MONDAY 19	TUESDAY 20
0730 hrs			Speaker Briefing	Speaker Briefing
0800 hrs	Continuing Education Courses and Workshops *Saturday and Sunday*		Plenary	Plenary
0830 hrs				
0900 hrs			Networking Break	Networking Break
0930 hrs			Forum 360 / Technical Sessions	Forum 360 / Technical Sessions
1000 hrs				
1030 hrs				
1100 hrs				
1130 hrs				
1200 hrs			Networking Lunch on Own	Networking Lunch on Own / Rising Leaders In Aerospace Lunch & Learn
1230 hrs				
1300 hrs				Exposition Hall Open
1330 hrs			Technical Sessions	Forum 360 / Technical Sessions
1400 hrs			Forum 360	
1430 hrs				
1500 hrs				
1530 hrs				
1600 hrs		Meet the Employers *1600-1800 hrs Sunday*	Networking Break	Networking Break
1630 hrs			Pickering Lecture	von Kármán Lecture in Astronautics
1700 hrs				
1730 hrs				
1800 hrs		Student Welcome Mixer *1800-1930 hrs Sunday*	Rising Leaders In Aerospace Networking Reception	Reception in the Exposition Hall *(Purchase Required)*
1830 hrs				
1900 hrs				
1930 hrs				
2000 hrs				

GROW Technical Career Development

CONNECT Networking

EXPLORE the HUB & Exposition

DISCOVER High Level

DEVELOPMENT Student & Young Professionals

FORUM OVERVIEW

	WEDNESDAY 21	THURSDAY 22	FRIDAY 23	SATURDAY 24
0730 hrs	Speaker Briefing	Speaker Briefing		
0800 hrs	Plenary	Plenary	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*
0830 hrs				
0900 hrs	Networking Break in Exposition Hall	Networking Break in Exposition Hall		
0930 hrs	Meet the Technical Committees; Forum 360; Technical Sessions; Exposition Hall Open	Forum 360; Technical Sessions; Exposition Hall Open		
1000 hrs				
1030 hrs				
1100 hrs				
1130 hrs				
1200 hrs	Networking Lunch on Own; Exposition Hall Open	Boxed Luncheon in Exposition Hall *(Purchase Required)*; Exposition Hall Open		
1230 hrs	Excellence in Aerospace Awards Luncheon *(Proof of purchase required)*; Exposition Hall Open	Exposition Hall Open		
1300 hrs	Exposition Hall Open	Deep Space Talk Show; Exposition Hall Open		
1330 hrs	Exposition Hall Open	Exposition Hall Open		
1400 hrs	Forum 360; Technical Sessions; Exposition Hall Open	Technical Sessions; Exposition Hall Open		
1430 hrs	Forum 360; Technical Sessions; Exposition Hall Open	Technical Sessions; Exposition Hall Open		
1500 hrs	Forum 360; Technical Sessions; Exposition Hall Open	Technical Sessions; AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1530 hrs	Forum 360; Technical Sessions; Exposition Hall Open	Technical Sessions; AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1600 hrs	Forum 360; Technical Sessions; Networking Break	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1630 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1700 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1730 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1800 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1830 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1900 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
1930 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		
2000 hrs	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*	AIAA/IEEE Electric Aircraft Technologies Symposium *(Separate Registration Required)*		

GROW Technical Career Development

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PRE-FORUM ACTIVITIES

CONTINUING EDUCATION OFFERINGS

Stay at the top of your game with AIAA's continuing education offerings. You will leave with invaluable knowledge and solutions that you can put to immediate use.

SAT. 17 – SUN. 18 AUGUST

0800–1700 HRS **ROOM 102**

Applied Model-Based Systems Engineering

This two-day course provides a broad overview of the processes, practices, tools, and techniques that comprise the emerging discipline of model-based systems engineering (MBSE) with a greater focus on application for the user and practitioner.

0800–1700 HRS **ROOM 103**

Hypersonic Air-Breathing Propulsion: Emerging Technologies and Cycles

Emerging HAP cycles include the Japanese ATREX engine (Air Turbo Ramjet Engine with eXpander cycle) and the air-breathing rocket engine, which rely on pre-cooling the air with heat exchangers. Additional emerging cycles include pressure gain cycles (Pulse Detonation Engines and Rotating Detonation Engines), Mass Injection Pre-Combustion Cooling (MIPCC), Oxy-Boost, and turbo-ramjets. This course is designed to explore these cycles and bring a theoretical understanding of how to apply them and what performance advantages they might have.

0800–1700 HRS **ROOM 104**

Missile Propulsion

This course provides a system-level, integrated approach for missile propulsion design, development, and system engineering. The methods presented are generally simple closed-form analytical expressions that are physics-based to provide insight into the primary driving parameters.

SUNDAY 18 AUGUST

1600-1800 HRS **WHITE RIVER BALLROOM AB**

Meet the Employers

This event offers students and young professionals the opportunity to meet AIAA corporate members and government agency representatives. This is a fun and dynamic environment where students and professionals interact with organizations regarding employment opportunities. Participating companies/organizations will present a brief organizational overview and opportunities available, then have follow-on discussions with the attendees. Organizations will host a table and attendees will switch every 10 minutes. All attendees are welcome; no registration required.

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1800–1930 HRS **WHITE RIVER BALLROOM G**

Student Welcome Mixer

Mingle with your peers and hear from AIAA leadership! This networking event provides you with the opportunity to meet your fellow students and learn more about the opportunities available to you as an AIAA student member. *Proof of student registration is required. Appetizers will be provided, and a cash bar will be available.*

Sponsor: LOCKHEED MARTIN

PLENARY & FORUM 360 SESSIONS

MONDAY, 19 AUGUST

0800–0900 HRS JW GRAND BALLROOM 5

Pioneering the Power that Matters

KEYNOTE: Phil Burkholder, President, Defense Programs, Rolls-Royce Corporation

FORUM 360°

0930–1200 HRS JW GRAND BALLROOM 3-4

Human Exploration Launch Systems

PART I: SLS OVERVIEW (0930–1045 hrs)

MODERATOR: Douglas Cooke, Aerospace Consultant, Cooke Concepts and Solutions, and former Associate Administrator, Exploration Systems Mission Directorate, NASA (ret.)

PANELISTS:
Robert L. Broeren, SLS Propulsion, The Boeing Company

Jeff Foote, Vice President, NASA Programs, Northrop Grumman Innovation Systems

W. Michael Hawes, Vice President, Human Space Exploration, and Orion Program Manager, Lockheed Martin Space

Jim Maser, Senior Vice President, Space Business Unit, Aerojet Rocketdyne

PART II: COMMERCIAL HUMAN SPACEFLIGHT (1045–1200 hrs)

MODERATOR: Kelvin Coleman, Deputy Associate Administrator, Commercial Space Transportation, FAA

PANELISTS:
Christopher Allison, Senior Systems Engineer, Sierra Nevada Corporation

Hans Koenigsmann, Vice President, Build and Flight Reliability, SpaceX

Peter McGrath, Director, Global Sales and Marketing, Boeing Human Space Exploration

FORUM 360°

1400–1600 HRS JW GRAND BALLROOM 3-4

Lunar, Martian and Deep Space Exploration: Electric Propulsion and System Application

MODERATOR: Daniel Herman, Power and Propulsion Element Ion Propulsion System Lead, Electric Propulsion Systems Branch, NASA Glenn Research Center

PANELISTS:
Joseph Cassady, Executive Director, Space, Aerojet Rocketdyne

Franklin Chang Diaz, CEO and Board Chairman, Ad Astra Rocket Company

Ty Lee, Lead, Power and Propulsion Element Systems Engineering, Maxar Space Solutions

TUESDAY, 20 AUGUST

0800–0900 HRS JW GRAND BALLROOM 5

Partnering Advances in Aerospace

OPENING REMARKS: The Honorable Eric Holcomb, Governor, Indiana

PLENARY SPEAKERS:
Mung Chiang, Dean of Engineering, Purdue University

Kathleen Howell, Hsu Lo Distinguished Professor of Aeronautics and Astronautics, Purdue University

David Spencer, Director, Space Flight Projects Laboratory, and Associate Professor, School of Aeronautics and Astronautics, Purdue University

FORUM 360°

0930–1200 HRS JW GRAND BALLROOM 3-4

Propulsion Efficiency: Engine Optimization and MRO Advancements

PART I: TURBINE AND COMBUSTION EFFICIENCY TRENDS (0930–1045 hrs)

MODERATOR: Kenneth Suder, Senior Technologist, Airbreathing Propulsion, Propulsion Division, Research and Engineering Directorate, NASA Glenn Research Center

PANELISTS:
William "Bill" Cummings, Chief, Combustor and Turbine Aero, Rolls-Royce Corporation

Sunil James, Senior Technical Manager, Propulsion Technologies, Honeywell Aerospace

Irewole "Wally" Orisamolu, Associate Director, Advanced Propulsion Technologies, Pratt & Whitney

Carlos Perez, Advanced Systems Design & Technology Lead, GE Aviation

PART II: FLEET REPLENISHMENT, MODERNIZATION AND MRO MOVEMENTS (1045–1200 hrs)

MODERATOR: Marc Meredith, Executive Director, Global MRO Network and Cost Management, Pratt & Whitney

FORUM 360°

1330–1600 HRS JW GRAND BALLROOM 3-4

Next Steps in Supersonic and Hypersonic Propulsion: Platforms and Applications

PART I: HYPERSONIC PROPULSION ADVANCEMENTS (1330–1445 hrs)

MODERATOR: Steven Sinacore, Deputy Project Manager, Hypersonic Technology Project, Aeronautics Research Mission Directorate, NASA

PANELISTS:
Robert Bakos, Principal and Co-Founder, Innoveering, LLC

Glenn Case, Founder and Chief Technology Officer, Hermeus

PLENARY & FORUM 360 SESSIONS

Adam Dissel, President, Reaction Engines Inc.

J. Brent Staubach, Manager and Chief, Systems Optimization, Pratt & Whitney

PART II: COMMERCIAL SUPERSONIC PROPULSION ADVANCEMENTS (1445–1600 hrs)

MODERATOR: Peter Coen, Low Boom Flight Demonstration Mission Manager, Aeronautics Research Mission Directorate, NASA

PANELISTS:
Irewole "Wally" Orisamolu, Associate Director, Advanced Propulsion Technologies, Pratt & Whitney

Carlos Perez, Advanced Systems Design & Technology Lead, GE Aviation

Donald Scata, Noise Division Manager, Office of Environment and Energy, FAA

Jonathan A. Seidel, Chief Engineer, Propulsion Systems Analysis Branch, NASA Glenn Research Center

PJ Steffen, Chief, Future Projects Engineer, Rolls-Royce Corporation

WEDNESDAY, 21 AUGUST

0800–0900 HRS JW GRAND BALLROOM 5

Optimizing the U.S. Air Force's Operational Energy Use Through 21st-Century Tools and Technologies

KEYNOTE: Roberto Guerrero, Deputy Assistant Secretary of the Air Force for Operational Energy, Office of the Assistant Secretary of the Air Force for Installations, Environment and Energy

FORUM 360° 0930–1130 HRS JW GRAND BALLROOM 3-4

Rising to the Challenge of America's Workforce Needs

MODERATOR: Lisa Teague, Head, Research and Technology, Rolls-Royce Corporation

OPENING REMARKS: Carla Sands, Program Manager, Workforce, Aviation Week Network

PANELISTS:
David L. Dimmett, Senior Vice President and Chief Engagement Officer, Project Lead The Way

Shaun Humes, Senior Manager, Program Management, Collins Aerospace

Teresa Lubbers, Commissioner, Indiana Commission for Higher Education

Gerry McCartney, Executive Vice President, Purdue Online

Carla Sands, Program Manager, Workforce, Aviation Week Network

FORUM 360° 1400–1630 HRS JW GRAND BALLROOM 3-4

Challenges and Opportunities in Continuing Advancement of Gas Turbine Technologies

PART I: FUNDING AGENCIES (1400–1515 hrs)

MODERATOR: Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

PANELISTS:
Robert Hancock, Principal Scientist, Turbine Engine Division, Air Force Research Laboratory

Steven Martens, Program Officer, Power, Propulsion and Thermal Management, Office of Naval Research

Simon Weeks, Chief Technology Officer, Aerospace Technologies Institute

PART II: OEMS (1515–1630 hrs)

MODERATOR: Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

PANELISTS:
Eric Ducharme, Chief Engineer and General Manager, GE Aviation

Mark Wilson, Chief Operating Officer, Rolls-Royce LibertyWorks

Michael Winter, Senior Fellow, Advanced Technology, Pratt & Whitney

THURSDAY, 22 AUGUST

0800–0900 HRS JW GRAND BALLROOM 5

Toward Sustainable Aviation

KEYNOTE: Alan Newby, Director, Aerospace Technology and Future Programmes, Rolls-Royce Corporation

FORUM 360° 0930–1130 HRS JW GRAND BALLROOM 3-4

Electrified Aircraft Propulsion Technologies – Air Taxis to Airliners

MODERATOR: Marty Bradley, Technical Fellow, The Boeing Company

PANELISTS:
Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

Andrew Gibson, President, Empirical Systems Aerospace, Inc.

Hao Huang, Technology Chief, Electrical Power, GE Aviation

John Nairus, Chief Engineer, Power & Control Division, Air Force Research Laboratory

Join the Q&A at aiaa.cnf.io

RISING LEADERS IN AEROSPACE

This multidimensional program, planned by the Young Professionals Group, features sessions with the 35-and-under crowd in mind. These exciting and energetic activities will provide access to top aerospace leaders and their perspectives, with subject matter relevant to your career. Participating in this program will allow you the opportunity to build your network of fellow peers.

MONDAY, 19 AUGUST

1800–1930 HRS **THIRD FLOOR PRE-FUNCTION**

Networking Reception

Come unwind and network with other young professionals who are also attending the forum.

TUESDAY, 20 AUGUST

1200-1330 HRS **JW GRAND BALLROOM 2**

Lunch and Learn: Beyond Apollo: Looking Forward to the Next Moon Landing

Shamim Rahman, Orion to SLS Integration Lead, NASA; Co-Editor, *Remembering the Giants—Apollo Rocket Propulsion Development*

Dave McGrath, Director of Advanced Technology, Northrop Grumman Innovation Systems; Expert on Saturn V Propulsion

Michael Smith, Professor of History, Purdue University; Author, *Rockets and Revolution*

The 50th anniversary of the Apollo 11 moon landing reminds us of the legacy of the U.S. space program, the progress we have made in establishing a human presence in space, and the steps we still have to take to return to the moon and reach Mars. Today's aerospace industry provides young professionals with a unique opportunity in history to contribute to the next big leap in space

WEDNESDAY, 21 AUGUST

0930-1030 HRS **THE HUB- EXPOSITION HALL**

Meet the AIAA Technical Committees

Come and go at this interactive session with some of AIAA's Technical Committee members. Learn what they are currently working on, when they meet, and how you can contribute as a Young Professional if you choose to join.

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SPECIAL PROGRAMMING

THURSDAY 22 AUGUST

1300-1400 HRS **JW GRAND BALLROOM 5**

Deep Space Talk Show

It has been forty years since humans traveled in deep space. Did you know right now NASA is building the rocket and spacecraft that will return humans to the moon and help us explore exciting new deep space destinations? If you want to learn more about America's new Space Launch System and Orion spacecraft—which will take us farther into space than we have ever been—don't miss this forum with NASA and industry leaders.

SPEAKERS:

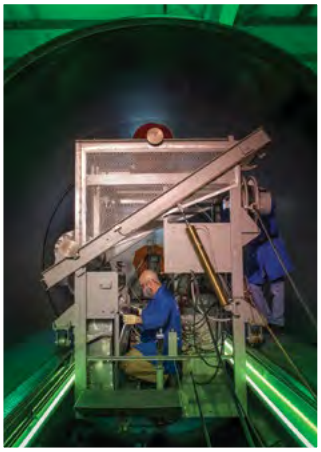
Joseph Cassady, Executive Director, Space, Aerojet Rocketdyne

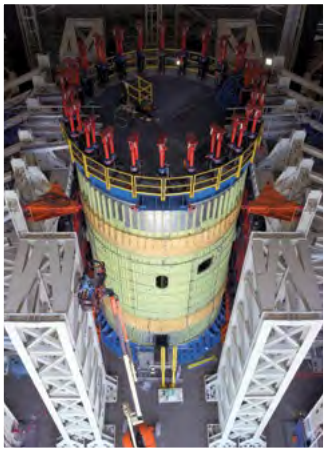
Tony Gilliland, Aerospace Programs Manager, Major Tool & Machine

Marcia Lindstrom, Strategic Communications Manager, NASA Marshall Space Flight Center

Carolyn Overmyer, Orion Service Module Integrated Product Team Manager, Lockheed Martin Space

Don Thomas, Former Astronaut, NASA





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ITAR SESSIONS

AIAA offers authors the opportunity to present information that is covered by the U.S. International Traffic in Arms Regulations (ITAR), in U.S.-Only sessions during the forum. These sessions provide an opportunity for discussion of topics and presentations that is not possible in an open forum.

If you want to attend any of these special sessions, you will need to complete an additional registration and verification process. In addition to a forum registration that includes access to sessions, a separate registration process is required to attend these restricted sessions. To register, please bring the required documentation with you to the on-site ITAR registration desk: most important is proof of U.S. citizenship. (Please note that a CAC card IS NOT official proof of U.S. citizenship.) See the specific requirements below to determine individual requirements.

Access to ITAR Sessions

All attendees, presenters, and session chairs participating in ITAR sessions will need to register for the forum (using one of the options that includes access to sessions), and then complete the ITAR registration process, including validating U.S. citizenship as well as government employment or contractor status. The following are the documents required to register for the ITAR sessions:

EVERYONE MUST HAVE:

Valid U.S. passport
or
Birth certificate
or
Certificate of citizenship
CAC Cards, Military ID, Driver's License, state ID are not Proof of U.S. Citizenship

AND

U.S. Government Attendees*
AIAA forum badge
CAC card or other proof of government employment

Non-U.S. Government Attendees
AIAA forum badge
Corporate badge, or business card and photo ID
Copy of approved and active **DD2345** contractor certificate** ^

Students
There are additional requirements needed from your University Security Officer — please visit the ITAR Registration Desk for more details.

**Please note that if your paycheck comes from someone other than the U.S. government, for example, a university, you will need to follow the process of the non-U.S. Government Attendees.*

*** If you are not familiar with the DD2345, please check with your Corporate Security Officer.*

^DD2345 certificates are office location specific.

All ITAR sessions will be located in room 209.

TUESDAY, 20 AUGUST

0930–1200 HRS	**ITAR-01**	**In-Space Propulsion**
1330–1500 HRS	**ITAR-02**	**Propellants and Combustion**

WEDNESDAY, 21 AUGUST

0930–1130 HRS	**ITAR-03**	**Hypersonics**
1400–1600 HRS	**ITAR-04**	**Scramjet School**

THURSDAY, 22 AUGUST

0930–1130 HRS	**ITAR-05**	**Advanced Intelligent Controls II**

ITAR Registration Hours:

Sunday, 18 August	1600–1900 hrs	Registration Area
Monday, 19 August	0900–1700 hrs	Registration Area
Tuesday, 20 August	0900–1730 hrs	Room 209
Wednesday, 21 August	0900–1630 hrs	Room 209
Thursday, 22 August	0900–1130 hrs	Room 209

ITAR badges must be worn during the sessions.

Photo IDs and ITAR badges will be checked upon entrance to the ITAR session room(s).

ITAR Electronics Policy

Cell phones, computers, tablets, cameras, personal fitness devices, or other electronic devices with cameras, recording, or two-way transmission capabilities will not be permitted into the ITAR session room(s). There will be a check-in desk in front of the room where you can check these devices. Large briefcases and bags will also need to be checked at the desk.

Availability of Manuscripts from ITAR Sessions

For those who are registered to attend the ITAR sessions, a DVD containing the papers from the ITAR sessions will be available for purchase on site at the forum for $25. Those purchasing the DVD must be available to pick it up on Thursday, 22 August 2019, between 1000-1130 hrs at the ITAR Registration Desk. All DVDs must be picked up in person. There will be no sale or distribution of these papers after the event. Note this forum has a "no paper, no podium" and "no podium, no paper" policy and it is therefore not possible to get all papers until after the last presentation has occurred.

Please be advised that all policies and procedures MUST be followed or admittance to the restricted sessions will not be permitted. Anyone wishing to enter the restricted session room MUST abide by the policies, procedures, and submission of verified documents mandated by the DoD. No Exceptions!

RECOGNITION

Join us at the 2019 AIAA Propulsion and Energy Forum as we recognize the very best in our industry – those individuals and teams who have taken aerospace technology and discovery to the next level. These remarkable individuals have leveraged their expertise for the benefit of society. Their achievements have inspired us to dream and to explore new frontiers.

MONDAY, 19 AUGUST

1630–1730 HRS JW BALLROOM 5

Pickering Lecture

Rocketing to the Future: Space Electric Propulsion

The Pickering Lecture will describe this extraordinary space propulsion technology and how Dawn and other missions take advantage of it to accomplish amazing interplanetary adventures.

John Brophy, Expert in Space Electric Propulsion, JPL Fellow

Marc Rayman, Dawn Mission Director, JPL Chief Engineer for Operations and Science, JPL Fellow

TUESDAY, 20 AUGUST

1630–1730 HRS JW GRAND BALLROOM 5

von Kármán Lecture in Astronautics

Salvatore T. "Tory" Bruno, President and Chief Executive Officer, United Launch Alliance

"Vision for CisLunar Economy"

WEDNESDAY, 21 AUGUST

1230–1400 HRS JW GRAND BALLROOM 5

Excellence in Aerospace Awards Luncheon*

Each year, the dedicated members of our technical and outreach committees come together to identify and elevate the best and the brightest practitioners in their field. Join us as we celebrate the excellence of the aspiring, innovating and inspiring members of our aerospace community.

**A ticket for the luncheon is required and can be selected during the registration process. Additional tickets may be purchased on-site if space is available.*

TECHNICAL EXCELLENCE AWARDS

2019 AIAA Space Automation and Robotics Award

Orbital Express Team

DARPA

Received by: Dr. Fred Kennedy, DARPA

In recognition of Orbital Express's pioneering work in demonstrating autonomous orbital robotics, including these firsts: autonomous robotic grapple, robotic ORU changeout, and robotic fluid transfer in space.

2019 AIAA Space Systems Award
Jess M. Sponable, XS-1 Program Manager, DARPA

For unique and extraordinary leadership in providing the pathway for the evolution of the United States military launch capability toward robust and affordable reusable space systems.

2019 AIAA von Braun Award for Excellence in Space Program Management
Christopher M. Crumbly, Executive Director, von Braun Center for Science and Innovation
For sustained excellence in furthering human spaceflight through strategic planning, managing several NASA projects, and leading key programs within the Space Launch System.

2019 AIAA Aerospace Power Systems Award
Judith A. Jeevarajan, Senior Scientist, NASA Johnson Space Center
In recognition of significant contributions to the design, development, and test of safe and reliable battery energy storage power systems for aerospace applications.

2019 AIAA Air Breathing Propulsion Award
Karen A. Thole, Professor and Department Head, Mechanical and Nuclear Engineering, Pennsylvania State University
For significant technical contributions to the understanding of convective heat transfer in gas turbine engines, and continuing efforts to promote participation of underrepresented groups in aerospace.

2019 AIAA Energy Systems Award
Arun Majumdar, Director, Precourt Institute for Energy, and Jay Precourt Professor of Mechanical Engineering and of Photon Science, Stanford University
For superior contributions to the science and engineering of nanoscale energy-conversion materials and devices and outstanding energy-related service at the highest administrative levels.

2019 AIAA Wyld Propulsion Award
Stanley K. Borowski, Senior Aerospace Research Engineer, NASA Glenn Research Center (retired)
For sustained outstanding contributions in advanced propulsion, including the development and application of nuclear thermal propulsion for future human lunar and Mars exploration missions.

2019 AIAA Engineer of the Year
Timothy Dominick, Senior Principal Mechanical Engineer, Northrop Grumman Innovation Systems
For successful development and implementation of a novel structural insulator material, JT-700, into multiple controllable solids propulsion systems with potential applications across the aerospace industry.

RECOGNITION

SERVICE AWARDS

2019 Sustained Service Award
Marty K. Bradley, Technical Fellow, Boeing Commercial Airplanes

For sustained, significant service at the national level with emphasis on Technical and Program/Integration Committee leadership, including formation of new committees.

2019 Sustained Service Award
Timothy Dominick, Senior Principal Mechanical Engineer, Northrop Grumman Innovation Systems

For sustained AIAA leadership at the section, region, and national committee levels attested by service to the Delaware Section and Public Policy Committee.

BEST PAPERS

Best Papers are voted to be the latest, most significant research by AIAA technical peers. We will recognize the following:

2018 ASME Propulsion Best Paper "Additive Manufacturing of Liquid Rocket Engine Combustion Devices: A Summary of Process Developments and Hot-Fire Testing Results" (AIAA 2018-4625), Paul Gradl, Sandy E. Greene, Christopher Protz, Brad Bullard, James Buzzell, Chance Garcia, Jessica Wood, and Kenneth Cooper, NASA Marshall Space Flight Center; James Hulka, Jacobs Technology, Inc.; and Robin Osborne, ERC Incorporated

2018 AIAA Aerospace Power Systems Best Papers

- "An Intelligent Autonomous Power Controller for the NASA Human Deep Space Gateway" (AIAA-4634), Jeffrey Csank, James Soeder, Jeffrey Follo, Matthew Muscatello, Yu Hin Hau and Marc Carbone, NASA Glenn Research Center
- "The Kilopower Reactor Using Stirling TechnologY (KRUSTY) Nuclear Ground Test Results and Lessons Learned" (AIAA 2018-4973), Marc A. Gibson, James Sanzi and Maxwell H. Briggs, NASA Glenn Research Center; David I. Poston and Patrick McClure – Los Alamos National Laboratory; and Thomas Godfroy, Vantage Partners, LLC

2018 AIAA Aerospace Power Systems Best Student Paper "The SPACE Computer Code for Analyzing the International Space Station Electrical Power System: Past, Present, and Future" (AIAA 2018-4635), Sara G. Miller, Brandon T. Klefman, Steven Korn, Terrian Nowden, Ann M. Delleur and David McKissock, NASA Glenn Research Center

2018 AIAA Electric Propulsion Best Paper "In-Flight Verification and Validation of Colloid Microthruster Performance" (AIAA 2018-4643), John Ziemer, Colleen Marrese-Reading, Curt Cutler, Charles Dunn, Andrew Romero-Wolf, Shahram Javinda, Thanh Le, Irena Li, Phil Barela, NASA Jet Propulsion Laboratory, California Institute of Technology; Nathaniel Demmons, Vlad Hruby, Busek Company, Inc.; Jacob Slutsky, James Ira Thorpe, Peiman Maghami, Oscar Hsu, James O'Donnell, NASA Goddard Space Flight Center

2018 AIAA Gas Turbine Engine Best Paper "Active Turbine Tip Clearance Control Trade Space Analysis of an Advanced Geared Turbofan Engine" (AIAA 2018-4822), Jonathan L. Kratz and Jeffreys W. Chapman, NASA Glenn Research Center

2018 AIAA High Speed Air-Breathing Propulsion Best Paper "Sustained Combustion Limits of a Central Dump Solid Fuel Ramjet Combustor at High Altitude Operational Conditions" (AIAA 2018-4449), Ronald G. Veraar and Wolter Wieling, TNO Defence Security and Safety

2018 AIAA Hybrid Rockets Best Paper "Investigation of Graphite Nozzle Erosion in Hybrid Rockets Using O2/C2H4" (AIAA 2018-4531), Landon T. Kamps, Shota Hirai, Kazuhito Sakurai, and Tor Viscor, Hokkaido University; Yuji Saito, Tokoku University; Raymond Guan, University of Alberta; Hikaru Isochi and Naoto Adachi, Uematsu Electric Co.; Mitsunori Itoh, IHI Corporation; and Harunori Nagata, Hokkaido University

2018 AIAA Hybrid Rockets Best Student Paper "Hypergolic Ignition and Relights of a Paraffin-based Hybrid Grain" (AIAA 2018-4661), Alicia Benhidjeb-Carayon, Jason Gabl and Timothee L. Pourpoint, Purdue University

2018 AIAA Liquid Propulsion Best Paper "Computational Analysis of Supercritical and Transcritical Flow in Cooling Channels with Rough Surface" (AIAA 2018-4465), Hideyo Negishi, Yu Daimon and Hideto Kawashima, Japan Aerospace Exploration Agency

2018 AIAA Nuclear and Future Flight Propulsion Best Paper "Consideration of Low Enriched Uranium Space Reactors" (AIAA 2018-4673), David L. Black, Westinghouse Electric Corporation (retired)

2018 AIAA Pressure Gain Combustion Best Paper "Characterization of Detonation Wave Propagation in a Rotating Detonation Rocket Engine using Direct High-Speed Imaging" (AIAA 2018–4688) John W. Bennewitz and Blaine R. Bigler, ERC, Inc.; William A. Hargus and Stephen A. Danczyk, Air Force Research Laboratory; and Richard D. Smith, GHKN Engineering, LLC

2018 AIAA Propellants and Combustion Best Paper "Complete Determination of the Velocity Gradient Tensor upstream of the Flame Front with High-Speed Tomo-PIV/Dual-Plane-PIV/OH-PLIF Measurements" (AIAA 2018–0153), Tongxun Yi, Christopher A. Fugger, Naibo Jiang, Josef Felver, Mikhail N. Slipchenko, and Sukesh Roy, Spectral Energies, LLC; Travis Smith, Jamie Lim, Matthew Sirignano, Benjamin L. Emerson, and Tim C. Lieuwen, Georgia Institute of Technology; and Benjamin R. Halls and James R. Gord, Air Force Research Laboratory

2018 AIAA Space Architecture Best Paper "Recommendations for Next Generation Crew Quarters" (ICES 2018-106), Brandon W. Maryatt, NASA Johnson Space Center; Michael J. Van Wie, KBRwyle; and Toni A. Clark, Leidos, Inc.

2018 AIAA Space Architecture Best Student Paper "MARSH: Multi-Mission Artificial-Gravity Reusable Space Habitat" (AIAA 2018-5100), Dale Martin, Melissa Adams, Spencer Aman, Derek Bierly, Andrew Delmont, Caleb Fricke, Simon Hochmuth, Nicholas Levitsky, Neel Patel, Aseel Syed, Skylar Trythall, Peter Wight and David L. Akin, University of Maryland, College Park

2018 AIAA Solid Rockets Best Paper "An analytical model for acoustic induced heat release disturbances from aluminum combustion in solid rocket motors" (AIAA 2018-4788), Aurélien Genot CNES DLA; Stany Gallier, ArianeGroup; Thierry Schuller, Laboratoire EM2C

2018 AIAA Solid Rockets Best Student Paper "Overview of a Supersonic Probe for Solid Propellant Rocket CCP Collection" (AIAA 2018-4882), Stefania Carlotti, Filippo Maggi, Riccardo Bisin, Stefano Dossi and Luciano Galfetti, Politecnico di Milano; Dominik Saile and Ali Gülhan, German Aerospace Center; and Christopher Groll and Tobias Langener, European Space Agency

2019 AIAA Terrestrial Energy Systems Best Paper "Impact of alternative fuel on gas turbine noise, vibration and instability" (AIAA 2019-0240), Charith J. Wijesinghe and Bhupendra Khandelwal, University of Sheffield

NETWORKING EVENTS

Understanding the importance of networking with colleagues new and old, a series of activities have been planned that will help you connect with current colleagues and new acquaintances.

SUNDAY, 18 AUGUST

1800–1930 HRS **WHITE RIVER BALLROOM G**

Student Welcome Mixer

Mingle with your peers and hear from AIAA leadership! This networking event provides you with the opportunity to meet your fellow students and learn more about the opportunities available to you as an AIAA student member. *Proof of student registration is required. Appetizers will be provided, and a cash bar will be available.*

Sponsor: LOCKHEED MARTIN

TUESDAY, 20 AUGUST

1800–1930 HRS **EXPOSITION HALL, JW BALLROOM 6**

Welcome Reception in the Exposition Hall

(Proof of Purchase Required)

Discuss the day's events and talk with exhibitors over drinks and light fare in the Exposition Hall.

THURSDAY, 22 AUGUST

1200–1330 HRS **EXPOSITION HALL, JW BALLROOM 6**

Luncheon in the Exposition Hall

(Proof of Purchase Required)

Meet with dozens of companies and network with fellow attendees over lunch in the Exposition Hall.

Coffee Breaks

Networking coffee breaks allow even more time for making new contacts, continuing discussions from sessions, visiting the Exposition Hall, or checking emails and voicemails to keep in touch with the office while you are at the forum. Networking coffee breaks will be held at the following locations and times:

Monday, 19 August	0900–0930 hrs | JW Grand Ballroom Pre-Function
	1600–1630 hrs | JW Grand Ballroom Pre-Function
Tuesday, 20 August	0900–0930 hrs | JW Grand Ballroom Pre-Function
	1600–1630 hrs | Exposition Hall
Wednesday, 21 August	0900–0930 hrs | Exposition Hall
	1600–1630 hrs | Exposition Hall
Wednesday coffee break sponsor:	BASTION TECHNOLOGIES
Thursday, 22 August	0900–0930 hrs | Exposition Hall
	1600–1630 hrs | Exposition Hall

AIAA/IEEE ELECTRIC AIRCRAFT TECHNOLOGIES SYMPOSIUM (EATS)

22–24 AUGUST 2019 | INDIANAPOLIS, IN

Indiana Convention Center across the street from JW Marriott Indianapolis

Separate registration required

The aerospace industry has set ambitious goals for the next three generations of commercial transport aircraft to accommodate rapid growth in emerging markets and ensure sustainability of air travel. One approach being explored to meet these targets is non-traditional aircraft propulsion using electric, turboelectric or hybrid-electric powertrains. Recent workshops by the IEEE and AIAA have identified the need to bring together electrical engineers and aerospace experts as the industry looks to more electric propulsion technologies for future aircraft. The AIAA Aircraft Electric Propulsion and Power Working Group and the IEEE Transportation Electrification Community have organized this symposium to address these issues. The symposium technical program will focus on electric aircraft technology across three programmatic tracks:

1) Electric-power-enabled aircraft configurations and system requirements

2) Enabling technologies for electric aircraft propulsion

3) Electric aircraft system integration and controls

WEDNESDAY, 21 AUGUST

0800–1700 HRS **JW GRAND BALLROOM 1**

Aircraft Electrified Propulsion Systems and Component Design Course *(Separate Registration Required)*

Prior to the AIAA/IEEE Electric Aircraft Technologies Symposium (EATS), this eight-hour course will focus on the major components of electrified propulsion systems, which include batteries, thermal engines, generators, feeders, power electronics, motors, propulsion fans, propellers, cooling pumps and fans, cooling plumbing and ducting, heat pumps, and heat exchangers. Participants will learn component theory of operation and design considerations, methods for modeling or estimating component weight and performance, and approaches for system steady-state and dynamic performance analysis. To provide context, electrified aircraft and electrified propulsion architectures will be reviewed and potential benefits will be discussed, before the underlying component technologies are covered in detail.

THURSDAY, 22 AUGUST

0800–0900 HRS **JW GRAND BALLROOM 5**

Toward Sustainable Aviation

KEYNOTE: Alan Newby, Director, Aerospace Technology and Future Programmes, Rolls-Royce Corporation

FORUM 360°

0930–1130 HRS **JW GRAND BALLROOM 3-4**

Electrified Aircraft Propulsion Technologies – Air Taxis to Airliners

MODERATOR: Marty Bradley, Technical Fellow, The Boeing Company

PANELISTS:

Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

Andrew Gibson, President, Empirical Systems Aerospace, Inc.

Hao Huang, Technology Chief, Electrical Power, GE Aviation

John Nairus, Chief Engineer, Power & Control Division, Air Force Research Laboratory

1230–1330 HRS **Indiana Convention Center Room: 137-139**

Electric Aircraft Technologies Symposium Keynote

Speaker: Dr. Andreas Klöckner, Coordinator, Electric Flight, Programme Strategy Aeronautics, German Aerospace Center (DLR)

1330–1600 HRS **Indiana Convention Center Room: 134-136**

Technical Sessions I

Topic Area 1: Electrified Aircraft Systems Studies
Topic Area 2: Motor Power Electronics and Systems Fault Detection
Topic Area 3: Component Integration and System Architectures

AIAA/IEEE ELECTRIC AIRCRAFT TECHNOLOGIES SYMPOSIUM (EATS)

22–24 AUGUST 2019 | INDIANAPOLIS, IN

Indiana Convention Center across the street from JW Marriott Indianapolis

Separate registration required

1330–1630 HRS Indiana Convention Center Room: 137-139
Electric Propulsion: Challenges and Opportunities, A NASA Led Initiative

1600–1730 HRS Indiana Convention Center Room: 137-139
Safety, Standards, and Regulations for Electrified Aircraft

1800 hrs Punch Bowl Social Indianapolis
Reception hosted by the University of Illinois

FRIDAY, 23 AUGUST

0800–0900 HRS Indiana Convention Center Room: 137-139
Electric Aircraft Technologies Symposium Keynote

The Many Possible Futures of Electric Flight

Speaker: Paul Eremenko, Chief Technology Officer, United Technologies Corporation

0900–0930 HRS **Networking Break**

0930–1200 HRS Indiana Convention Center Room: 134-136
Technical Sessions II

Topic Area 1: Electrified Aircraft Design and Novel Concepts
Topic Area 2: Power Converters
Topic Area 2: Energy Storage Systems

1200–1300 HRS Indiana Convention Center Room: 137-139
Lunch

1300–1430 HRS Indiana Convention Center Room: 137-139
Electrified Propulsion Technologies for Emerging Small Aircraft Markets

1430–1500 HRS **Networking Break**

1500–1730 HRS Indiana Convention Center Room: 134-136
Technical Sessions III

Topic Area 2: Design and Test of Electric Motor Systems
Topic Area 2: Electromechanical Interactions and Modeling
Topic Area 3: System Optimization

SATURDAY, 24 AUGUST

0800–0900 HRS Indiana Convention Center Room: 137-139
Electric Aircraft Technologies Symposium Keynote

Speaker: Alexander Walan, Program Manager, Lightning Strike Program Tactical Technology Office (TTO), DARPA

0900–1130 HRS Indiana Convention Center Room: 134-136
Technical Sessions IV

Topic Area 1: Electrified Aircraft Subsystem Simulations and Methods
Topic Area 2: Superconducting Materials
Topic Area 3: Power Management Systems

1130–1300 HRS Indiana Convention Center Room: 137-139
Progress in Energy Storage & Conversion for Aeropropulsion

1300–1530 HRS Indiana Convention Center Room: 134-136
Technical Sessions V

Topic Area 1: Challenges and Opportunities in Electrified Aircraft Systems
Topic Area 2: Megawatt-Scale Motor Systems
Topic Area 2: Electric Motor Wire and Power Transmission Insulation

1530–1600 HRS **Closing Remarks**

EXPOSITION HALL

EXPOSITION HALL HOURS

TUESDAY, 20 AUGUST

1300–1630 HRS
1800–1930 HRS — RECEPTION*

WEDNESDAY, 21 AUGUST

0845–1630 HRS

THURSDAY, 22 AUGUST

0845–1330 HRS

**Proof of purchase is required and included in the registration fee where indicated.*

AIAA FOUNDATION
Advancing Aerospace

Please join our generous donors in advancing aerospace with your gift today. With your help, we will continue to inspire and support the next generation of aerospace professionals. Be sure to stop by the silent auction in the HUB as we have some really cool aerospace items up for bid!

AIAA Publications Pavilion within the HUB
Stop by the AIAA Publications Pavilion, located in the Exposition Hall, to browse publications and merchandise, learn about your membership benefits, and meet AIAA staff.

30% OFF ALL BOOKS

AIAA Publications is offering a special show discount on all titles featured at the AIAA Propulsion and Energy Forum. Attendees can take advantage of a 30% discount off the list price of all books for sale at the AIAA Bookstore located in the AIAA Pavilion. This show special will only be available during the forum! Take advantage of these super savings and visit the AIAA Bookstore!

Meet the Author

EUGENE FLEEMAN
Missile Design and System Engineering

Thursday, 22 August 1200-1330 hrs

the HUB

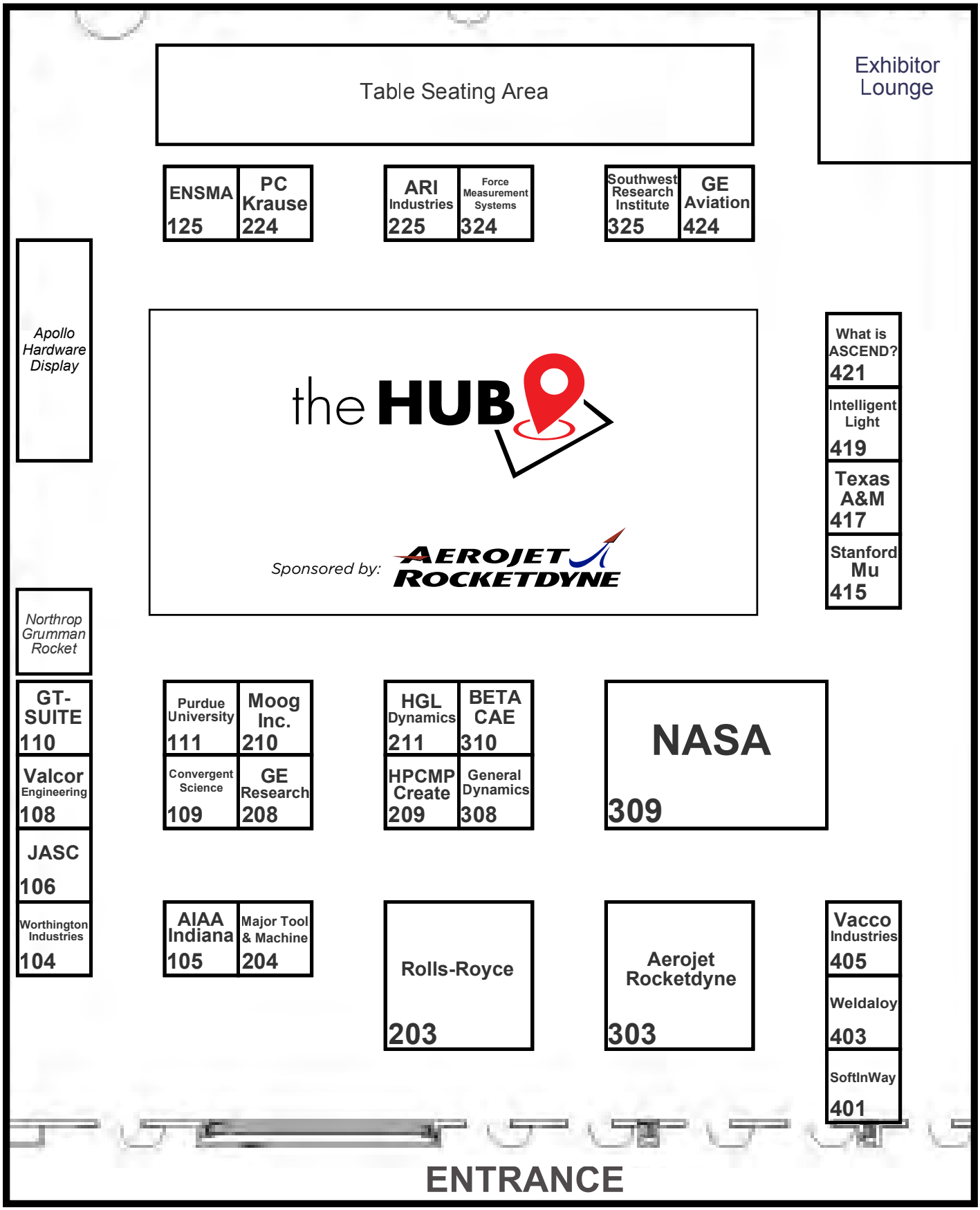
DAILY PRIZE DRAWINGS — VISIT THE HUB TO ENTER!

Visit the HUB in the Exposition Hall to drop your business card for a chance at **winning one of three gift cards!** Visit daily to enter as prize entry collection restarts each morning with an empty box. You must drop a business card each day to have a chance to win each day!

- Prize 1 drawing at 1900 hrs on Tuesday during reception in Exposition Hall.
- Prize 2 drawing at 1600 hrs on Wednesday.
- Prize 3 drawing at 1130 hrs on Thursday.

Please drop only one entry (business card) per day! Multiple entries will be removed. You do not need to be present to win, but you may claim your prize in the HUB while at the 2019 AIAA Propulsion and Energy Forum.

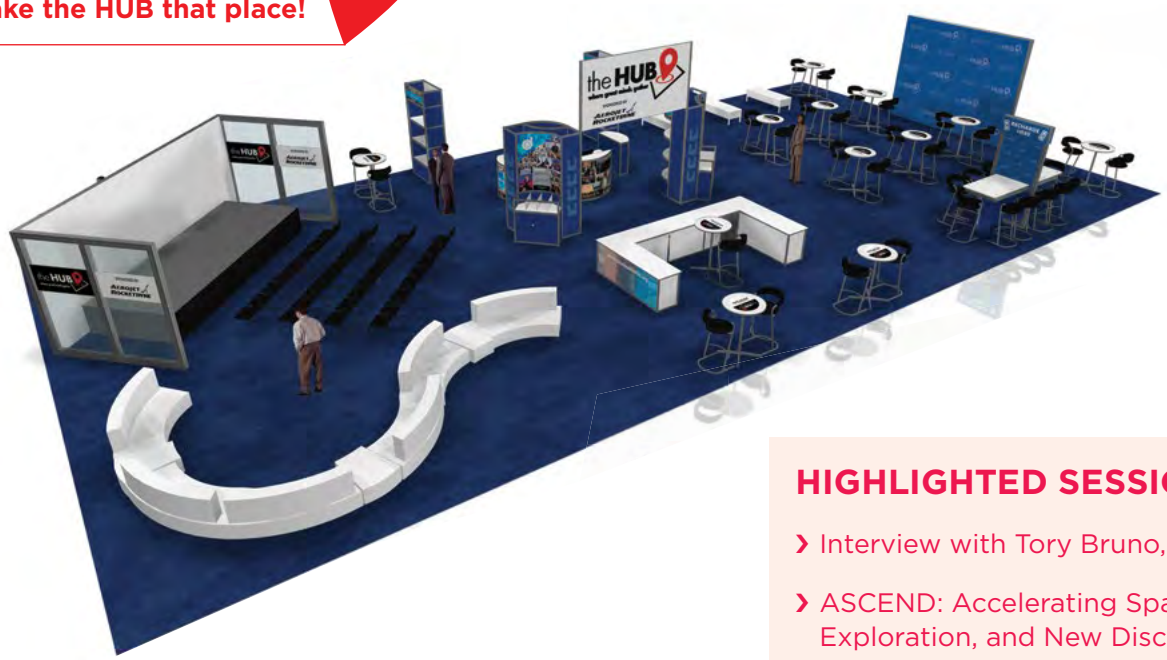
EXPOSITION HALL FLOOR PLAN



the HUB

where great minds gather

Need to identify a place to meet up with friends?
Make the HUB that place!



The HUB is open Tuesday–Thursday during Exposition Hall hours!

This multi-use area built into the heart of AIAA expositions will feature many attendee-favorite activities like Q&A with keynote speakers, innovative programming, a silent auction, contests, charging stations, a lounge area, and more.

Check out the complete schedule of activities:
aiaa.org/PropEnergyTheHub

HIGHLIGHTED SESSIONS

- Interview with Tory Bruno, CEO, ULA
- ASCEND: Accelerating Space Commerce, Exploration, and New Discovery
- Interview with Simon Weeks, CTO, Aerospace Technology Institute
- USC's Student Rocketry Success
- Q&A with Roberto Guerrero, Deputy Assistant Secretary of the Air Force for Operational Energy, Office of the Assistant Secretary of the Air Force for Installations, Environment and Energy
- Allison Engine's Apollo Lunar Excursion Module

Schedule subject to change.

Sponsored by:

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EXHIBITORS BY BOOTH NUMBER

303 Aerojet Rocketdyne ★

105 AIAA - Indiana Section

225 ARI Industries, Inc. ★

310 BETA CAE Systems USA, Inc.

109 Convergent Science

125 ENSMA - INSTITUT Pprime

324 Force Measurement Systems Inc. ★

424 GE Aviation ★

208 GE Research

308 General Dynamics Ordinance and Tactical Systems

110 GT-SUITE System Simulation

211 HGL Dynamics, Inc

209 HPCMP CREATE

419 Intelligent Light ★

106 JASC

204 Major Tool & Machine

210 Moog Inc. ★

309 NASA

224 PC Krause and Associates, Inc.

111 Purdue University

203 Rolls-Royce ★

401 SoftInWay Inc.

325 Southwest Research Institute

415 Stanford Mu Corporation

417 Texas A&M Turbomachinery Laboratory

405 Vacco Industries

108 Valcor Engineering Corporation

403 Weldaloy Specialty Forgings

421 What is ASCEND?

104 Worthington Industries

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AIAA - Indiana Section 105

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BETA CAE Systems is an engineering services company that distributes & supports the industry leading ANSA & µETA software. ANSA is a CAE pre-processing tool for CFD & FE Analysis, for full-model build, from CAD to solver input file in one integrated environment. µETA is a post-processor for analyzing results from FLUENT, STAR CCM, CFD++, ANSYS, NASTRAN, ABAQUS, LS-DYNA, PAMCRASH & other solvers.

Convergent Science 109

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ENSMA - INSTITUT Pprime 125

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Pprime Institute (P') is a french research laboratory, created in 2010, affiliated to CNRS (National Center for Scientific Research), in collaboration with ISAE-ENSMA (Ecole Nationale Supérieure de Mécanique et d'Aérotechnique) and the University of Poitiers.

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FORCE MEASUREMENT SYSTEMS (FMS) is a comprehensive resource for the design and fabrication of high precision force measurement systems, load cells, and flexures. FMS expertise is in high accuracy jet engine and rocket thrust stands. FMS personnel are experience in thrust stands from 1 lb to 5.4 million lbs, single and multi-component.

GE Aviation 424

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GE Aviation is a world-leading provider of jet and turboprop engines, components and integrated systems for commercial, military, business and general aviation aircraft and has a global service network to support these offerings. With unprecedented growth in both our commercial and military aviation product portfolios, we have a number of engineering positions available and are looking to grow! For more information, visit us at www.ge.com/aviation, www.gecareers.com, and on Twitter.

EXHIBITORS

GE Research 208

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Inspired by Thomas Edison and led by GE's early chief consulting engineer, Charles Steinmetz, GE Research was created to maintain market edge and to foster new discoveries and commercial applications. That mission rings true today as we harness unparalleled scientific breadth and depth to drive innovation at the intersection of technical fields, move product to entitlement, solve problems and deliver outcomes to our customers.

General Dynamics Ordinance and Tactical Systems 308

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GT-SUITE System Simulation 110

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Gamma Technologies develops GT-SUITE, the industry-leading Model-Based Systems Engineering (MBSE) CAE system simulation software. GT-SUITE provides a comprehensive set of validated 0D/1D/3D multi-physics component libraries, which simulate the physics of fluid flow, thermal, mechanical, multi-body, structural, electrical, magnetic, chemistry, and controls. Using combinations of these libraries, models simulate any aircraft system, including the complete Virtual Integrated Aircraft (VIA).

HGL Dynamics, Inc 211

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HGL Dynamics is a world-leading supplier of high specification test measurement equipment for the integrated capture, monitoring, analysis, storage and management of high bandwidth data. HGL systems are used for a range of industrial and engineering applications, particularly turbine and rotating equipment. HGL provides a comprehensive service from the design and manufacture of low level PCBs through to the commissioning of complete turnkey solutions.

HPCMP CREATE 209

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The U.S. DoD High Performance Computing Modernization Program (HPCMP) includes a strategically important portfolio of software technology investments known as "CREATE" (Computational Research and Engineering Acquisition Tools and Environments). The portfolio produces physics-based, multi-disciplinary software products that deliver capabilities for design, analysis, and virtual testing of weapon systems and associated electromagnetic subsystems.

Intelligent Light 419

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EXHIBITORS

JASC 106

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The JASC Corporation specializes in the design and production of high-reliability components for pneumatic, hydraulic, and fuel systems. Since its inception in 1990, JASC has been providing fluid control solutions and advanced products for the aircraft, spacecraft, and power generation industries. We have comprehensive solutions to address problems on your most demanding applications.

Major Tool & Machine 204

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Major Tool & Machine (MTM) is a world leader in contract manufacturing services. MTM partners with NASA and Aeronautic / Astronautic industry leaders, providing manufacturing solutions to meet mission critical requirements. Examples of past and current manufacturing solutions will be on display at the MTM exhibit. MTM personnel will be on-site to discuss your mission critical manufacturing needs. As MTM is extraordinarily dynamic and in high growth mode, our personnel will be available to discuss career opportunities at MTM as well.

Moog Inc. 210

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Moog Space Sector designs and manufactures systems and components for spacecraft and launch vehicles. Moog provides solutions in propulsion, actuation, mechanisms, avionics, structures, power, shock and vibration control and spacecraft delivery vehicles. Moog is also leading the way in introducing metal additive manufactured hardware for next generation space vehicles.

NASA (HQ) 309

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NASA's Vision: We reach for new heights and reveal the unknown for the benefit of humankind.

PC Krause and Associates, Inc. 224

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PC Krause and Associates (PCKA) focuses on model-based design, analysis, and development of power and thermal technologies for DoD applications operating in harsh environments. PCKA, established in 1983, has successfully transitioned over 20 SBIR technologies and has locations in West Lafayette, Indiana, Indianapolis, Indiana, and Dayton, Ohio. PCKA has grown to over 50 full-time professionals, including 27 full-time PhD's. PCKA's wide-band-gap power electric drives and controls provide increased power density, efficiency and response for demanding aerospace applications.

Purdue University 111

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Purdue University is leading an effort that will provide national leadership in the development of cislunar capabilities and advance the space-based economy through collaboration with industry, academia and government agencies. The Cislunar Initiative aims to take a leadership role in expanding access to cislunar space, supplying the building blocks for infrastructure, identifying and utilizing space resources, advancing the development of space policy and providing critical educational opportunities.

The Zucrow Labs research facilities occupy a 24-acre site adjacent to the Purdue University Airport. The Laboratory's research capability encompasses many disciplines: aerodynamics of turbo machinery, aeroacoustics, combustion, measurement and control, computational fluid mechanics, particle flow heat transfer, and atomization processes. Founded by Maurice J. Zucrow in 1948, Zucrow Labs is the largest academic propulsion lab in the world.

Rolls-Royce 203

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EXHIBITORS

SoftInWay Inc. 401

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SoftInWay Inc. is an engineering R&D company specializing in advanced turbomachinery and power plants by offering consulting services, training, and software platform AxSTREAM® for design, analysis and optimization of flow paths, thermodynamic cycles, secondary flows calculations, and rotor dynamics.

Southwest Research Institute 325

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Southwest Research Institute® is an independent, nonprofit, applied research and development organization. We perform R&D for power and propulsion applications. Our facilities include test capabilities for rotating machinery, combustion and fluids, and cryogenic systems. In addition to test and evaluation, we offer additive manufacturing and detailed propulsion system cycle modeling. We provide solutions for industry and government clients that improve efficiency, performance, and safety.

Stanford Mu Corporation 415

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Texas A&M Turbomachinery Laboratory 417

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The Turbomachinery Laboratory is a center of the Texas A&M Engineering Experiment Station (TEES) and a member of the Texas A&M University System. The Turbo Lab conducts both Basic and Applied Research with nine active research professors, and over 100 graduate student researchers in areas that include combustion and gas dynamics, computational fluid mechanics, heat transfer, laser diagnostics, rotordynamics and bearings, turbine blade cooling, materials, and data analytics.

The Turbo Lab also sponsors two large industrial symposia to provide continuing education opportunities to users of industrial turbomachinery, and to generate profits to foster and support graduate and undergraduate education in turbomachinery.

Vacco Industries 405

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Valcor Engineering Corporation 108

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Weldaloy Specialty Forgings 403

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What is ASCEND? 421

Nathan Boll, NathanB@aiaa.org

Launching November 16-18, 2020, in Las Vegas, Nevada, ASCEND will convene luminaries from across the space community to discuss, debate, and develop a shared vision for the future of the space economy and human exploration. Stop by our booth to learn more and ask questions.

Worthington Industries 104

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Manufacturer of Composite Overwrapped Pressure Vessels and Composite Structures.

GENERAL INFORMATION

AIAA Registration and Information Center Hours

The AIAA Registration and Information Center will be located in the Chantilly Foyer. Hours are as follows:

Sunday, 18 August:	1500–1900 hrs
Monday, 19 August – Wednesday, 21 August:	0700–1730 hrs
Thursday, 22 August:	0700–1600 hrs

ITAR Registration Hours:

Sunday, 18 August	1600–1900 hrs	Registration Area
Monday, 19 August	0900–1700 hrs	Registration Area
Tuesday, 20 August	0900–1730 hrs	Room 209
Wednesday, 21 August	0900–1630 hrs	Room 209
Thursday, 22 August	0900–1130 hrs	Room 209

Wi-Fi Internet Access On Site

AIAA provides limited Wi-Fi service for attendees to use while onsite. To keep this service available and optimized for all attendees, please do not download files larger than 2MB, create multiple sessions across multiple devices, or download multiple files in one session. If you receive an error message that an AIAA server is blocking your current IP address, please inform the AIAA registration desk.

Network Name: **AIAA** Password: **PROPENERGY**

AIAA Livestream Channel

Visit **https://livestream.com/AIAAvideo/PropEnergy2019** to view selected keynotes, plenaries, and Forum 360 sessions. Share the link with colleagues who couldn't attend the forum so they can watch live or view later.

Social Media at #aiaaPropEnergy

Watch the social media kiosks spaced throughout the forum for announcements and content shared by attendees using the hashtag #aiaaPropEnergy.

Win prizes including gift cards. See contest official rules: **aiaa.org/propulsionenergy/SocialMedia**

Conference Proceedings

Proceedings for the forum will be available online. The cost is included in the registration fee where indicated. Online proceedings will be available on 19 August 2019. Please follow the instructions below to access the proceedings:

1. To view proceedings visit **aiaa.org** >ARC>Meeting Papers.
   a. Log in with the link at the top right of the page.
   b. To browse, click on the **Meeting Papers** link at the top of the page and select the appropriate conference from the list.
   c. To search for individual papers, use the **Quick Search** toolbar at the top:
      i. Use the **Search** textbox to find papers by author, title or keyword
      ii. To search by paper number - click the **Anywhere** drop down, select **Find by Paper**, select the conference year, and enter the paper number
2. All manuscript files submitted four days prior to the conference are currently in the proceedings.
3. Direct any questions concerning access to proceedings and/or ARC to **arcsupport@aiaa.org**.

Manuscript Corrections

Check for updates

1. The manuscript in the proceedings is the version of record and may not be edited. All changes will be available through the Crossmark feature. View corrections by clicking the Crossmark icon, located on every article's page and PDF. Please visit **arc.aiaa.org/page/crossmark** for more information.
2. Corrections will be available online approximately 15 business days after the last day of the conference.

Certificate of Attendance

The Certificates of Attendance will be sent to all registered attendees on Thursday, 22 August. AIAA offers this service to better serve the needs of the professional community. Claims of hours or applicability toward professional education requirements are the responsibility of the participant.

Employment Opportunities

AIAA members can post and browse resumes, browse job listings, and access other online employment resources by visiting the AIAA Career Center at **careercenter.aiaa.org**.

Membership

AIAA is a great resource for networking with other aerospace professionals, continuing your education, staying up to date on the latest news, and furthering your career. Aerospace is a field where Membership Matters. Regardless of what aerospace area you are involved with, being an active member of AIAA can accelerate and strengthen your professional life. Don't miss any of the benefits that come with being a part of the largest professional association built by and for aerospace practitioners. **aiaa.org/membership**

Continue the Conversation on Engage

Just because the forum ends, the conversation doesn't have to end too. AIAA Engage allows you to connect with a community of nearly 30,000 of your AIAA colleagues online. Continue your conversations from the forum on the Engage platform. Discuss the sessions, connect with attendees you met at the forum, and share your experiences. Visit **engage.aiaa.org** to start connecting.

Badge Policy

AIAA forum badges are provided to those individuals who have paid for a registration to the event. Badges must be worn at all times to participate in all forum activities. Badges are not provided at the registration desk for committee meeting attendance. To obtain an AIAA Propulsion and Energy Forum badge, one must register for the forum.

Nondiscriminatory Practices

AIAA accepts registrations irrespective of age, race, creed, sex, sexual orientation, color, physical handicap, and national or ethnic origin.

Restrictions

Photos, video, or audio recording of sessions or exhibits, as well as the unauthorized sale of AIAA-copyrighted material, is prohibited.

GENERAL INFORMATION

AIAA Photography and Video Notice

Attendance at, or participation in, this American Institute of Aeronautics and Astronautics (hereinafter "AIAA") event constitutes consent to the use and distribution by AIAA and its employees, agents and assignees of the attendee's image and/or voice for purposes related to the mission of AIAA, including but not limited to, publicity, marketing, other electronic forms of media, and promotion of AIAA and its various programs and events. Please contact AIAA's Communications Director John Blacksten at johnb@aiaa.org with requests or questions.

Anti-Harrassment Policy

All attendees, including members, students, guests, staff, organizers, exhibitors, and speakers, must adhere to the Institute's Anti-Harassment Policy found at **aiaa.org/Anti-Harassment-Policy.**

International Traffic in Arms Regulations (ITAR)

AIAA speakers and attendees are reminded that some topics discussed in the conference could be controlled by the International Traffic in Arms Regulations (ITAR). U.S. nationals (U.S. citizens and permanent residents) are responsible for ensuring that technical data they present in open sessions to non-U.S. nationals in attendance or in conference proceedings are not export restricted by the ITAR. U.S. nationals are likewise responsible for ensuring that they do not discuss ITAR export-restricted information with non-U.S. nationals in attendance.

AUTHOR AND SESSION CHAIR INFORMATION

Speakers' Briefing in Session Rooms

Authors who are presenting papers will meet with session chairs and co-chairs in their session rooms for a short 30-minute briefing on the day of their sessions to exchange bios and review final details prior to the session. Please attend on the day of your session(s). Laptops preloaded with the Speakers' Briefing preparation slides will be provided in each session room. Speakers' Briefings will be held, **Monday, 19 August–Thursday, 22 August: 0730 hrs.**

Speakers' Practice Room

Speakers who wish to practice their presentations may do so in room 300. A sign-up sheet will be posted on the door. In consideration of others, please limit practice time to 30-minute increments.

Session Chair Reports

All session chairs are asked to complete a session chair report to evaluate their session for future planning. AIAA has partnered with Canvas Solutions to provide an electronic Session Chair Report form. You can download the FREE mobile app at **gocanvas.com/m**. If you do not have a tablet or a smartphone, enter your session chair report information at the session chair reporting computer station located on-site near the AIAA registration area. Report data will be collected and used for future planning purposes, including session topics and room allocations. Please submit your session chair report electronically by **Saturday, 24 August 2019**.

Audiovisual

Each session room will be preset with the following: Laptop computer, LCD projector, screen, microphone and sound system (if necessitated by room size), and a laser pointer. You may use your own laptop if you wish. Any additional audiovisual equipment requested onsite will be at cost to the presenter. Please note that AIAA does not provide security in the session rooms and recommends that items of value not be left unattended.

"No Paper, No Podium" and "No Podium, No Paper" Policies

If a written paper is not submitted by the final manuscript deadline, authors will not be permitted to present the paper at the forum. It is also the responsibility of those authors whose papers or presentations are accepted to ensure that a representative attends the forum to present the paper. If a paper is not presented at the forum, it will be withdrawn from the forum proceedings. These policies are intended to eliminate no-shows, to improve the quality of the forum for all participants, and to ensure that the published proceedings accurately represent the presentations made at a forum.

Journal Publication

Authors of appropriate papers are encouraged to submit them for possible publication in one of the Institute's archival journals: *AIAA Journal; Journal of Aerospace Information Systems; Journal of Air Transportation; Journal of Aircraft; Journal of Guidance, Control, and Dynamics; Journal of Propulsion and Power; Journal of Spacecraft and Rockets; or Journal of Thermophysics and Heat Transfer.* You may now submit your paper online at **http://mc.manuscriptcentral.com/aiaa**.

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COMMITTEE MEETINGS

TIME	COMMITTEE AND ANCILLARY MEETINGS/EVENTS	ROOM
	Sunday, 18 August	
0800–1730	**Regional Leadership Conference**	White River Ballroom CD
1600–1800	**Meet the Employers**	White River Ballroom AB
1600–2000	**Space Systems Technical Committee**	Room 105
1700–2000	**Propulsion and Energy Group Meeting**	Room 201
1830–2030	**Regional Leadership Conference Reception**	White River Balllroom AB
	Monday, 19 August	
0900–1000	**Air Breathing Propulsion Steering Committee**	Room 109
0930–1700	**Regional Engagement Activities Division**	Room 304
0930–1700	**Technical Activities Division**	JW Grand Ballroom 1
1000–1100	**GTE/HSAPB/INPSI New Member Orientation**	Room 302/03
1100–1200	**GTE TC Steering Committee**	Room 302/03
1100–1200	**HSABP TC Steering Committee**	Room 109
1100–1200	**INPSI TC Steering Committee**	Room 108
1300–1400	**Gas Turbine Engines Technical Committee**	Room 109
1300–1400	**High Speed Air Breathing Propulsion (HSABP) Technical Committee**	Room 302/03
1300–1400	**INPSI Technical Committee**	JW Grand Ballroom 2
1330–1430	**Propulsion and Energy Operations Group**	Room 108
1400–1500	**ABP Student Design Competition Working Group**	Room 109
1500–1600	**ABP Honors and Awards Working Group**	Room 109
1600–1700	**Journal of Propulsion and Power Editors and Advisory Board Meeting**	Room 302/03
1730–2030	**Propellants and Combustion Technical Committee**	White River F
1800–2100	**Electric Propulsion Technical Committee**	JW Grand Ballroom 2
1800–1900	**ABP Working Group**	Rooom 109
1900–2200	**Solid Rockets TC**	White River Ballroom E
1900–2100	**Air Breathing Propulsion TC**	JW Grand Ballroom 1
	Tuesday, 20 August	
0930–1130	**Council Innovation and Initiatives Committee (CIIC)**	Room 304
0930–1130	**Space and Missiles Group**	Room 109
1100–1200	**Propulsion and Energy 2020 Technical Committee**	JW Grand Ballroom 1
1200–1500	**Nuclear and Future Flight Propulsion Technical Committee**	Room 108
1300–1700	**Public Policy Committee**	Room 304
1300–1700	**AIAA Council of Directors**	White River F
1300–1430	**Propulsion and Energy Products Group**	Room 109
1500–1700	**HSABP TC Education Subcommittee**	Room 109
1700–1800	**PAW Working Group**	Room 109
1800–2100	**Aerospace Power Systems TC**	Room 108
1800–2100	**Energetic Components and Systems Technical Committee**	Room 302/03
1900–2200	**Terrestrial Energy Systems TC**	JW Grand Ballroom 1
1900–2100	**Hybrid Rockets Technical Committee**	JW Grand Ballroom 2
	Wednesday, 21 August	
0900–1200	**ASCEND 2020 Technical Program Workshop**	JW Grand Ballroom 2
1400–1500	**Propulsion and Energy Energy Group**	Room 304
1800–1930	**Aircraft Electrified Propulsion and Power Working Group (AEPP)**	JW Grand Ballroom 2
1900–2200	**Liquid Propulsion Technical Committee**	White River F
1900–2100	**Pressure Gain Combustion Technical Committee**	JW Grand Ballroom 1
1930–2100	**Green Engineering Integration Committee**	Room 109

Sunday

Sunday, 18 August 2019

1-NW-1 1600 - 1800 hrs	Meet the Employers	White River A/B

Sunday, 18 August 2019

2-NW-2 1800 - 1930 hrs	Student Welcome Mixer	White River G

Monday

Monday, 19 August 2019

3-SB-1 0730 - 0800 hrs	Monday Speaker Briefing	Session Rooms

Monday, 19 August 2019

4-PLNRY-1 0800 - 0900 hrs	Monday Plenary: Pioneering the Power that Matters	JW Grand Ballroom 5
	Keynote Speaker **Phil Burkholder** President, Defense Programs Rolls-Royce Corporation	

Monday, 19 August 2019

5-NW-3 0900 - 0930 hrs	Networking Break	JW Grand Ballroom Prefunction

Monday, 19 August 2019

6-APC-1 — Advanced Propulsion Concepts I — Room 208

Chaired by: J. ROBINSON and T. GIEL, Jacobs Technology

0930 hrs AIAA-2019-3800 **Performance Analysis of a Combined Laser and Neutral Particle Beam Propulsion Concept Based on Self-Guiding** C. Limbach, K. Hara, Texas A&M University, College Station, TX	1000 hrs AIAA-2019-3801 **Development of a stable acceleration system for a spherical capsule using a doughnut beam profile** D. Tran, C. Xie, K. Mori, Nagoya University, Nagoya, Japan	1030 hrs AIAA-2019-3802 **A Simplified Model for The Thrust Performance of Porous Heat eXchanger (PHX) Laser Rocket Propulsion** K. Mori, H. Itoh, Nagoya University, Nagoya, Japan	1100 hrs AIAA-2019-3803 **Numerical Simulation of Laser and Particle Coupled Beam Propagation** D. Kuldinow, Yale University, New Haven, CT; K. Hara, D. Morales, C. Limbach, Texas A&M University, College Station, TX	

Monday, 19 August 2019

7-EDU-1 — Workforce Development - Propulsion Education — Room 209

Chaired by: E. FLEEMAN and J. AGNEW, UAH Propulsion Research Center

0930 hrs AIAA-2019-3804 **Collaborative Space and Propulsion Education: Leveraging all sectors of the space enterprise to benefit the future U.S. Space and Propulsion Workforce!** S. Godshall, R. Frederick, University of Alabama, Huntsville, Huntsville, AL	1000 hrs AIAA-2019-3805 **Increasing Undergraduate Involvement in Propulsion at Penn State Harrisburg** B. Maicke, Pennsylvania State University, Middletown, PA	1030 hrs AIAA-2019-3806 **Airbreathing Electric Propulsion Survey** M. Hitt, D. Martin, C. Duron, A. Wolf, K. Johnaon, Army Space and Missile Defense Command, Huntsville, AL	1100 hrs AIAA-2019-3807 **TurboRocket - The project progress report** R. Rezende, J. Barros, Federal University of Minas Gerais, Belo Horizonte, Brazil	1130 hrs AIAA-2019-3808 **Development and Experimentation of a Lab-Scale Pulse Detonation Engine (PDE)** A. Murray, Orbital ATK, Rocket Center, WV; T. Smith, Pennsylvania State University, University Park, PA; E. Pittman, J. Moore, G. Risha, Pennsylvania State University, Altoona, PA

Monday, 19 August 2019				
8-EP-1	**High Power Electric Propulsion**			**White River A/B**
Chaired by: B. JORNS, University of Michigan, Ann Arbor and H. KAMHAWI, NASA Glenn Research Center				
0930 hrs AIAA-2019-3809 **High Power Demonstration of a 100 kW Nested Hall Thruster System** S. Shark, S. Hablitzel, A. Tolentino, B. Welander, J. Jackson, Aerojet Rocketdyne, Redmond, WA; S. Hall, Vantage Partners, LLC, Cleveland, OH; et al.	1000 hrs AIAA-2019-3810 **Steady-state Testing at 100 kW in the VASIMR® VX-200SS Project** J. Squire, M. Carter, F. Chang Diaz, A. Corrigan, L. Dean, J. Farrias, Ad Astra Rocket Company, Webster, TX; et al.	1030 hrs AIAA-2019-3811 **The Gateway Power and Propulsion Element: Setting the Foundation for Exploration and Commerce** R. Ticker, M. Gates, NASA Headquarters, Washington, D.C.; D. Manzella, A. Biaggi-Labiosa, NASA Glenn Research Center, Cleveland, OH; T. Lee, Maxar Technologies, Palo Alto, CA	1100 hrs AIAA-2019-3812 **Development Status of SITAEL's 20 kW Class Hall Thruster** A. Piragino, V. Giannetti, M. Reza, F. Faraji, E. Ferrato, A. Kitaeva, SITAEL S.p.A., Pisa, Italy; et al.	1130 hrs AIAA-2019-3813 **EPS architecture analysis for future high-power missions** C. Paissoni, N. Viola, Technical University of Turin, Turin, Italy; T. Andreussi, A. Kitaeva, M. Andrenucci, SITAEL S.p.A., Ospedaletto, Italy

Monday, 19 August 2019				
9-EP-2	**Electrospray Flight Development**			**Room 204**
Chaired by: J. MACKEY and J. ROVEY, University of Illinois				
0930 hrs AIAA-2019-3814 **Incorporating Lessons Learned into LISA Colloid Microthruster Technology Development** J. Ziemer, C. Marrese-Reading, S. Arestie, D. Conroy, S. Leifer, A. Lopez Ortega, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; et al.	1000 hrs AIAA-2019-3815 **Component-Level Development and Testing of a Colloid Micro-Thruster (CMT) System for the LISA Mission** N. Demmons, D. Courtney, N. Alvarez, Z. Wood, Busek Company, Inc., Natick, MA	1030 hrs AIAA-2019-3816 **Electrospray Thruster Performance and Lifetime Investigation for the LISA Mission** R. Wirz, University of California, Los Angeles, Los Angeles, CA	1100 hrs AIAA-2019-3817 **Characterization of a High Thrust, Pressure-Fed Electrospray Thruster for Precision Attitude Control Applications** N. Demmons, Z. Wood, N. Alvarez, Busek Company, Inc., Natick, MA	

Monday, 19 August 2019		
10-F360-1 **0930 - 1045 hrs**	**Monday Forum 360 AM: Human Exploration Launch Systems (Part I - SLS Overview)**	**JW Grand Ballroom 3/4**

Moderator: Douglas Cooke, Aerospace Consultant, Cooke Concepts and Solutions, and former Associate Administrator, Exploration Systems Mission Directorate, NASA (ret.)

Panelists:

Robert L. Broeren	**Jeff Foote**	**W. Michael Hawes**	**Jim Maser**
SLS Propulsion	Vice President, NASA Programs	Vice President, Human Space Exploration, and Orion Program	Senior Vice President, Space Business Unit
The Boeing Company	Northrop Grumman Innovation Systems	Manager, Lockheed Martin Space	Aerojet Rocketdyne

Monday, 19 August 2019				
11-GTE-1	**Compressors I**			**Room 312**
Chaired by: J. HAYNES, GE Global Research Center				
0930 hrs AIAA-2019-3818 **Investigation of Slip Models for High-Speed Centrifugal Compressors** H. Harrison, F. Lou, N. Key, Purdue University, West Lafayette, IN	1000 hrs AIAA-2019-3819 **Aerodynamic Performance Improvement of A Transonic Axial Compressor by Swept and Leaned Rotors** N. Huang, X. Zhao, Y. Zhang, Northwestern Polytechnical University, Xi'an, China; X. Wu, Franklin W. Olin College of Engineering, Needham, MA	1030 hrs AIAA-2019-3820 **A New Vortex Solution for Axial Compressor Design-Part 1: Design and Methodology** M. Attia, W. Li, Embry-Riddle Aeronautical University, Daytona Beach, FL	1100 hrs AIAA-2019-3821 **A New Vortex Solution for Axial Compressor Design-Part 2: Validation and CFD Analysis** M. Attia, W. Li, Embry-Riddle Aeronautical University, Daytona Beach, FL	

Monday, 19 August 2019				
12-GTE-2	**Gas Turbine Noise**			**Room 301**
Chaired by: J. TAI, Georgia Institute of Technology				
0930 hrs AIAA-2019-3822 **Numerical Simulation of Acoustic Shielding Effect on Supersonic Jets** S. Salehian, R. Mankbadi, Embry-Riddle Aeronautical University, Daytona Beach, FL	1000 hrs AIAA-2019-3823 **Study on aerodynamic and noise characteristics of thrust reverser in Aircraft propulsion system integration design** J. Mao, S. Bi, X. Han, Nanjing University of Aeronautics and Astronautics, Nanjing, China	1030 hrs AIAA-2019-3824 **A 20 Year Retrospective of The Advanced Noise Control Fan – Contributions to Turbofan Noise Research** D. Sutliff, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-3825 **Evaluation of Radiated Sound from the Advanced Noise Control Fan facility in an Outdoor Environment Using Ground Microphones** K. Figueroa-Ibrahim, S. Morris, M. Ross, University of Notre Dame, Notre Dame, IN; D. Sutliff, NASA Glenn Research Center, Cleveland, OH	

Monday, 19 August 2019				
13-GTE-3	**Advanced Engine Cycles I**			**Room 311**
Chaired by: M. BELMOUSS				
0930 hrs AIAA-2019-3826 **An Analysis of the Strayton Engine, a Brayton and Stirling Cycle Recuperating Engine** J. Chapman, D. Simon, E. McNichols, NASA Glenn Research Center, Cleveland, OH	1000 hrs AIAA-2019-3827 **Compressible Isolated Actuator Disk Theory Solutions** S. Dick, P. Ng, S. Gnagy, S. Waal, R. Westphal, California Polytechnic State University, San Luis Obispo, CA	1030 hrs AIAA-2019-3828 **A Fully Coupled Body Force-Engine Performance Methodology For Boundary Layer Ingestion** L. López de Vega, G. Dufour, N. García Rosa, Higher Institute of Aeronautics and Space, Toulouse, France		

Monday, 19 August 2019				
14-GTE-4	**Multidisciplinary Design, Analysis, Optimization I**			**Room 307**
Chaired by: S. DRENNAN, Convergent Science, Inc.				
0930 hrs AIAA-2019-3829 **A Medial-Object-based Design-in-Context Approach for the Structural Design of Engine Subsystems** H. Yong, L. Wang, D. Toal, A. Keane, University of Southampton, Southampton, United Kingdom; F. Stanley, Rolls-Royce Group plc, Derby, United Kingdom	1000 hrs AIAA-2019-3830 **Parameteric Shape Optimization of Pin Fin Arrays Using Surrogate Model Based Bayesian Methods** S. Ghosh, University of Central Florida, Orlando, FL; S. Mondal, Pennsylvania State University, University Park, PA	1030 hrs AIAA-2019-3831 **A file-based approach to multi-component coupled simulations in gas turbine engines** C. Nastase, Rolls-Royce Group plc, Indianapolis, IN; I. Tristanto, Rolls-Royce Group plc, Derby, United Kingdom; M. Anand, Rolls-Royce Group plc, Indianapolis, IN		

Monday, 19 August 2019				
15-HR-1	**Design and Development of Novel Hybrid Rocket Motor Concepts I**			**Room 104**
Chaired by: S. COOGAN, Southwest Research Institute				
0930 hrs AIAA-2019-3832 **Thrust Augmentation of an Additively Manufactured Hybrid Rocket System Using Secondary H2O2 Injection** S. Whitmore, M. Heiner, Utah State University, Logan, UT	1000 hrs AIAA-2019-3833 **Diode Laser Ignition Mechanism for Hybrid Propulsion Systems** D. Dyrda, V. Korneyeva, B. Cantwell, Stanford University, Stanford, CA	1030 hrs AIAA-2019-3834 **Novel Hybrid Rocket Internal Ballistic Configuration with Coaxially Located Tube Injector** M. Kahraman, DeltaV Space Technologies, Inc., Istanbul, Turkey; I. Ozkol, Istanbul Technical University, Istanbul, Turkey; A. Karabeyoglu, Koc University, Istanbul, Turkey	1100 hrs AIAA-2019-3835 **Porosity and Temperature Effects on Axial-Injection, End-Burning Hybrid Rocket Motor Regression** M. Hitt, Army Space and Missile Defense Command, Huntsville, AL	

Monday, 19 August 2019					
16-HR-2	**Program Progress, Future Investment, Business Case, and New Developments**				**Room 103**
Chaired by: T. ELLIOTT, University of Tennessee at Chattanooga					
0930 hrs AIAA-2019-3836 **Viability Study of Acrylonitrile Butadiene Styrene Polymer as Fuel for Hybrid Rocket Engines in Colombia** H. Lozada, A. Urrego, F. Rojas, University of San Buenaventura, Bogota, Colombia	1000 hrs AIAA-2019-3837 **Development of Hapith Small Launch Vehicle based on Hybrid Rocket Propulsion** Y. Chen, TiSPACE, Inc., Chunan, Taiwan	1030 hrs AIAA-2019-3838 **Feasibility Study for Hypersonic Flight Test Using a Reusable Hybrid Rocket Motor** P. Nardozzo, S. Popkin, J. Smith, Johns Hopkins University Applied Physics Laboratory, Laurel, MD	1100 hrs AIAA-2019-3839 **Development of the Nucleus Hybrid Propulsion System: Enabling A Successful Flight Demonstration** M. Faenza, A. Boiron, B. Haemmerli, C. Verberne, Nammo Raufoss AS, Raufoss, Norway	1130 hrs AIAA-2019-3840 **A Single Stage to Orbit Design for a Hybrid Mars Ascent Vehicle** G. Story, A. Schnell, D. Yaghoubi, NASA Marshall Space Flight Center, Huntsville, AL; A. Karp, B. Nakazono, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; G. Zilliac, NASA Ames Research Center, Moffett Field, CA

Monday, 19 August 2019				
17-HSABP-1	**Reduced-Order Analysis and Engineering**			**Room 305/06**
Chaired by: O. POWELL, Millennium Engineering & Integration Company and C. MARLEY, Boeing				
0930 hrs AIAA-2019-3841 **Performance of a Generic X-51 Waverider – Thrust, Drag, and Trim Computed Using the MASIV Reduced Order Model** M. Yost, Y. Choi, E. Lerner, J. Driscoll, University of Michigan, Ann Arbor, Ann Arbor, MI	1000 hrs AIAA-2019-3842 **Development of a 1D dual mode scramjet model for a hypersonic civil aircraft** A. Ispir, B. Saracoglu, von Kármán Institute for Fluid Dynamics, Rhode-Saint-Genèse, Belgium	1030 hrs AIAA-2019-3843 **Numerical investigation of the STRATOFLY MR3 propulsive nozzle during supersonic to hypersonic transition** L. Nista, B. Saracoglu, von Kármán Institute for Fluid Dynamics, Rhode-Saint-Genèse, Belgium	1100 hrs AIAA-2019-3844 **An Engineering Model to Predict Flow Features of a Sonic or Supersonic Gaseous Jet into Supersonic Crossflow** G. Huggins, D. Fries, S. Menon, Georgia Institute of Technology, Atlanta, GA	

Monday, 19 August 2019				
18-INPSI-1	**Propulsion Aerodynamics Workshop: S-Duct Session (Invited)**			**Room 308**
Chaired by: C. WINKLER, The Boeing Company				
0930 hrs AIAA-2019-3845 **Summary of the 4th Propulsion Aerodynamics Workshop: S-duct Results (Invited)** D. Babcock, The Boeing Company, St. Louis, MO; L. Tobaldini Neto, Embraer, São José dos Campos, Brazil; Z. Davis, Kratos Defense & Rocket Support Services, Huntsville, AL	1000 hrs AIAA-2019-3846 **Invited paper: Analysis of IFCPT SDUCT using OpenFOAM for the 4th AIAA PAW conference (Invited)** P. Ghildiyal, F. Mendonca, ESI Group, Bracknell, United Kingdom	1030 hrs AIAA-2019-3847 **CFD Simulation of S-Duct Test Case Using ANSYS FLUENT (Invited)** J. Selvanayagam, C. Aliaga, J. Stokes, ANSYS, Inc., Montréal, Canada	1100 hrs AIAA-2019-3848 **FUN3D and USM3D analysis of the Propulsion Aerodynamic Workshop 2018 S-duct Test Case (Invited)** M. Carter, M. Bozeman, J. Carlson, NASA Langley Research Center, Hampton, VA	1130 hrs AIAA-2019-3849 **Computational analysis of the IFCPT S-Duct using CFD++ for the 4th Propulsion Aerodynamics Workshop (Invited)** A. Potturi, A. Bhatia, R. Oberoi, Metacomp Technologies, Inc., Agoura Hills, CA; L. Tobaldini Neto, L. Lima, Embraer, São José dos Campos, Brazil

Monday, 19 August 2019				
19-INPSI-2/GTE-5	**Green Propulsion for Advanced Gas Turbine Engines**			**Room 309/10**
Chaired by: I. HALLIWELL, Northwind Propulsion Inc. and G. PANIAGUA, Purdue University				
0930 hrs AIAA-2019-3850 **Design and computational analysis of a closed non-planar wing aircraft coupled to a boundary layer ingestion propulsion system** P. Bravo Mosquera, H. Cerón-Muñoz, F. Catalano, University of São Paulo, São Carlos, Brazil	1000 hrs AIAA-2019-3851 **The Propulsive Efficiency of Wake Ingestion** P. Bevilaqua, C. Yam, Purdue University, West Lafayette, IN	1030 hrs AIAA-2019-3852 **Experimental and Numerical Evaluation of Boundary Layer Ingestion Effect with Engine/Airframe Integration Model** K. Okai, Japan Aerospace Exploration Agency (JAXA), Chofu, Japan; Y. Mitani, H. Yoshida, S. Ogushi, R. Tsuruta, A. Okuno, Waseda University, Tokyo, Japan; et al.	1100 hrs AIAA-2019-3853 **Development of a Ducted Propulsor for BLI Electric Regional Aircraft - Part I: Aerodynamic Design and Analysis** K. Brown, J. Fleming, M. Langford, W. Ng, Techsburg, Inc., Christiansburg, VA; K. Schwartz, AVEC, Inc., Blacksburg, VA; C. Combs, Ampaire, Inc., Los Angeles, CA	1130 hrs AIAA-2019-3854 **Development of a Ducted Propulsor for BLI Electric Regional Aircraft - Part II: Aeroacoustic Analysis** K. Schwartz, R. Burdisso, B. Witcher, AVEC, Inc., Blacksburg, VA; K. Brown, J. Fleming, Techsburg, Inc., Christiansburg, VA; C. Combs, Ampaire, Inc., Los Angeles, CA

Monday, 19 August 2019				
20-LP-1	**In-Space Liquid Propulsion I**			**Room 105**
Chaired by: S. BUSHMAN, The Johns Hopkins University Applied Physics Laboratory and S. ALBERTS				
0930 hrs AIAA-2019-3855 **Design, Fabrication, Test, Launch, and Early Operation of the Parker Solar Probe Propulsion System** S. Kijewski, S. Bushman, Johns Hopkins University Applied Physics Laboratory, Laurel, MD	1000 hrs AIAA-2019-3856 **Final Dawn Reaction Control System (RCS) Propulsion System In-Flight Characterization** T. Barber, B. Nakazono, M. Mizukami, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA	1030 hrs AIAA-2019-3857 **AMC9 Successful Reorbitation - Propulsion Challenges** E. Kruch, A. Aresini, SES, Betzdorf, Luxembourg; A. Iffly, Thales Group, Cannes, France; J. Deck, ArianeGroup, Lampoldshausen, Germany	1100 hrs AIAA-2019-3858 **Design of the Europa Clipper Propellant Management Device** R. Manning, I. Ballinger, M. Bhatia, M. Dowdy, Keystone Engineering Company, Long Beach, CA	

Monday, 19 August 2019				
21-LP-2	**Liquid Propulsion Combustion and Ignition**			**Room 107**
Chaired by: M. MASQUELET, Blue Origin LLC and F. LASSOUDIERE, Ariane Group				
0930 hrs AIAA-2019-3859 **Development of a LOX/Ethanol Gas Generator for a Hybrid-Motor-Based Mini-Launcher** E. Paccagnella, University of Padua, Padua, Italy; M. Kobald, C. Schmierer, U. Fischer, K. Tomilin, German Aerospace Center (DLR), Hardthausen, Germany	1000 hrs AIAA-2019-3860 **Liquid Rocket Engine Torch Igniter Feed System** A. Vadera , University of Southern California, Los Angeles, CA	1030 hrs AIAA-2019-3861 **Evaluation of an Augmented Spark Igniter's Flame Length and Comparison of Numerical and Experimental Investigations** L. Öz, A. Özer, B. Sümer, TUBITAK, Ankara, Turkey; A. Ulas, Middle East Technical University, Ankara, Turkey		

Monday, 19 August 2019		
22-LP-3 0930 - 1100 hrs	Cryogenic Propellant Management: Science, Applications and Experiments	Room 106

Mohammad Kassemi, CWRU/NASA Glenn Research Center, and Philipp Behruzi, ArianeGroup

Goal of the session is to reflect on the present state of the art concerning propellant management for spacecrafts. The focus will be put on spacecraft tanks and propellant management. The current status of experiments performed reflecting the cryogenic propellant behaviour will be discussed. Both in-orbit as well as ground experiments will be addressed. Finally a selection of benchmark experiments which could be used for the evaluation of numerical and analytical tools will be discussed.

Monday, 19 August 2019		
23-NFF-1 0930 - 1200 hrs	Really Advanced Propulsion: Fission, Fusion, and Beyond	White River J

This lecture will be an introduction to the physics and engineering of breakthrough propulsion. Topics covered include nuclear fission, nuclear fusion, and breakthrough physics.

Monday, 19 August 2019		
24-PC-1 0930 - 1130 hrs	Combustion Dynamics in Gas Turbine Combustion Systems	Room 101

Tutorial by Tim Lieuwen, Georgia Institute of Technology

Combustion dynamics present a number of challenges by causing damage and reducing the operational envelope of gas turbines and other steady flowing combustion systems. This tutorial will provide an overview of each of the controlling issues, including an introduction to the key physics, a discussion of mitigation strategies, and real world examples.

Monday, 19 August 2019		
25-PC-2	Combustion Dynamics I	White River G

Chaired by: V. SANKARAN, US Air Force/AFRL/RQRC and J. OEFELEIN, Georgia Institute of Technology

0930 hrs Oral Presentation **Overview of Combustion Stability Experiments in Rocket Combustors (Invited)** W. Anderson, Purdue University, West Lafayette, IN	1030 hrs AIAA-2019-3862 **Characterization of Self-Excited High Frequency Combustion Instability in a Bluff-Body Stabilized Flame in Vitiated Flow** V. Shaw, R. Villalva Gomez, J. Clabbers, E. Gutmark, University of Cincinnati, Cincinnati, OH	1100 hrs AIAA-2019-3863 **An Experimental Investigation Into the Role of Equivalence Ratio Oscillations in the Heat Release Transfer Function** L. Humphreys, J. Walker, D. Scarborough, Auburn University, Auburn, AL	

Monday, 19 August 2019		
26-PC-3	High Fidelity Combustion Modeling I	White River H

Chaired by: C. HUANG, University of Michigan and M. HARVAZINSKI, AFRL/RQRC

0930 hrs AIAA-2019-3864 **Conjugate Heat Transfer Simulation of a Subscale Rocket Thrust Chamber Using a Timescale Based Frozen Non-Adiabatic Flamelet Combustion Model** D. Rahn, Technical University of Munich, Munich, Germany; H. Riedmann, ArianeGroup, Taufkirchen, Germany; O. Haidn, Technical University of Munich, Munich, Germany	1000 hrs AIAA-2019-3865 **Large-Eddy Simulation of Spray Flames in the DLR Generic Single Sector Combustor** F. Setzwein, P. Ess, P. Gerlinger, German Aerospace Center (DLR), Stuttgart, Germany	1030 hrs AIAA-2019-3866 **Extension of the Flamelet Generated Manifold Approach to Account for Heat Losses in Multiphase Combustor Simulations** B. Muralidharan, A. Zambon, A. Hosangadi, Combustion Research and Flow Technology, Inc., Pipersville, PA	1100 hrs AIAA-2019-3867 **Spray Flamelet Modeling of Kerosene Spray Combustion** R. Yi, X. Zhang, T. Yang, C. Chen, Shanghai Jiao Tong University, Shanghai, China	1130 hrs AIAA-2019-3868 **Application of dynamic zone flamelet model to a GH2/GO2 rocket combustor** W. Yao, X. Fan, Chinese Academy of Sciences, Beijing, China

Monday, 19 August 2019		
27-PGC-1	Pressure Gain Combustion: Component and Subsystem Development	White River C/D

Chaired by: B. SARACOGLU, von Karman Institute for Fluid Dynamics and W. ROBERTS, KAUST

0930 hrs AIAA-2019-3869 **Injector Mixing Effects in Rotating Detonation Rocket Engines** B. Bigler, ERC, Inc., Edwards, CA; J. Bennewitz, S. Danczyk, W. Hargus, Air Force Research Laboratory, Edwards AFB, CA	1000 hrs AIAA-2019-3870 **Influence of Nozzle Guide Vane Orientation Relative to RDC Wave Direction** E. Bach, M. Bohon, C. Paschereit, P. Stathopoulos, Technical University of Berlin, Berlin, Germany	1030 hrs AIAA-2019-3871 **Improving the Performance of an Active Valve Resonant Pulse Combustor** J. Lisanti, X. Zhu, W. Roberts, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia	1100 hrs AIAA-2019-3872 **Experimental Study on Shortening Deflagration-to-Detonation Transition by Nanosecond Laser Ignition** T. Sato, K. Matsuoka, A. Kawasaki, J. Kasahara, Nagoya University, Nagoya, Japan	1130 hrs AIAA-2019-3873 **Characterization of an integrated nozzle and supersonic axial turbine with a rotating detonation combustor** J. Braun, D. Cuadrado, V. Andreoli, G. Paniagua, Z. Liu, J. Saavedra, Purdue University, West Lafayette, IN; et al.

Monday, 19 August 2019		
28-PGC-2 **0930 - 1200 hrs**	**Modeling Approaches for Rotating Detonation Engines (RDE)**	**White River I**

This tutorial will cover different aspects of modeling Rotating Detonation Engines (RDE). The tutorial starts with a basic description of RDEs and how they fit into the broader Pressure Gain Combustion field. After this brief introduction, the tutorial reviews simple thermodynamic models, some early computational fluid dynamic models (typically two-dimensional), and then finishes with reviewing some of the more detailed three-dimensional models that have been accomplished for RDEs. While discussing the different levels of modeling, the tutorial will highlight the strengths and weaknesses of each approach specifically for RDEs, and also what remains challenging areas of RDE modeling.

Monday, 19 August 2019				
29-SATS-1	**Small Satellites I**			**Room 202**
Chaired by: J. STRAUB, North Dakota State University				
0930 hrs AIAA-2019-3874 **Conformal Tanks: Small-Sat Propellant Management Technology** S. Collicott, E. Beckman, P. Srikanth, Purdue University, West Lafayette, IN	1000 hrs AIAA-2019-3875 **Optimized Curvilinear Potential Field based Multi-objective Satellite Collision Avoidance maneuver** A. Hamed, Military Technical College, Cairo, Egypt; A. Badawy, October University for Modern Sciences and Arts, Cairo, Egypt; A. Omar, M. Ashry, Military Technical College, Cairo, Egypt			

Monday, 19 August 2019				
30-SBE-1/EP-3/NFF-2/APC-2	**Solar and Beamed Energy Sail Concepts and Missions**			**Room 201**
Chaired by: H. WHITE, NASA-Johnson Space Center and G. WILLIAMS				
0930 hrs AIAA-2019-3876 **A Steerable Robotic Solar-Sail for Angular Momentum Dumping in the Lunar Gateway** F. Aghili, D. Rey, Canadian Space Agency, Saint-Hubert, Canada	1000 hrs AIAA-2019-3877 **Directed-Energy Laser-Thermal Propulsion for Rapid Transit Missions in the Solar System** Z. Bao, A. Higgins, McGill University, Montréal, Canada; P. Lubin, University of California, Santa Barbara, Santa Barbara, CA	1030 hrs Oral Presentation **Exploring the Kuiper Belt with Desorptive, Sun-Diving Solar Photon Sails** G. Matloff, G. Matloff, New York City College of Technology, Brooklyn, NY		

Monday, 19 August 2019				
31-SR-1	**Controllable Solid Rockets**			**Room 102**
Chaired by: M. BERDOYES, ARIANEGROUP and H. CIEZKI, DLR - German Aerospace Center				
0930 hrs AIAA-2019-3878 **Innovative ArianeGroup Controllable Solid Propulsion Technologies** P. Caubet, M. Berdoyes, ArianeGroup, Le Haillan, France	1000 hrs AIAA-2019-3879 **Hot Gas Nozzle-Valve Assembly and Control Method for Continuously Operating Divert- and Attitude Control Systems** K. Naumann, N. Hopfe, Bayern-Chemie, Aschau am Inn, Germany	1030 hrs Oral Presentation **Overview on Solid Propellant Divert- and/or Attitude Control Systems** K. Naumann, Bayern-Chemie, Aschau am Inn, Germany	1100 hrs AIAA-2019-3880 **Experimental and Numerical Investigation of a Jet Vane of Thrust Vector Control System** B. Söğütcü, B. Sümer, TUBITAK, Ankara, Turkey	1130 hrs AIAA-2019-3881 **Dynamic Characteristics of the Aerospike-Shaped Pintle Nozzle for Variable Thrust** D. Ha, J. Kim, Agency for Defense Development, Daejeon, South Korea; H. Kim, Chungnam National University, Daejeon, South Korea

Monday, 19 August 2019				
32-SYS-1	**Space Mission Designs and Concepts of Operation**			**Room 203**
Chaired by: P. CHAI, NASA Langley Research Center and C. JOYNER, Aerojet Rocketdyne				
0930 hrs AIAA-2019-3882 **Lunar Exploration and Access to Polar Regions (LEAPR)** W. Ruperto, A. Rullán, A. Zapata García, A. Rodríguez Morales, A. Colon Cesani, A. Figueroa Velez, University of Puerto Rico, Mayaguez, ; et al.	1000 hrs AIAA-2019-3883 **Project Luna: Hybrid Gateway-Based Cislunar Tug** A. Sosa, G. Andrew, S. Regmi, B. Caudill, E. Baker, S. Ronvelwala, Virginia Polytechnic Institute and State University, Blacksburg, VA; et al.	1030 hrs AIAA-2019-3884 **2018-2019 AIAA Undergraduate Space Design Competition: Reusable Lunar Surface Access Vehicle** P. Chai, NASA Langley Research Center, Hampton, VA	1100 hrs AIAA-2019-3885 **Functional and Concept Trade-off Analysis of a Mission Architecture for Moon and Cis-Lunar Orbit: SEEDS 2018-19** S. Nambiar, P. Pino, L. Marchino, D. Carabellese, M. Giuliani, Technical University of Turin, Turin, Italy	

Monday, 19 August 2019

33-TM-1 0930 - 1200 hrs	Future Demands for Thermal Management Technologies in Aerospace and Terrestrial Applications: Challenges and Opportunities	Room 205

Moderator: Michael K. Choi, NASA Goddard Space Flight Center

Panelists will discuss the future demand of thermal management technologies in aerospace and terrestrial applications. The applications include, but are not limited to, propulsion systems, energy systems, spacecraft, aircraft, and electronics. Emphasis will be placed on challenges and opportunities.

Panelists:

Suresh Garimella	Tim Fisher	Andrew Alleyne	Mitch Wolff	Charles Lents
Goodson Distinguished Professor of Mechanical Engineering Purdue University	Chair of Department of Mechanical and Aerospace Engineering UCLA	Ralph & Catherine Fisher Professor Director Power Optimization of Electro-Thermal Systems University of Illinois	Mechanical Engineering Professor Department of Mechanical and Materials Engineering Wright State University	Associate Director, Research United Technologies Research Center

Monday, 19 August 2019

34-F360-2 1045 - 1200 hrs	Monday Forum 360 AM: Human Exploration Launch Systems (Part II - Commercial Human Spaceflight)	JW Grand Ballroom 3/4

Moderator: Kelvin Coleman, Deputy Associate Administrator, Commercial Space Transportation, FAA

Panelists:

Christopher Allison	Hans Koenigsmann
Senior Systems Engineer Sierra Nevada Corporation	Vice President, Build and Flight Reliability SpaceX

Monday, 19 August 2019

35-LP-4 1100 - 1200 hrs	Introduction to Sloshing Dynamics in Space Vehicles	Room 106

Fluid sloshing forces are a significant consideration in the control and stability of a spacecraft during all parts of its mission. In this tutorial, Steve Green, Southwest Reasearch Institute, will describe the theoretical foundations of the modeling and testing approaches to estimating the effects of fluid dynamics through the use of mechanical analogs.

Monday, 19 August 2019

36-APC-3	Advanced Propulsion Concepts II			Room 208
Chaired by: T. GIEL, Jacobs Technology and J. ROBINSON				
1330 hrs AIAA-2019-3886 **Availability Responsiveness for Affordable Sustainable Reusable Space Transportation System** J. Robinson, Self, Seal Beach, CA	1400 hrs AIAA-2019-3887 **Assessment of feedstocks for blended alcohol-to-jet fuel manufacturing from standalone and distributed scheme for sustainable aviation** S. Jagtap, Imperial College London, London, United Kingdom	1430 hrs AIAA-2019-3888 **Theoretical and Experimental Analysis for an Air-Breathing Pulsed Plasma Thruster** M. Azuara Rosales, R. Winglee, C. Hansen, University of Washington, Seattle, Seattle, WA	1500 hrs AIAA-2019-3889 **Buoyant Hybrid Propulsion Rigid Airship Spacecraft** E. Kideys, Intelicraft, Inc., Princeton, NJ	

Monday, 19 August 2019

37-EDU-2	University Programs in Propulsion Education			Room 209
Chaired by: J. BENNEWITZ and J. BUCKLEY				
1330 hrs AIAA-2019-3890 **Rolls-Royce University Collaboration** J. Krok, Rolls-Royce Group plc, Indianapolis, IN; M. Jefferies, Rolls-Royce Group plc, Bristol, United Kingdom; L. Teague, Rolls-Royce Group plc, Indianapolis, IN; K. Barnard, Rolls-Royce Group plc, Bristol, United Kingdom	1400 hrs AIAA-2019-3891 **Propulsion Research and Academic Programs at the University of Alabama in Huntsville - PRC Strategic Plan– 2019** R. Frederick, L. Thomas, P. Ligrani, University of Alabama, Huntsville, Huntsville, AL	1430 hrs AIAA-2019-3892 **Rocket Development and Testing Capabilities at Embry-Riddle Aeronautical University - Prescott AZ Campus** E. Bryner, D. Dyck, C. Kurtz, Embry-Riddle Aeronautical University, Prescott, AZ	1500 hrs AIAA-2019-3893 **Undergraduate Research in Energy and Propulsion: Outcomes and Lessons Learned from a 9-Year REU Site** E. Petersen, J. Thomas, T. Sammet, Texas A&M University, College Station, TX; C. Aul, Stephen F. Austin State University, Nacogndoches, TX	1530 hrs AIAA-2019-3894 **Numerical simulation of ion energy distribution of the hollow cathode plume** Y. Qin, H. Liu, J. Geng, Y. Hu, X. Liu, Y. Shen, Chinese Academy of Sciences, Beijing, China

Monday, 19 August 2019				
38-EP-4	**Hall Thruster Flight Development**			**White River A/B**
Chaired by: M. WALKER, Georgia Institute of Technology and Y. RAITSES, Princeton Plasma Physics Laboratory				
1330 hrs AIAA-2019-3895 **Completion of the Long Duration Wear Test of the NASA HERMeS Hall Thruster** J. Frieman, H. Kamhawi, P. Peterson, D. Herman, NASA Glenn Research Center, Cleveland, OH; J. Gilland, Ohio Aerospace Institute, Cleveland, OH; R. Hofer, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA	1400 hrs AIAA-2019-3896 **Uncertainty in Electric Propulsion Erosion Measurements** J. Mackey, J. Frieman, D. Ahern, NASA Glenn Research Center, Cleveland, OH; J. Gilland, Ohio Aerospace Institute, Cleveland, OH	1430 hrs AIAA-2019-3897 **Evidence of Counter-Streaming Ions near the Inner Pole of the HERMeS Hall Thruster** W. Huang, H. Kamhawi, D. Herman, NASA Glenn Research Center, Cleveland, OH	1500 hrs AIAA-2019-3898 **Accelerating 23,000 hours of Ground Test Backsputtered Carbon on a Magnetically Shielded Hall Thruster** R. Lobbia, J. Polk, R. Hofer, V. Chaplin, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; B. Jorns, University of Michigan, Ann Arbor, Ann Arbor, MI	

Monday, 19 August 2019				
39-EP-5	**Electrospray Plasma Plume**			**Room 204**
Chaired by: B. PRINCE, Air Force Research Laboratory and M. JUGROOT				
1330 hrs AIAA-2019-3899 **Hydroxylammonium Nitrate Species in a Monopropellant Electrospray Plume** M. Wainwright, Missouri University of Science and Technology, Rolla, MO; J. Rovey, University of Illinois, Urbana-Champaign, Urbana, IL; S. Miller, Boston College, Boston, MA; B. Prince, Air Force Research Laboratory, Kirtland AFB, NM; S. Berg, University of Illinois, Urbana-Champaign, Urbana, IL	1400 hrs AIAA-2019-3900 **Experimental Investigation of Mixtures of 1-Ethyl-3-Methylimidazolium Ethyl sulfate and Ethylammonium Nitrate with Electrospray Propulsion Applications** M. Wainwright, Missouri University of Science and Technology, Rolla, MO; J. Rovey, University of Illinois, Urbana-Champaign, Urbana, IL; S. Miller, Boston College, Chestnut Hill, MA; B. Prince, Air Force Research Laboratory, Kirtland AFB, NM	1430 hrs AIAA-2019-3901 **Data-Driven Scaling Laws for Electrospray Plume Divergence from a Capillary Tube** P. Dahl, A. Kimber, B. Jorns, University of Michigan, Ann Arbor, Ann Arbor, MI		

Monday, 19 August 2019				
40-EP-6	**RF and Pulsed Electric Propulsion**			**Room 102**
Chaired by: J. GILLAND, Ohio Aerospace Institute and K. HARA, Texas A&M University				
1330 hrs AIAA-2019-3902 **Recent Advances in the Clustering of High Power Helicon Thrusters** K. Vereen, J. Correy, H. Martin, K. Durkee, A. Kullman, S. Fraser, University of Washington, Seattle, Seattle, WA; et al.	1400 hrs AIAA-2019-3903 **Comparison between Experiments and Numerical Simulations of a Radio-frequency Inductively Coupled Plasma Thruster** M. Yamauchi, T. Fujino, University of Tsukuba, Tsukuba, Japan	1430 hrs AIAA-2019-3904 **Impulse Measurements of Electric Solid Propellant in an Electrothermal Ablation-Fed Pulsed Plasma Thruster** M. Glascock, Missouri University of Science and Technology, Rolla, MO; J. Rovey, University of Illinois, Urbana-Champaign, Urbana, IL; K. Polzin, NASA Marshall Space Flight Center, Huntsville, AL	1500 hrs AIAA-2019-3905 **Spectroscopic Plasma Emission from a Pulsed Plasma Thruster with Asymmetric Electrodes** Y. Ling, S. Zhang, X. Liu, Beijing Institute of Technology, Beijing, China; Z. Zhang, H. Tang, Beihang University, Beijing, China	

Monday, 19 August 2019		
41-GTE-6 **1330 - 1500 hrs**	**Combustion in Supercritical CO2 Medium - Fundamentals and Recent Progress**	**Room 309/10**
This tutorial will discuss the development and validation of a combustion chemical kinetic mechanism for supercritical CO2 (sCO2) oxy-methane/syngas combustion that can be used for computational fluid dynamic code (CFD) simulations in oxy-combustion development. This model is validated using unique experiments conducted in CO2 diluted methane/syngas mixtures and for pressures up to 300 bar. Acquiring experimental data is critical in the development of a sCO2 detailed kinetic mechanism as there is currently none available for methane at very high pressures approaching 300 bar and for CO2 diluted methane mixtures even at normal pressures. This work will enable industry to tackle challenges associated with oxy-combustion systems in directly heated sCO2 power cycles and propulsion systems.		

Monday, 19 August 2019

42-GTE-7 1330 - 1600 hrs	Introduction to Dynamic Propulsion System Modeling for Control Design, Analysis, and Simulation	Room 201

Control design and analysis involve the use of plant models of the appropriate fidelity: high enough to capture the relevant dynamics, but also able to execute in a reasonable time. The modeling of electrified propulsion systems for control design and analysis involves a multidisciplinary approach accounting for the widely different dynamics of the turbomachinery, power system, and the thermal interactions involved. This tutorial will present an overview of dynamic modeling, simulation, and analysis tools developed at NASA Glenn Research Center, specifically designed for traditional and electrified propulsion systems.

Introduction
Jonathan Litt
NASA Glenn Research Center
Intelligent Controls and Autonomy Branch

Toolbox for Modeling and Analysis of Thermodynamic Systems (TMATS)
Jeffreys Chapman
NASA Glenn Research Center
Propulsion Systems Analysis Branch

Electrical Modeling and Thermal Analysis Toolbox (EMTAT)
Mark Bell
Vantage Partners LLC

Partial Turbo-Electric Propulsion System
Joseph Connolly
NASA Glenn Research Center
Intelligent Controls and Autonomy Branch

Thermal Systems Analysis Toolbox (TSATS)
Jonathan Kratz
NASA Glenn Research Center
Intelligent Controls and Autonomy Branch

Monday, 19 August 2019

43-GTE-8	Compressors II			Room 312
Chaired by: F. LOU, Purdue University and M. SHIMO, Rolls-Royce				
1330 hrs AIAA-2019-3907 **Interacting Flow Effects in the Stages of a Low-Speed Multistage Axial Compressor Using Shrouded and Cantilevered Stators** I. De Dominicis, Technical University of Munich, Munich, Germany; S. Robens, Siemens, Berlin, Germany; N. Wolfrum, MTU Aero Engines AG, Munich, Germany; M. Lange, Technical University of Dresden, Dresden, Germany; V. Gümmer, Technical University of Munich, Munich, Germany	1400 hrs AIAA-2019-3908 **Improved Loss Modeling for a 2D Through-flow Compressor Design Code** T. Lanchman, Wright State University, Dayton, OH; M. List, Air Force Research Laboratory, Wright-Patterson AFB, OH; M. Wolff, Wright State University, Dayton, OH	1430 hrs AIAA-2019-3909 **Preliminary Design of a Three-Stage Low-Speed Research Compressor Using Tandem Vanes** M. Hopfinger, V. Gümmer, Technical University of Munich, Garching, Germany		

Monday, 19 August 2019

44-GTE-9	Advanced Engine Cycles II			Room 311
Chaired by: M. BELMOUSS				
1330 hrs AIAA-2019-3910 **Design and optimization of a micro turbine engine centrifugal compressor for engineering education** F. Fernandez-Fraire, C. Sanchez-Ramirez, Autonomous University of Chihuahua, Chihuahua, Mexico	1400 hrs AIAA-2019-3911 **Modeling of Micro Turbojet Engine** M. Ashry, M. Kamel, A. Shehata, Military Technical College, Nasr City, Egypt	1430 hrs AIAA-2019-3912 **Bypass Fan System of Turbofan Engines Optimization** I. Klimov, L. Moroz, E. Rublevskyi, T. Hryshchenko, SoftInWay, Inc., Burlington, MA	1500 hrs AIAA-2019-3913 **Application of Digital Twin for Gas Turbine Off-Design Performance and Operation Analyses** L. Moroz, M. Burlaka, V. Barannik, SoftInWay, Inc., Burlington, MA	

Monday, 19 August 2019

45-GTE-10	Multidisciplinary Design, Analysis, Optimization II			Room 307
Chaired by: D. SANDERS, Air Force Reseach Laboratory				
1330 hrs AIAA-2019-3914 **The Concept of Obtaining Reliable Compressor Characteristics Based on a Multilevel Mathematical Model with a Two-Stage Identification** I. Egorov, E. Marchukov, Moscow Aviation Institute, Moscow, Russia; A. Volkov, G. Popov, O. Baturin, Samara National Research University, Samara, Russia	1400 hrs AIAA-2019-3915 **Multidisciplinary Optimization of Compressor Stage with Different Parameterization Methods** G. Popov, E. Goriachkin, Samara National Research University, Samara, Russia; I. Egorov, Moscow Aviation Institute, Moscow, Russia; T. Buyukli, A. Salnikov, Central Institute of Aviation Motors, Moscow, Russia	1430 hrs AIAA-2019-3916 **Minimum Weight Engine Configuration Given Required Power** S. Torrez, Physical Sciences, Inc., Andover, MA		

Monday, 19 August 2019				
46-HR-3	**Combustion Stability, Motor Performance, and Related Issues I**			**Room 104**
Chaired by: B. BRADY, The Aerospace Corporation				
1330 hrs AIAA-2019-3917 **Evaluation of Safety Distance for Blast of Hybrid Rocket Propellants** A. Takahashi, Nihon University, Funabashi, Japan; K. Kitagawa, T. Shimada, Japan Aerospace Exploration Agency (JAXA), Sagamihara, Japan	1400 hrs AIAA-2019-3918 **Response Mechanisms in Axial-Injection End-Burning Hybrid Rockets** Y. Saito, Tohoku University, Sendai, Japan; A. Tsuji, A. Yamada, H. Nagata, Hokkaido University, Sapporo, Japan	1430 hrs AIAA-2019-3919 **Simulation of Surface Instabilities in Liquefying Hybrid Rocket Fuels** I. Knol, B. Maicke, Pennsylvania State University, Middletown, PA	1500 hrs AIAA-2019-3920 **Suppressing the LFI with Dual Fuel in Hybrid Rocket Combustion** H. Chae, C. Lee, Konkuk University, Seoul, South Korea	

Monday, 19 August 2019				
47-HR-4	**Development and Evaluation of Novel O/F Formulations and Combinations**			**Room 103**
Chaired by: G. STORY, NASA Marshall Space Flight Center				
1330 hrs AIAA-2019-3921 **Selection Criteria for Tackifier Addition to Paraffin Wax based Hybrid Rocket Fuels** K. Bilge, U. Kokal, N. Emerce, U. Yildiz, M. Baysal, DeltaV Space Technologies, Inc., Istanbul, Turkey; A. Karabeyoglu, Koc University, Istanbul, Turkey	1400 hrs AIAA-2019-3922 **Performance Enhancing Additives for Hybrid Rockets** H. Karakas, O. Kara, DeltaV Space Technologies, Inc., Istanbul, Turkey; I. Ozkol, Istanbul Technical University, Istanbul, Turkey; A. Karabeyoglu, DeltaV Space Technologies, Inc., Istanbul, Turkey	1430 hrs AIAA-2019-3923 **Experimental Test of N2O/CO2 Oxidizer Mixture with Paraffin based Aluminum Fuel for Mars Ascent Vehicles** O. Kara, H. Karakas, A. Karabeyoglu, DeltaV Space Technologies, Inc., Istanbul, Turkey		

Monday, 19 August 2019				
48-HSABP-2	**Flowpath Plasma Applications**			**Room 305/06**
Chaired by: J. BRAUN, Purdue and D. PAXSON, NASA Glenn Research Center				
1330 hrs AIAA-2019-3924 **Cold Start-Up and Plasma-Based Flameholding in Model Scramjet** A. Houpt, S. Elliott, S. Leonov, University of Notre Dame, Notre Dame, IN	1400 hrs AIAA-2019-3925 **Instabilities of Supersonic Combustion at Plasma-Based Flameholding** S. Elliott, A. Houpt, S. Leonov, University of Notre Dame, Notre Dame, IN	1430 hrs AIAA-2019-3926 **Laser-Induced Plasma Ignition Experiments in a Direct-Connect Supersonic Combustor at Mach 3** D. Baccarella, G. Lee, Q. Liu, G. Elliott, J. Freund, T. Lee, University of Illinois, Urbana-Champaign, Urbana, IL		

Monday, 19 August 2019				
49-INPSI-3	**Propulsion Aerodynamics Workshop: Nozzle Session (Invited)**			**Room 308**
Chaired by: D. CROWE, Air Force Research Laboratory				
1330 hrs AIAA-2019-3927 **Propulsion Aerodynamic Workshop IV: Modeling of the Jet From a High Aspect Ratio Rectangular Convergent Nozzle, With and Without an Aft Deck, at Pressure Ratios up to 3.5, Including a Comparison With Experimental Results (Invited)** D. Crowe, Air Force Institute of Technology, Wright-Patterson AFB, OH; R. Thornock, Self, Seattle, WA; T. Brown, Air Force Institute of Technology, Wright-Patterson AFB, OH	1400 hrs AIAA-2019-3928 **FUN3D and USM3D Analysis of the 4th AIAA Propulsion Aerodynamic Workshop Nozzle Test Case (Invited)** M. Bozeman, M. Carter, NASA Langley Research Center, Hampton, VA	1430 hrs AIAA-2019-3929 **Lattice-Boltzmann Very Large Eddy Simulations of an Underexpanded Jet from a Rectangular Nozzle with and without Aft-deck (Invited)** J. Kopriva, F. Polidoro, C. Nardari, L. Gregory, Dassault Group, Waltham, MA	1500 hrs AIAA-2019-3930 **BCFD and Kestrel Analysis for the 4th AIAA Propulsion Aerodynamics Workshop: Nozzle Results (Invited)** C. Winkler, The Boeing Company, Hazelwood, MO; D. Crowe, Air Force Institute of Technology, Wright-Patterson AFB, OH	

Monday, 19 August 2019				
50-LP-5	**Liquid Rocket Propellant Injectors I**			**Room 105**
Chaired by: S. MILLER, Aerojet Rocketdyne and W. MARSHALL, NASA-Glenn Research Center				
1330 hrs AIAA-2019-3931 **Impact of Supercritical and Transcritical Effects on Rocket Engine Injector Mass Flux and Stiffness** N. Gloria, Stanford University, Stanford, CA	1400 hrs AIAA-2019-3932 **Uncertainty Analysis of Experimental Discharge Coefficients in Additively Manufactured Liquid Injector Elements** J. Venters, M. Costa, E. Unruh, D. Lineberry, R. Frederick, University of Alabama, Huntsville, Huntsville, AL; J. Wood, NASA Marshall Space Flight Center, Huntsville, AL; et al.	1430 hrs AIAA-2019-3933 **Stiff phase-change phenomenon modeled by a compressible LES solver** W. Yao, Y. Jin, Y. Li, Chinese Academy of Sciences, Beijing, China		

Monday, 19 August 2019				
51-LP-6	**Student Liquid Rocket Engine and Vehicle Programs**			**Room 301**
Chaired by: A. LEKEUX, CNES and E. BESNARD, Vector and J. RICCIUS, DLR - German Aerospace Center				
1330 hrs AIAA-2019-3934 **Student Development of a Liquid Oxygen, Liquid Methane Sounding Rocket and Launch Infrastructure** S. Meriam, C. Nilsen, M. Tanner, K. Runkle, B. Jacob, R. Groome, Purdue University, West Lafayette, IN; et al.	1400 hrs AIAA-2019-3935 **Update on the Student Development of a Nitrous Oxide-Ethane Bipropellant Rocket Engine** M. Perry, E. Korizon, O. Copeland, A. Bower, University of Alabama, Huntsville, Huntsville, AL	1430 hrs AIAA-2019-3936 **Modular Liquid Propellant Launch Vehicle Design** D. Honkawa, M. Yoozbashizadeh, California State University, Long Beach, CA	1500 hrs AIAA-2019-3937 **Design and Testing of a 500 lbf Liquid Oxygen/ Liquid Methane Engine** M. Herrera, M. Chaidez, Z. Welsh, J. Adams, L. Bugarin, J. Chessa, University of Texas, El Paso, El Paso, TX; et al.	

Monday, 19 August 2019				
52-LP-7	**Liquid Propulsion Chamber Cooling**			**Room 106**
Chaired by: C. KIRCHBERGER, German Aerospace Center (DLR) and J. GRUMBACH				
1330 hrs AIAA-2019-3938 **Optimization of Regeneratively Cooled Rocket Engines Cooling Channel Dimensions** E. Atefi, M. Naraghi, Manhattan College, Riverdale, NY	1400 hrs AIAA-2019-3939 **Carbon Deposit Formation in Supercritical Methane-based, Hydrocarbon Fuels Using a Cooling Channel Surrogate** R. Driscoll, T. Moore, B. Brady, S. Frolik, J. Morehart, The Aerospace Corporation, El Segundo, CA	1430 hrs AIAA-2019-3940 **Numerical Investigation of Bulk Velocity and Pressure on Near Wall Chemistry in Fuel Rich RP-2/GOX Combustion** R. Kulakhmetov, T. Pourpoint, Purdue University, West Lafayette, IN	1500 hrs AIAA-2019-3941 **A first step into the blanching modelling of Liquid Rocket Engines: taking into account the roughness increase of the chamber wall** J. Riccius, M. Böttcher, German Aerospace Center (DLR), Lampoldshausen, Germany	

Monday, 19 August 2019					
53-NFF-3	**Nuclear Thermal Rockets - Analysis and Models**				**White River J**
Chaired by: B. PALASZEWSKI, NASA Glenn Research Center and J. CAVERA, Blue Origin LLC					
1330 hrs AIAA-2019-3942 **Nuclear Thermal Propulsion Vehicle Scaling and the Importance of Densified Propellant** A. Aueron, L. Thomas, University of Alabama, Huntsville, Huntsville, AL	1400 hrs AIAA-2019-3943 **Evolution of Low Enriched Uranium Nuclear Thermal Propulsion Vehicle and Engine Design** D. Levack, J. Horton, Aerojet Rocketdyne, Canoga Park, CA; T. Jennings, C. Joyner, Aerojet Rocketdyne, West Palm Beach, FL; T. Kokan, Aerojet Rocketdyne, Huntsville, AL; J. Mandel, Aerojet Rocketdyne, Canoga Park, CA; et al.	1430 hrs AIAA-2019-3944 **Thermal, Fluid, and Neutronic Analysis of the GCD LEU Nuclear Thermal Propulsion Core** M. Stewart, NASA Glenn Research Center, Cleveland, OH	1500 hrs AIAA-2019-3945 **Material Characterization of Subscale Molybdenum Cermets for Nuclear Thermal Propulsion** T. Duffin, S. Zinkle, University of Tennessee, Knoxville, Knoxville, TN; K. Benensky, NASA Marshall Space Flight Center, Huntsville, AL	1530 hrs AIAA-2019-3946 **Nuclear Thermal Rocket System Instrumentation** D. Floyd, D. Sikorski, R. Wood, University of Tennessee, Knoxville, Knoxville, TN

Monday, 19 August 2019		
54-PC-4 **1330 - 1530 hrs**	**Model Validation for Propulsion**	**Room 101**
A summary of the key outcomes from the Model validation for Propulsion (MVP) workshop series will be provided and discussed. Invited speakers will present topics relevant to model validation of turbulent reacting flows. Significant time will be allocated for audience feedback and open discussion regarding MVP progress and future validation efforts.		

Monday, 19 August 2019				
55-PC-5	**Combustion Dynamics II**			**White River G**
Chaired by: K. MCMANUS, GE Global Research Center and V. SANKARAN, US Air Force/AFRL/RQRC				
1330 hrs Oral Presentation **Challenges in Stabilizing High-Speed Ethylene-Air Premixed Turbulent Flames over Cavity Recirculation Regions with Applications to Hypersonic Propulsion Systems (Invited)** H. Chelliah, University of Virginia, Charlottesville, Charlottesville, VA	1400 hrs AIAA-2019-3947 **Transverse Combustion Instabilities in a High Pressure Multi-Element Combustor** R. Gejji, W. Anderson, Purdue University, West Lafayette, IN; B. Austin, INSpace, LLC, West Lafayette, IN	1430 hrs AIAA-2019-3948 **Investigation of Combustion Instabilities in a Full Flow Staged Combustion Model Rocket Combustor** A. Lemcherfi, R. Gejji, T. Fuller, W. Anderson, C. Slabaugh, Purdue University, West Lafayette, IN	1500 hrs AIAA-2019-3949 **Experimental Analysis of Thermoacoustic Oscillations in a Model Aeronautical Gas Turbine Combustor at Realistic Conditions** M. Passarelli, T. Wabel, University of Toronto, Toronto, Canada; K. Venkatesan, A. Cross, General Electric Company, Niskayuna, NY; A. Steinberg, Georgia Institute of Technology, Atlanta, GA	1530 hrs AIAA-2019-3950 **Plasma-Assisted Control of Combustion Instabilities in Low-Emissions Combustors at Realistic Conditions** F. Gomez del Campo, FGC Plasma Solutions, Somerville, MA

Monday, 19 August 2019				
56-PGC-3/HSABP-3	**Pressure Gain Combustion: Physics Modeling and Exploration I**			**White River C/D**
Chaired by: E. BACH, TU Berlin and G. MEHOLIC, The Aerospace Corporation				
1330 hrs AIAA-2019-3951 **Chemical Kinetic Effects on Detonation Wave Generation in a Semi-Bounded Channel** K. Schwinn, R. Gejji, C. Slabaugh, Purdue University, West Lafayette, IN	1400 hrs AIAA-2019-3952 **Detonation Limits and Velocity Deficits of CH4, C2H4, C2H6 and C3H8 with N2O in a Small Diameter Tube** M. Hageman, D. Hopper, M. Knadler, U.S. Air Force Academy, Colorado Springs, CO	1430 hrs AIAA-2019-3953 **Momentum Transfer and the Stability of Detonations** C. Nordeen, New Cycle Engineering, LLC, Manchester, CT; D. Schwer, Naval Research Laboratory, Washington, D.C.	1500 hrs AIAA-2019-3954 **Numerical studies of initiations in preheated regions and possible implications to PDE and RDE** J. Tegner, Swedish Defense Research Agency (FOI), Stockholm, Sweden	

Monday, 19 August 2019		
57-PGC-4 **1330 - 1600 hrs**	**Experimental Efforts with Rotating Detonation Engines (RDE)**	**White River I**
This technical workshop will review considerations for conducting experimentation of rotating detonation engines. It will cover different classes of RDEs, which fuels are friendly for research and provide design recommendations for experimental RDE hardware. It will also review special considerations for test facility setup, instrumentation and data acquisition. There will be some discussion of proper interpretation of measured RDE data.		

Monday, 19 August 2019				
58-SATS-2	**Small Satellites II**			**Room 202**
Chaired by: J. STRAUB, North Dakota State University				
1330 hrs AIAA-2019-3955 **Comparison of Performance by different operation method of a Water Resistojet Propulsion System : AQUARIUS Installed on 6U CubeSat : EQUULEUS.** K. Kikuchi, K. Nishii, M. Akiyama, Q. Wang, M. Murohara, Y. Ataka, University of Tokyo, Bunkyo, Japan; et al.	1400 hrs AIAA-2019-3956 **Design, Development, and Certification, of the Seeker Robotic Free Flier Propulsion System** C. Radke, M. Atwell, B. Studak, NASA Johnson Space Center, Houston, TX	1430 hrs **Panel**		

Monday, 19 August 2019				
59-SR-2	**Solid Rocket Simulation and Analysis Methodologies I**			**Room 107**
Chaired by: R. YOUNG, Northrop Grumman Innovation Systems and J. MAJDALANI, Auburn University				
1330 hrs AIAA-2019-3957 **Development of the Multifactorial Computational Models of the Solid Propellants Combustion by Means of Data Science Methods –Phase III** V. Abrukov, Chuvash State University, Cheboksary, Russia; A. Lukin, Western-Caucasus Research Center, Tuapse, Russia; N. C, C. Oommen, Indian Institute of Science, Bengaluru, India; M. V. Kiselev, D. A. Anufrieva, Chuvash State University, Cheboksary, Russia; et al.	1400 hrs AIAA-2019-3958 **Fully Transient Conjugate Analysis of Silica-Phenolic Charring Ablation Coupled with Interior Ballistics** C. Alanyalioglu, TUBITAK, Ankara, Turkey; Y. Özyörük, Middle East Technical University, Ankara, Turkey	1430 hrs AIAA-2019-3959 **Numerical simulations of air inclusions using ROBOOST simulation tool** F. Ponti, S. Mini, University of Bologna, Bologna, Italy; A. Annovazzi, Avio S.p.A., Colleferro, Italy	1500 hrs AIAA-2019-3960 **A simplified approach to predict Friedman Curl effect in a solid rocket motor using ROBOOST simulation tool** F. Ponti, S. Mini, University of Bologna, Bologna, Italy; A. Annovazzi, Avio S.p.A., Colleferro, Italy	

Monday, 19 August 2019				
60-SYS-2	**Space Mission Analysis and Design**			**Room 203**
Chaired by: C. JOYNER, Aerojet Rocketdyne				
1330 hrs AIAA-2019-3961 **Hybrid Transportation System Integrated Trajectory Design and Optimization for Mars Landing Site Accessibility** P. Chai, NASA Langley Research Center, Hampton, VA; M. Qu, Analytical Mechanics Associates, Inc., Hampton, VA; R. Merrill, NASA Langley Research Center, Hampton, VA; K. Pfrang, Massachusetts Institute of Technology, Cambridge, MA	1400 hrs AIAA-2019-3962 **SPARROW: A Steam Propelled Autonomous Retrieval Robot for Ocean Worlds** G. Meirion-Griffith, D. Levine, B. Hockman, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; T. Pourpoint, Purdue University, West Lafayette, IN	1430 hrs AIAA-2019-3963 **A Kuiper Belt Object Orbiter Enabled By 10 kW Kilopower Electric Propulsion** S. Oleson, NASA Glenn Research Center, Cleveland, OH; P. Schmitz, Vantage Partners, LLC, Cleveland, OH	1500 hrs AIAA-2019-3964 **Making it Through the Lunar Night Using Chemicals: Internal Combustion Engine Solar Independent Propulsion** C. Dyess, Technology Elevated, LLC, Kansas City, MO; W. Platts, Technology Elevated, LLC, Brookville, PA	

Monday, 19 August 2019				
61-TM-2	**Thermal System Applications and Unique Environment**			**Room 205**
Chaired by: M. CHOI, NASA-Goddard Space Flight Center and D. ZAKAR, NRL				
1330 hrs AIAA-2019-3965 **Effects of Coolant Supply Arrangement on Hot-Side Effusion Performance and Cold-Side Nusselt Numbers at Different Initial Blowing Ratios** P. Ligrani, A. Click, D. Ritchie, University of Alabama, Huntsville, Huntsville, AL; F. Liberatore, R. Patel, Y. Ho, Solar Turbines, Inc., San Diego, CA	1400 hrs AIAA-2019-3966 **Successful Use of Microporous Polytetrafluoroethylene Flexible Thin Sheets in NASA's OSIRIS-REx Mission** M. Choi, B. Bos, J. Tveekrem, NASA Goddard Space Flight Center, Greenbelt, MD; C. d'Aubigny, B. Rizk, D. Lauretta, University of Arizona, Tucson, Tucson, AZ	1430 hrs AIAA-2019-3967 **Double Wall Cooling of an Effusion Plate with Cross Flow and Impingement Jet Combination Internal Cooling: Comparisons of Main Flow Contraction Ratio Effects** A. Click, D. Ritchie, P. Ligrani, University of Alabama, Huntsville, Huntsville, AK; F. Liberatore, R. Patel, Y. Ho, Solar Turbines, Inc., San Diego, CA	1500 hrs AIAA-2019-3968 **On The Modeling of Vortex Tubes Cooling Performance** E. Khalil, K. Beshay, G. ElHarriri, M. AbdelGhafar, Cairo University, Cairo, Egypt	

Monday, 19 August 2019		
62-F360-3 **1400 - 1600 hrs**	**Monday Forum 360 PM: Lunar, Martian and Deep Space Exploration: Electric Propulsion and System Application**	**JW Grand Ballroom 3/4**

Moderator: Daniel Herman, Power and Propulsion Element Ion Propulsion System Lead, Electric Propulsion Systems Branch, NASA Glenn Research Center

Panelists:

Joseph Cassady	**Franklin Chang Diaz**	**Christopher D'Souza**	**Ty Lee**	**Kathleen Howell**
Executive Director, Space Aerojet Rocketdyne	CEO and Board Chairman Ad Astra Rocket Company	Navigation Technical Discipline Lead for Human Spaceflight NASA Johnson Space Center	Lead, Power and Propulsion Element Systems Engineering Maxar Space Solutions	Hsu Lo Distinguished Professor of Aeronautics and Astronautics Purdue University

Monday, 19 August 2019		
63-NW-3 **1600 - 1630 hrs**	**Networking Break**	**JW Grand Ballroom Prefunction**

Monday, 19 August 2019		
64-LEC-1 **1630 - 1730 hrs**	**Pickering Awards Lecture**	**JW Grand Ballroom 5**

Monday, 19 August 2019		
65-NW-4 **1800 - 1930 hrs**	**Young Professionals Networking Reception**	**JW Grand Ballroom Prefunction**

Tuesday

Tuesday, 20 August 2019

66-SB-2 0730 - 0800 hrs	Tuesday Speaker Briefing	Session Rooms

Tuesday, 20 August 2019

67-PLNRY-2 0800 - 0900 hrs	Tuesday Plenary: Partnering Advances in Aerospace	JW Grand Ballroom 5

Opening Remarks
The Honorable Eric Holcomb
Governor, Indiana

Speakers:

Mung Chiang
Dean of Engineering
Purdue University

Kathleen Howell
Hsu Lo Distinguished Professor of Aeronautics and Astronautics
Purdue University

David Spencer
Director, Space Flight Projects Laboratory, and
Associate Professor, School of Aeronautics and Astronautics
Purdue University

Tuesday, 20 August 2019

68-NW-5 0900 - 0930 hrs	Networking Break	JW Grand Ballroom Prefunction

Tuesday, 20 August 2019

69-AVS-1 0930 - 1200 hrs	Small Launch Vehicle Propulsion Panel	White River I

The revolutionary development of small satellites in recent years has created a strong demand for dedicate launch service. Many companies have started development of small sat launch vehicles in response to this market demand. This panel invites Small Sat Launch Vehicle developers to provide a status on their vehicle development and unique propulsion features of their concepts.

Tuesday, 20 August 2019

70-COL-1	Space Architecture and Lunar Mission Considerations			Room 202
Chaired by: R. HOWARD, NASA Johnson Space Center				
0930 hrs AIAA-2019-3969 **Lunar Lander Architectural Considerations** X. Simon, M. Duggan, J. Engle, T. Moseman, The Boeing Company, Houston, TX	1000 hrs AIAA-2019-3970 **A Permanent Human Lunar Surface Presence Enabled By a CLV Class JUMP Lander** R. Howard, NASA Johnson Space Center, Houston, TX	1030 hrs AIAA-2019-3971 **Commercialization and Human Settlement of the Moon and Cislunar Space - A Look Ahead at the Possibilities Over the Next 50 Years** S. Borowski, Self, Cleveland, OH; S. Ryan, NASA Glenn Research Center, Cleveland, OH; D. McCurdy, Vantage Partners, LLC, Brook Park, OH; B. Sauls, XP4D, LLC, Seabrook, TX	1100 hrs AIAA-2019-3972 **Resilience-oriented Design of Extraterrestrial Habitat Systems** A. Maghareh, A. Lenjani, S. Dyke, K. Marais, D. Whitaker, A. Bobet, Purdue University, West Lafayette, IN; et al.	

Tuesday, 20 August 2019

71-ECD-1	Stirling Energy Conversion Components and Analysis			Room 305/06
Chaired by: D. WOERNER, Jet Propulsion Laboratory				
0930 hrs AIAA-2019-3973 **Analytical Evaluation of Appendix Gap Losses in Stirling Cryocoolers** P. Graefe, H. Kuehl, Technical University of Dortmund, Dortmund, Germany	1000 hrs AIAA-2019-3974 **Experimental Investigation of Stirling Engine Robust Foil Regenerator** K. Yanaga, S. Qiu, West Virginia University, Morgantown, WV	1030 hrs AIAA-2019-3975 **Design and Development of a Heater Head for Free-Piston Stirling Engine** Y. Gao, S. Qiu, R. Li, West Virginia University, Morgantown, WV	1100 hrs AIAA-2019-3976 **Overview of Multi-Layer Metal Insulation Development for Small Stirling Convertors at NASA GRC** D. Goodell, N. Schifer, S. Wilson, NASA Glenn Research Center, Cleveland, OH	1130 hrs AIAA-2019-3977 **Thermo-Radiative Cell - A New Waste Heat Recovery Technology for Space Power Applications** J. Wang, C. Chen, R. Bonner, W. Anderson, Advanced Cooling Technologies, Inc., Lancaster, PA

Tuesday, 20 August 2019				
72-ECS-1	**Launch Vehicle Explosive-Mechanical Devices: Detonation Theory, Device Design and Testing**			**Room 102**
Chaired by: S. SAWHILL, Systima Technologies, Inc. and J. ZEVENBERGEN, Delft Technical University of Technology				
0930 hrs AIAA-2019-3978 **Characterization of the Influence of No-Fire Testing on Electro-Explosive Devices Utilizing Thermal Transient Test (TTT) Methods** C. Moore, NASA Kennedy Space Center, Cape Canaveral, FL; T. Hinkel, M. Maples, M. Dutton, K. Heiman, NASA Johnson Space Center, Houston, TX; M. O'Malley, NASA Kennedy Space Center, Cape Canaveral, FL; et al.	1000 hrs AIAA-2019-3979 **Behavior of Equation-of-State (EOS) in Detonation of Solid Energetic Materials, II** L. Yang, Self, La Canada Flintridge, CA	1030 hrs AIAA-2019-3980 **New Formulation For Studying of Detonation Of Gaseous Energetic Mixtures** L. Yang, Self, La Canada Flintridge, CA	1100 hrs AIAA-2019-3981 **Utilization of Hydraulic Damping in Explosive-Mechanical Devices** H. Lee, Chemring Energetic Devices, Downers Grove, IL	

Tuesday, 20 August 2019				
73-EDU-3	**Student Research Projects in Propulsion Education I**			**Room 301**
Chaired by: A. PATEL and R. FREDERICK, UAH Propulsion Research Center				
0930 hrs AIAA-2019-3982 **Design and Testing of a Low Thrust Liquid Oxygen and Liquid Methane Rocket Engine** F. Chandler, California State Polytechnic University, Pomona, CA	1000 hrs AIAA-2019-3983 **Thermal Analysis Techniques and Autoignition Testing for Solid Polymers: a Review** D. Jones, R. Frederick, University of Alabama, Huntsville, Huntsville, AL	1030 hrs AIAA-2019-3984 **Experimental Investigation of High Regression Rate Paraffin for Solid Fuel Ramjet Propulsion** V. Azevedo, I. Alves, O. Shynkarenko, University of Brasilia, Brasilia, Brazil; C. Veras, Brazilian Space Agency, Brasilia, Brazil	1100 hrs AIAA-2019-3985 **Design of Planet Landers for Soft Landing with DHEM Propulsion System-Phase-I** A. Mariappan, A. Sukumaran, T. U K, Kumaraguru College of Technology, Coimbatore, India; A. Kumar, S. Yoon, Sejong University, Coimbatore, India; V. Sanal Kumar, Indian Space Research Organisation, Trivandrum, India; et al.	1130 hrs AIAA-2019-3986 **Design of a High Pressure, Optically Accessible Flame Tube for Plasma-Assisted Combustion Studies** F. Gomez del Campo, Argonne National Laboratory, Argonne, IL

Tuesday, 20 August 2019				
74-EP-7	**Hall Thruster Plasma Plume**			**Room 204**
Chaired by: T. SWANSON, AEDC and J. PILCHUK, Orbital ATK				
0930 hrs AIAA-2019-3987 **Erosion of a meshed reflector in the plume of a Hall effect thruster, Part 1: Modeling** M. Meyer, M. Byrne, B. Jorns, I. Boyd, University of Michigan, Ann Arbor, Ann Arbor, MI	1000 hrs AIAA-2019-3988 **Erosion of Meshed Reflector in the Plume of a Hall Effect Thruster, Part 2: Experiments** M. Byrne, M. Meyer, I. Boyd, B. Jorns, University of Michigan, Ann Arbor, Ann Arbor, MI	1030 hrs AIAA-2019-3989 **3D Detailed Far Field Plume Modeling of SPT-100** A. Tekinalp, D. Levin, University of Illinois, Urbana-Champaign, Urbana, IL	1100 hrs AIAA-2019-3990 **Behavior of Triple Langmuir Probes in Non-equilibrium Plasmas** K. Polzin, E. Blumhagen, NASA Marshall Space Flight Center, Huntsville, AL; A. Sherrod, T. Moeller, University of Tennessee, Tullahoma, Tullahoma, TN	

Tuesday, 20 August 2019				
75-EP-8	**Ion and Hall Thruster Simulations**			**Room 208**
Chaired by: R. THOMAS and M. WAINWRIGHT				
0930 hrs AIAA-2019-3991 **Effect of Electron Source Location on Ion Thruster Plume Neutralization and Backflow Characteristics Using PIC-DSMC** R. Jambunathan, D. Levin, University of Illinois, Urbana-Champaign, Urbana, IL	1000 hrs AIAA-2019-3992 **Direct Grid-Based Vlasov Simulation of Collisionless Plasma Expansion of Ion Thruster Plume** C. Cui, Y. Hu, J. Wang, University of Southern California, Los Angeles, CA	1030 hrs AIAA-2019-3993 **A Numerical Study on Plasma Plumes of an Ion Thruster Using a decoupled PIC-MCC method** J. Wang, Beihang University, Beijing, China; Y. Jiang, Hong Kong Polytechnic University, Hong Kong, China; C. Laiwen, C. Lee, Beihang University, Beijing, China	1100 hrs AIAA-2019-3994 **Unknown Input and State Estimation in Plasma Dynamical Systems for Data-Driven Modeling Applications** K. Hara, M. Majji, C. Greve, Texas A&M University, College Station, TX	

Tuesday, 20 August 2019

76-EP-9	Unconventional Propellants for Plasma Thrusters			Room 205
Chaired by: G. BENAVIDES, NASA Glenn Research Center and L. PINERO, NASA Glenn Research Center				
0930 hrs AIAA-2019-3995 **Development Status and Way Forward of SITAEL's Air-breathing Electric Propulsion Engine** T. Andreussi, E. Ferrato, V. Giannetti, A. Piragino, SITAEL S.p.A., Pisa, Italy; C. Paissoni, Technical University of Turin, Turin, Italy; G. Cifali, SITAEL S.p.A., Pisa, Italy; et al.	1000 hrs AIAA-2019-3996 **Development of an Iodine Feeding System for Low Power Ion and Hall Effect Thrusters** F. Paganucci, L. Bernazzani, A. Ceccarini, M. Saravia, University of Pisa, Pisa, Italy	1030 hrs AIAA-2019-3997 **Development of an Iodine Compatible Hollow Cathode** S. Thompson, J. VanGermert, Colorado State University, Fort Collins, CO; C. Farnell, C. Farnell, S. Farnell, Plasma Controls, LLC, Fort Collins, CO; T. Hensen, Colorado State University, Fort Collins, CO; et al.	1100 hrs AIAA-2019-3998 **PIC Simulations of Chemistry Effects in an Electrodeless Water Plasma Thruster** E. Petro, R. Sedwick, University of Maryland, College Park, College Park, MD; L. Brieda, Particle In Cell Consulting, LLC, Westlake Village, CA	1130 hrs AIAA-2019-3999 **Hall thruster performances using low cost propellant** J. Yamasaki, S. Yokota, K. Shimamura, University of Tsukuba, Tsukuba, Japan

Tuesday, 20 August 2019

77-F360-5 0930 - 1045 hrs	Tuesday Forum 360 AM: Propulsion Efficiency: Engine Optimization and MRO Advancements (Part I - Turbine and Combustion Efficiency Trends)	JW Grand Ballroom 3/4

Moderator: Kenneth Suder, Senior Technologist, Airbreathing Propulsion, Propulsion Division, Research and Engineering Directorate, NASA Glenn Research Center

Panelists:

William "Bill" Cummings
Chief, Combustor and Turbine Aero
Rolls-Royce Corporation

Sunil James
Senior Technical Manager, Propulsion Technologies
Honeywell Aerospace

Irewole "Wally" Orisamolu
Associate Director, Advanced Propulsion Technologies
Pratt & Whitney

Carlos Perez
Advanced Systems Design & Technology Lead
GE Aviation

Tuesday, 20 August 2019

78-GTE-11	Test Facilities for Gas Turbine Engines and Components			Room 311
Chaired by: A. NIX, West Virginia University				
0930 hrs AIAA-2019-4000 **Purdue 3-Stage Axial Compressor Research Facility: Through the Years, to Infinity, and Beyond** N. Kormanik, D. Matthews, N. Key, Purdue University, West Lafayette, IN; A. King, Rolls-Royce Group plc, Indianapolis, IN	1000 hrs AIAA-2019-4001 **Development of a 10MW facility for gas turbine engine and component testing** C. Bernardini, T. Takakura, E. Perez, J. Cameron, S. Morris, University of Notre Dame, Notre Dame, IN	1030 hrs AIAA-2019-4002 **The Compact Icing Research Tunnel (CIRT)** E. Tetteh, E. Loth, University of Virginia, Charlottesville, Charlottesville, VA; J. Loebig, J. Cummings, Rolls-Royce Group plc, Indianapolis, IN; N. Lilly, University of Virginia, Charlottesville, Charlottesville, VA	1100 hrs AIAA-2019-4003 **Development and Commissioning of a High-Speed Research Compressor Facility** M. Schmieder, W. Erhard, V. Gümmer, Technical University of Munich, Munich, Germany; C. Aalburg, P. Schuler, General Electric Company, Munich, Germany; C. Schneider, Self, Munich, Germany; et al.	1130 hrs AIAA-2019-4004 **Purdue Small Turbine Aerothermal Research Rig (STARR)** A. Wallace, D. Johnson, Florida Turbine Technologies, Jupiter, FL; D. Cuadrado, N. Aye-Addo, V. Andreoli, L. Bhatnagar, Purdue University, West Lafayette, IN; et al.

Tuesday, 20 August 2019

79-GTE-12	Turbines I			Room 312
Chaired by: S. SUBRAMANIAN, QuEST Global, Inc.				
0930 hrs AIAA-2019-4005 **Investigation of Loss Reduction in a High Lift Turbine by Localized Endwall Jets** H. Babcock, M. Reeder, L. Thomas, Air Force Institute of Technology, Wright-Patterson AFB, OH; C. Marks, Air Force Research Laboratory, Wright-Patterson AFB, OH	1000 hrs AIAA-2019-4006 **Unsteady Flow Physics in the Trail Edge Region of a Transonic Turbine Cascade VKV1 Baseline** N. Posada, J. Clark, A. Lethander, Air Force Research Laboratory, Wright-Patterson AFB, OH; M. Wolff, Wright State University, Dayton, OH	1030 hrs AIAA-2019-4007 **Selection of Parameters for Numerical Models of the Working Process of Axial Uncooled Turbines Intended to Perform Optimization and Verification Calculations** G. Popov, V. Matveev, V. Zubanov, D. Kolmakova, Y. Novikova, Samara National Research University, Samara, Russia	1100 hrs AIAA-2019-4008 **Experimental Vibration Analysis of an Aircraft Diesel Engine Turbocharger** R. McGowan, J. Pieri, M. Szedlmayer, K. Kim, P. Clerkin, K. Kruger, Army Research Laboratory, Aberdeen Proving Ground, MD; et al.	

Tuesday, 20 August 2019

80-HR-5	Current Programs: Objectives, Developments, and Progress to Date			Room 104
Chaired by: T. ELLIOTT, University of Tennessee at Chattanooga and A. KARP, Jet Propulsion Laboratory				
0930 hrs AIAA-2019-4009 **Low Pressure Ignition Testing of a Hybrid SmallSat Motor** E. Jens, A. Karp, B. Nakazono, K. Williams, J. Rabinovitch, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; D. Dyrda, Stanford University, Stanford, CA; et al.	1000 hrs AIAA-2019-4010 **State of Art and Current Challenges of the Paraffin-Based Hybrid Rocket Technology** G. Leccese, E. Cavallini, M. Pizzarelli, Italian Space Agency (ASI), Rome, Italy	1030 hrs AIAA-2019-4011 **Development and Test Flight of The Atlantis I Nitrous Oxide/Paraffin-based Hybrid Rocket** T. Messinger, C. Hill, D. Quinn, D. Stannard, G. Doerksen, C. Johansen, University of Calgary, Calgary, Canada	1100 hrs AIAA-2019-4012 **An Investigation of the Centrifugal Casting of Paraffin Wax on Earth and in Microgravity** K. Stober, J. Wanyiri, A. Sanchez, M. Hooper, M. Mazumder, S. Jiwani, Massachusetts Institute of Technology, Cambridge, MA; et al.	

Tuesday, 20 August 2019				
81-HSABP-4	**Flowpath Dynamics and Control**			**Room 309/10**
Chaired by: T. O'BRIEN, Raytheon Missiles Systems and R. MOEHLENKAMP, Aerojet Rocketdyne				
0930 hrs AIAA-2019-4013 **Modal Decomposition Analysis of the Fuel-Air mixing in the Supersonic Combustor with a Cavity** S. Jeong, P. Pavalavanni, J. Choi, Pusan National University, Busan, South Korea	1000 hrs AIAA-2019-4014 **Research on Transient Characteristics of Scramjet Engine Using Dynamic Simulator** K. Kubosaki, Tohoku University, Sendai, Japan; S. Tomioka, T. Kimura, Japan Aerospace Exploration Agency (JAXA), Kakuda, Japan	1030 hrs AIAA-2019-4015 **Flow Path and Interaction Analysis in a Hydrogen Transpiration Cooled Scramjet Model Combustor** F. Strauss, S. General, German Aerospace Center (DLR), Hardthausen, Germany; C. Manfletti, ESA, Paris, France; S. Schlechtriem, German Aerospace Center (DLR), Hardthausen, Germany	1100 hrs AIAA-2019-4016 **Using Computational Flow Imaging to Optimize Filtered Rayleigh Scattering Measurements of an Isolator Shock Train** R. Hunt, C. Ground, R. Baurle, P. Danehy, NASA Langley Research Center, Hampton, VA	1130 hrs AIAA-2019-4017 **Study on steady state control schedule and characteristic calculation of hydrogen-fueled scramjet** H. Li, Y. Chen, Z. Wang, T. Zhang, Y. Li, Northwestern Polytechnical University, Xi'an, China

Tuesday, 20 August 2019				
82-INPSI-4	**Propulsion Aerodynamics Workshop: Special Topic, External Compression Inlet (Invited)**			**Room 308**
Chaired by: J. BRAUN, Purdue				
0930 hrs AIAA-2019-4018 **BCFD Analysis for the 4th AIAA Propulsion Aerodynamics Workshop: Special Topic Results (Invited)** C. Winkler, The Boeing Company, Hazelwood, MO	1000 hrs AIAA-2019-4019 **Analysis of a High-Speed External-Compression Inlet with Simcenter STAR-CCM+ (Invited)** O. Tong, Y. Yanagita, Siemens, Irvine, CA	1030 hrs AIAA-2019-4020 **Propulsion Aerodynamics Workshop IV Results for the Special Topic (Invited)** N. Domel, Lockheed Martin Corporation, Fort Worth, TX	1100 hrs AIAA-2019-4021 **Propulsion Aerodynamics Workshop Special topics: Supersonic Channeled Centerbody Inlet (Invited)** J. Braun, Purdue University, West Lafayette, IN; S. Podleski, Self, Mukilteo, WA	

Tuesday, 20 August 2019				
83-ITAR-1	**In-Space Propulsion**			**Room 209**
Chaired by: J. HORTON, Aerojet Rocketdyne				
0930 hrs Oral Presentation **In-Space Propulsion Overview** W. Sack, Aerojet Rocketdyne, Canoga Park, CA	1000 hrs Oral Presentation **Lunar Nuclear Thermal Propulsion Architectures and Possible Demonstrator Evaluations from Cis-lunar Orbit** J. Horton, C. Joyner, T. Kokan, D. Levack, C. Reynolds, Aerojet Rocketdyne, Canoga Park, CA	1030 hrs AIAA-2019-4022 **High Thrust-to-Power NEXT Thruster Assessment** M. Patterson, R. Thomas, N. Arthur, NASA Glenn Research Center, Cleveland, OH; M. Crofton, The Aerospace Corporation, El Segundo, CA	1100 hrs Oral Presentation **LOX Bearing Health Monitoring Using Frequency Analysis Method** M. Peneda, E. Briggs, Virgin Orbit, Long Beach, CA	1130 hrs AIAA-2019-4023 **MMRTG Degradation Modeling to Enhance Spacecraft Power Lifetime Performance Predictions** T. Hendricks, C. Matthes, E. Wood, B. Phan, J. Patel, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

Tuesday, 20 August 2019				
84-LP-8	**Liquid Rocket Engines I**			**Room 106**
Chaired by: D. COOTE, NASA Stennis Space Center and K. OKITA, JAXA				
0930 hrs AIAA-2019-4024 **Development Status of LE-9 Engine for H3 Launch Vehicle** H. Kawashima, Y. Funakoshi, A. Kurosu, T. Kobayashi, K. Okita, Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan	1000 hrs AIAA-2019-4025 **Genesis and Application of SMC-S-025: Evaluation and Test Requirements for Liquid Rocket Engines** S. Fusselman, W. Van Lerberghe, V. Goyal, K. Behring, G. Reber, The Aerospace Corporation, El Segundo, CA	1030 hrs AIAA-2019-4026 **Development and Testing of a 5 lbf LO2/LCH4 Reaction Control Engine** S. Torres, C. Hansen, L. Bugarin, J. Chessa, A. Choudhuri, University of Texas, El Paso, El Paso, TX		

Tuesday, 20 August 2019				
85-LP-9	**In-Space Liquid Propulsion II**			**Room 107**
Chaired by: S. MILLER, Aerojet Rocketdyne and D. GUADAGNOLI, Orbital ATK				
0930 hrs AIAA-2019-4027 **Chemical Propulsion for Outer Planet Exploration** A. Casillas, J. Reh, California Institute of Technology, Pasadena, CA; J. Gervasi, S. Williams, J. Yager, Moog, Inc., East Aurora, NY	1000 hrs AIAA-2019-4028 **Preliminary Results of a Micropump for MON-25/MMH Propulsion and Attitude Control** A. Besnard, S. Tennakoon, J. Torres, E. Besnard, Flight Works, Inc., Irvine, CA	1030 hrs AIAA-2019-4029 **Small-Scale Hydrogen Peroxide Vapor Propulsion System: Catalyst Performance and Heat Transfer** B. Rhodes, E. Ulrich, The Aerospace Corporation, El Segundo, CA; P. Ronney, University of Southern California, Los Angeles, CA		

Tuesday, 20 August 2019		
86-LP-10/PC-7 **0930 - 1130 hrs**	**Rocket Engine Combustion Stability Prediction Using Large Eddy Simulation: A VISP Tool Overview**	**Room 105**
VISP (Virtual Injector Screening Platform) is a collection of two high fidelity simulation codes that have been developed to predict the dynamic behavior of liquid rocket engine injectors. In the first hour of this session an overview of both codes will be presented along with a sampling of validation cases that have been run. In the second hour a tutorial will be provided on how to setup a case including the selection of various setting.		

Tuesday, 20 August 2019				
87-NFF-4	**Missions Enabled by Nuclear Propulsion**			**White River J**
Chaired by: J. CAVERA, Blue Origin LLC and J. CASSIBRY				
0930 hrs AIAA-2019-4030 **Fission Reactor Options and Scaling for Powering Magnetic Fusion Thrusters for a Manned Mars Mission** P. Stockett, R. Bean, C. Choi, Purdue University, West Lafayette, IN	1000 hrs AIAA-2019-4031 **Atmospheric Mining in the Outer Solar System: Outer Planet Resource Processing, Moon Base Propulsion, and Vehicle Design Issues** B. Palaszewski, NASA Glenn Research Center, Cleveland, OH	1030 hrs AIAA-2019-4032 **Applications of Nuclear Thermal Propulsion to Lunar Architectures** C. Reynolds, Aerojet Rocketdyne, Huntsville, AL; J. Horton, Aerojet Rocketdyne, Canoga Park, CA; C. Joyner, Aerojet Rocketdyne, West Palm Beach, FL; T. Kokan, Aerojet Rocketdyne, Huntsville, AL; D. Levack, Aerojet Rocketdyne, Canoga Park, CA	1100 hrs AIAA-2019-4033 **Round-Trip Mission to Neptune Using Nuclear Fusion Propulsion** S. Kumar, J. Cassibry, University of Alabama, Huntsville, Huntsville, AL	

Tuesday, 20 August 2019		
88-PC-8 **0930 - 1130 hrs**	**Optical Combustion Diagnostics at Engine Conditions**	**Room 101**
Optical measurement techniques - predominantly laser-based - have become indispensable for the study of combustion physics and chemistry, but their application in realistic engine environments has been limited. This session will explore recent advances aimed at bridging the gaps between measurement techniques and engine-relevant conditions, including open challenges and opportunities.		

Tuesday, 20 August 2019				
89-PC-9	**Combustion Dynamics III**			**White River H**
Chaired by: C. HUANG, University of Michigan and P. PALIES, CFD Research Corporation				
0930 hrs Oral Presentation **Physical Analysis of Swirling Flames from Experimental and Numerical Data** P. Palies, CFD Research Corporation (CFDRC), Huntsville, AL		1030 hrs AIAA-2019-4034 **Lagrangian Flame-Vorticity Characterization of Bluff-Body Flame Blowout** C. Rising, A. Morales, K. Ahmed, University of Central Florida, Orlando, FL	1100 hrs AIAA-2019-4035 **Fuel Sensitivity of Lean Blowout in a RQL Gas Turbine Combustor** C. Wey, NASA Glenn Research Center, Cleveland, OH	1130 hrs AIAA-2019-4036 **Experimental Investigation of Lean Blowout Limits of a Combustion-Air-Heater** M. Pelit, B. Sümer, B. Yazici, M. Dogrudil, TUBITAK, Ankara, Turkey; N. Eskin, Istanbul Technical University, Istanbul, Turkey

Tuesday, 20 August 2019				
90-PGC-5/HSABP-5	**Pressure Gain Combustion: Measurement Techniques and Test Facilities I**			**White River C/D**
Chaired by: M. BOHON, Technische Universität Berlin and J. BURR, University of Maryland at College Park				
0930 hrs AIAA-2019-4037 **Enhancement of the Radial Wave Engine** P. Akbari, C. Tait, G. Brady, California State Polytechnic University, Pomona, CA; M. Polanka, Air Force Institute of Technology, Wright-Patterson AFB, OH; B. Sell, Innovative Scientific Solutions, Inc., Dayton, OH	1000 hrs AIAA-2019-4038 **Influence of Injector-to-Annulus Area Ratio on Rotating Detonation Engine Operability** J. Koch, L. Chang, C. Upadhye, K. Chau, M. Kurosaka, C. Knowlen, University of Washington, Seattle, Seattle, WA	1030 hrs AIAA-2019-4039 **A Testrig to evaluate Turbine Performance and Operational Strategies under pulsating Inflow Conditions** A. Heinrich, M. Herbig, D. Peitsch, D. Topalovic, R. King, Technical University of Berlin, Berlin, Germany	1100 hrs AIAA-2019-4040 **Towards a laser-absorption technique for ultra-fast, simultaneous temperature and concentration measurements inside pressure gain combustion devices** Z. Loparo, S. Vasu, E. Ninnemann, K. Thurmond, A. Laich, A. Azim, University of Central Florida, Orlando, FL; et al.	1130 hrs AIAA-2019-4041 **Turbine-integrated High-pressure Optical RDE (THOR) for injection and detonation dynamics assessment** V. Athmanathan, J. Fisher, Z. Ayers, D. Cuadrado, V. Andreoli, J. Braun, Purdue University, West Lafayette, IN; et al.

Tuesday, 20 August 2019				
91-PGC-6/PC-11	**Pressure Gain Combustion: Physics Modeling and Exploration II**			**White River A/B**
Chaired by: V. TANGIRALA, General Electric and C. BROPHY, Naval Postgraduate School				
0930 hrs AIAA-2019-4042 **Multi-dimensional Simulations of Liquid-Fueled JP10/Oxygen Detonations** D. Schwer, Naval Research Laboratory, Washington, D.C.	1000 hrs AIAA-2019-4043 **Geometry Parameter Variation for C_2H_4-Fueled Rotating Detonation Combustor** S. Monahan, K. Singh, V. Tangirala, General Electric Company, Niskayuna, NY	1030 hrs AIAA-2019-4044 **Wedge-Stabilized Oblique Detonation Waves in a Hypersonic Hydrogen-Air Premixed Freestream** C. Bachman, G. Goodwin, Naval Research Laboratory, Washington, D.C.; K. Ahmed, University of Central Florida, Orlando, FL	1100 hrs AIAA-2019-4045 **Effects of Heat Release Distribution on Detonation Properties in a H2/Air Rotating Detonation Combustor from OH* Chemiluminesence** A. Feleo, F. Chacon, M. Gamba, University of Michigan, Ann Arbor, Ann Arbor, MI	

Tuesday, 20 August 2019		
92-SR-3 **0930 - 1100 hrs**	**Developments in Solid Rocket Propulsion Systems for Manned Space Flight and Deep Space Exploration**	**Room 103**

Solid Rocket Motor design flexibility can be leveraged to meet a variety of mission-specific performance demands, including those required for manned spaceflight or deep space exploration. This session will focus on unique propulsion system approaches, qualification requirements, risk reduction activity, and future test/flight for several new vehicles/missions, to be discussed by individuals involved in the progress to date. Key topics include:

Orion Launch Abort System Attitude Control Motor Qualification Progress
Katie Bonner, Daniel Dunlap, David McGrath
Northrop Grumman Innovation Systems

Mars Ascent Vehicle Solid Propulsion History and Current Progress
David McGrath, Jonathan Katz, Stephen Palopoli, Eric Rohrbaugh
Northrop Grumman Innovation Systems

Europa Clipper Lander Solid Propulsion Retro Motor
David McGrath, Jonathan Katz, Stephen Palopoli
Northrop Grumman Innovation Systems

Tuesday, 20 August 2019				
93-ST-1	**Space Launch Transportation**			**Room 201**
Chaired by: W. HAMMOND				
0930 hrs AIAA-2019-4046 **The Space Launch System's Enablement of Crewed Lunar Missions and Architectures** B. Donahue, The Boeing Company, Huntsville, AL	1000 hrs AIAA-2019-4047 **NASA's Space Launch System: First Mission Hardware Nears Completion** J. Honeycutt, C. Cianciola, NASA Marshall Space Flight Center, Huntsville, AL	1030 hrs AIAA-2019-4048 **Enabling a Near-Term Interstellar Probe with the Space Launch System** M. Paul, R. McNutt, Johns Hopkins University Applied Physics Laboratory, Laurel, MD; R. Stough, D. Hitt, NASA Marshall Space Flight Center, Huntsville, AL; S. Vernon, Johns Hopkins University Applied Physics Laboratory, Laurel, MD; E. Alvarez, NASA Marshall Space Flight Center, Huntsville, AL; et al.	1100 hrs AIAA-2019-4049 **The Nammo Nucleus Launch: Norwegian Hybrid Sounding Rocket over 100km** M. Faenza, A. Boiron, B. Haemmerli, C. Verberne, Nammo Raufoss AS, Raufoss, Norway	1130 hrs AIAA-2019-4050 **A New Web-based Knowledge Repository of the World's Launch Systems and Programs** W. Hammond, University of Central Florida, Orlando, FL

Tuesday, 20 August 2019				
94-SYS-3	**Space Systems: Technology Research and Development**			**Room 203**
Chaired by: W. TOMEK, NASA LaRC RD/CAB and J. BLOOMER, Raytheon Space & Airborne Systems				
0930 hrs AIAA-2019-4051 **Fatigue – Creep Phenomenological Models of Composites and Nanocomposites** L. Razdolsky, LR Structural Engineering, Inc., Lincolnshire, IL	1000 hrs AIAA-2019-4052 **Investigation of the effect of composite material on rocket fin flutter speed** A. Kolusz, T. Palacz, Z. Rydz, M. Guzik, AGH University of Science and Technology, Krakow, Poland	1030 hrs AIAA-2019-4053 **Virtual Systems Integration Applied to Advanced Space Systems** L. Thomas, A. Averon, V. Lopez, A. Bower, University of Alabama, Huntsville, Huntsville, AL	1100 hrs AIAA-2019-4054 **Mission Architectures Made Accessible Through Economies of Scale** K. Scholtes, W. Coogan, T. Markusic, Firefly Aerospace, Inc., Cedar Park, TX	

Tuesday, 20 August 2019				
95-TM-3	**Heat Transfer and Transport I**			**Room 307**
Chaired by: M. CHOI, NASA-Goddard Space Flight Center and D. ZAKAR, NRL				
0930 hrs AIAA-2019-4055 **Numerical Study to Evaluate Soot Formation in a JP Combustor Equipped to Different Types of Swirler** M. Darbandi, M. Ghafourizadeh, Sharif University of Technology, Tehran, Iran; G. Schneider, University of Waterloo, Waterloo, Canada	1000 hrs AIAA-2019-4056 **Stabilizing Transient Operation of High-Power Loop Heat Pipes with Condenser Bypass Approach** T. Holman, R. Baldauff, D. Khrustalev, Naval Research Laboratory, Washington, D.C.	1030 hrs AIAA-2019-4057 **Robust 1-D Fluid Flow and Heat Transfer Predictions in Gas Turbine Cooling Passages** R. Jalali, M. Darbandi, Sharif University of Technology, Tehran, Iran; G. Schneider, University of Waterloo, Waterloo, Canada		

Tuesday, 20 August 2019		
96-F360-6 **1045 - 1200 hrs**	**Tuesday Forum 360 AM: Propulsion Efficiency: Engine Optimization and MRO Advancements (Part II - Fleet Replenishment, Modernization and MRO Movements)**	**JW Grand Ballroom 3/4**

Moderator: Marc Meredith, Executive Director, Global MRO Network and Cost Management, Pratt & Whitney

Panelists: To Be Confirmed

Tuesday, 20 August 2019				
97-COL-2	**Space Architecture and Mars Mission Considerations**			**Room 202**
Chaired by: R. HOWARD, NASA Johnson Space Center				
1330 hrs AIAA-2019-4058 **Optimizing the Geometric Parameters of a Space Module's Outer Shell during a Rocket's Flight Sequence** B. Mackey, A. Tricic, C. Merrett, Clarkson University, Potsdam, NY	1400 hrs AIAA-2019-4059 **Mars Garden An Engineered Greenhouse for a Sustainable Residence on Mars** S. Babakhanova, S. Baber, Massachusetts Institute of Technology, Cambridge, MA; F. Bernelli Zazzera, Technical University of Milan, Milan, Italy; E. Hinterman, J. Hoffman, J. Kusters, Massachusetts Institute of Technology, Cambridge, MA; et al.	1430 hrs AIAA-2019-4060 **Preliminary Design of the Ceres Mars Greenhouse Concept** A. Fichou, B. Kitsu, C. Warren, A. Iordanov, C. Murphy, R. March, Embry-Riddle Aeronautical University, Prescott, AZ; et al.		

Tuesday, 20 August 2019				
98-ECD-2	**Stirling Systems**			**Room 307**
Chaired by: D. WOERNER, Jet Propulsion Laboratory				
1330 hrs AIAA-2019-4062 **ASC and TDC Stirling Converter and Control Testing** G. Gaines, R. Sickenberger, Teledyne Technologies, Inc., Hunt Valley, MD	1400 hrs AIAA-2019-4063 **CFD Analyses of Thermal Lag Engine** M. ElDebawy, K. Beshay, C. Fernandez-Aballi, E. Khalil, Cairo University, Cairo, Egypt	1430 hrs AIAA-2019-4064 **Development of an advanced Free Piston Stirling Engine of space power system** R. Li, S. Qiu, Y. Gao, West Virginia University, Morgantown, WV	1500 hrs AIAA-2019-4065 **NASA Proof-of-Concept 1-W Stirling Convertor Development for Small RPS** N. Schifer, S. Wilson, D. Goodell, NASA Glenn Research Center, Cleveland, OH; M. Casciani, Vantage Partners, LLC, Cleveland, OH	1530 hrs AIAA-2019-4066 **A Systems Study of a Stirling Convertor based Space Nuclear Power System** J. VanderVeer, R. Sievers, Teledyne Technologies, Inc., Hunt Valley, MD; M. Amato, M. White, American Superconductor, Richland, WA

Tuesday, 20 August 2019				
99-EDU-4	**Student Research Projects in Propulsion Education II**			**Room 301**
Chaired by: R. REZENDE and M. HITT, U.S. Army SMDC				
1330 hrs AIAA-2019-4067 **External Flow Choking at the Landing Phase of Aircraft and Re-entry Vehicles** D. Krishnamoorthy, D. Natarajan, A. Mariappan, Kumaraguru College of Technology, Coimbatore, India; V. Sanal Kumar, Indian Space Research Organisation, Trivandrum, India	1400 hrs AIAA-2019-4068 **Gas Cooling Generator Technologies for Aerospace Applications** A. Patel, R. Frederick, University of Alabama, Huntsville, Huntsville, AL	1430 hrs AIAA-2019-4069 **Solid Fuel Regression Measurements Rate Using an Optical Hybrid Rocket Engine** D. Over, M. Ianuzzi, J. Moore, G. Risha, Pennsylvania State University, Altoona, PA	1500 hrs AIAA-2019-4070 **Experimental and Numerical Studies on Jet Acoustic Characteristics of Chevron Nozzles** D. S, T. U K, A. Sukumaran, J. A, V. J, V. B, Kumaraguru College of Technology, Coimbatore, India; et al.	1530 hrs AIAA-2019-4071 **Determination of the Effect of Frequency and Spark Timing on the Thrust Using a Lab-Scale Pulsed Detonation Engine** H. Liu, E. Crisp, J. Moore, G. Risha, Pennsylvania State University, Altoona,

Tuesday, 20 August 2019				
100-EERE-1	**Green Energy**			**Room 305/06**
Chaired by: R. AMANO, University of Wisconsin-Milwaukee and L. QIAO, School of Aeronautics & Astronautics, Purdue University				
1330 hrs AIAA-2019-4072 **The Opportunity for Energy Saving in Foundry-Case Study** R. Amano, M. Saravani, A. Abbas, University of Wisconsin, Milwaukee, Glendale, WI	1400 hrs AIAA-2019-4073 **Process Flow Analysis of the Thermochemical Conversion of Food Waste in a Gasification Plant** T. Oshodi, D. Okeke, O. Awosanya, E. Ogedengbe, A. Ehinmowo, University of Lagos, Akoka-Yaba, Nigeria	1430 hrs AIAA-2019-4074 **Thermodynamic Analysis of sCO_2 Allam Cycle for Concentrated Solar Power Complemented with Oxy-Combustion** A. Alenezi, J. Kapat, University of Central Florida, Orlando, FL		

Tuesday, 20 August 2019		
101-EP-10 **1330 - 1500 hrs**	**The Future of Smallsat/Cubesat Propulsion**	**White River J**

Propulsion devices for small satellites enable exciting in-space missions and create new opportunities for industrial, educational, and scientific purposes. In this panel, the current status and future directions of small satellite propulsion devices will be discussed by the leaders of the field. The technologies include chemical and electrical propulsion systems, which cover a wide range of specific impulse and thrust levels.

Panelists:

Alina Alexeenko	**Thomas Liu**	**Michael VanWoerkom**	**John Ziemer**	**Nathaniel Demmons**
Purdue University	NASA Glenn Research Center	ExoTerra Corporation	NASA Jet Propulsion Laboratory	Busek Company

Tuesday, 20 August 2019

102-EP-11	Hall Thruster Plasma Oscillation			Room 204
Chaired by: R. LOBBIA, Jet Propulsion Laboratory and J. FRIEMAN, NASA Glenn Research Center				
1330 hrs AIAA-2019-4076 **Frequency Scaling of the Hall Thruster Breathing Mode** E. Dale, B. Jorns, University of Michigan, Ann Arbor, Ann Arbor, MI	1400 hrs AIAA-2019-4077 **Investigation into the Use of Cathode Flow Fraction to Mitigate Pressure-Related Facility Effects on a Magnetically Shielded Hall Thruster** S. Cusson, M. Byrne, B. Jorns, A. Gallimore, University of Michigan, Ann Arbor, Ann Arbor, MI	1430 hrs AIAA-2019-4078 **Hall thruster with externally driven oscillations** Y. Raitses, Princeton Plasma Physics Laboratory, Princeton, NJ; I. Romadanov, University of Saskatchewan, Saskatoon, Canada; J. Simmonds, Princeton Plasma Physics Laboratory, Princeton, NJ; A. Smolyakov, University of Saskatchewan, Saskatoon, Canada; I. Kaganovich, Princeton Plasma Physics Laboratory, Princeton, NJ	1500 hrs AIAA-2019-4079 **Time-varying Non-classical Collisions and Turbulence in a Hollow Cathode** M. Georgin, B. Jorns, A. Gallimore, University of Michigan, Ann Arbor, Ann Arbor, MI	1530 hrs AIAA-2019-4080 **Stationary Profiles and Axial Mode Oscillations in Hall Thruster** A. Smolyakov, O. Chapurin, I. Romadanov, University of Saskatchewan, Saskatoon, Canada; Y. Raitses, I. Kaganovich, Princeton University, Princeton, NJ

Tuesday, 20 August 2019

103-EP-12	Hall Thruster Design and Experiment			Room 205
Chaired by: D. AHERN				
1330 hrs AIAA-2019-4081 **Design analysis of a plasma thruster with superconducting magnets** J. Glowacki, R. Badcock, N. Long, Victoria University of Wellington, Wellington, New Zealand	1400 hrs AIAA-2019-4082 **Research progress on the ignition reliability of Hall thruster in HIT** W. Li, F. Wu, Y. Lv, W. Gu, Q. Gao, X. Yang, Harbin Institute of Technology, Harbin, China; et al.	1430 hrs AIAA-2019-4083 **Performance Comparison of a 1.5 kW Hall Thruster with Center-Mounted and Outer-Pole-Mounted Heaterless Cathodes** T. Andreano, J. Williams, Colorado State University, Fort Collins, CO; M. Clement, Higher Institute of Mechanics of Paris, Saint-Ouen, France; C. Farnell, Plasma Controls, LLC, Fort Collins, CO		

Tuesday, 20 August 2019

104-F360-7 1330 - 1445 hrs	Tuesday Forum 360 PM: Next Steps in Supersonic and Hypersonic Propulsion: Platforms and Applications (Part I - Hypersonic Propulsion Advancements)	JW Grand Ballroom 3/4

Moderator: Steven Sinacore, Deputy Project Manager, Hypersonic Technology Project, Aeronautics Research Mission Directorate, NASA

Panelists:

Robert Bakos	Glenn Case	Adam Dissel	J. Brent Staubach
Principal and Co-founder	Founder and Chief Technology Officer	President	Manager and Chief, Systems Optimization
Innoveering, LLC	Hermeus	Reaction Engines Inc.	Pratt & Whitney

Tuesday, 20 August 2019

105-GTE-13 1330 - 1600 hrs	A Contemporary Approach to Modeling Existing Gas Turbine Engines	Room 311

This tutorial will examine how existing gas turbine engines can be modeled simply but with sufficient accuracy to enable their behavior and performance to be estimated not only at a selected design point but also over an extended range of off-design operation. A corresponding geometric model is essential and the data on which it is based must be assessed with some care. We ensure that the engine model works by exploring how its components interact and how their behavior influences off-design engine characteristics.

Tuesday, 20 August 2019

106-GTE-14	Gas Turbine Measurement Techniques			White River I
Chaired by: R. HOWARD, AFRL/RQTT and S. LYNCH, Penn State				
1330 hrs AIAA-2019-4084 **Temperature Distribution Measurements on Turbine Blade Surface by the Aid of Simple Dotted Pt/PtRh Thermal Couple Test Array** Z. Ji, H. Weng, M. Hu, F. Duan, Shanghai Jiao Tong University, Shanghai, China; J. Li, AECC Commercial Aircraft Engine Co., Ltd, Shanghai, China	1400 hrs AIAA-2019-4085 **High Temperature Wireless Sensing on Aeroengine Turbine Blade Surface** H. Weng, F. Duan, Shanghai Jiao Tong University, Shanghai, China	1430 hrs AIAA-2019-4086 **CFD-based design of optical diagnostic techniques for turbine vane testing** N. Aye-Addo, V. Andreoli, N. Long, G. Paniagua, Purdue University, West Lafayette, IN	1500 hrs AIAA-2019-4087 **Study of Electrical Properties of Thermal Barrier Coating under High Temperatures for Aero-engine Smart Sensors** F. Duan, Shanghai Jiao Tong University, Shanghai, China	1530 hrs AIAA-2019-4088 **Statistical modeling in failure detection in gas turbine** V. Goyal, M. Xu, J. Kapat, University of Central Florida, Orlando, FL

Tuesday, 20 August 2019				
107-GTE-15	**Turbines II**			**Room 312**
Chaired by: D. SANDERS, Air Force Reseach Laboratory				
1330 hrs AIAA-2019-4089 **Hybrid Eddy Simulations of Low Reynolds Number Shaped Hole Film Cooling on an Adiabatic Flat Plate** M. Boehler, A. Sudesh, M. Turner, University of Cincinnati, Cincinnati, OH	1400 hrs AIAA-2019-4090 **CFD Simulation of Flat Plate Film Cooling of Shaped Hole Using LES** A. Sudesh, M. Boehler, M. Turner, University of Cincinnati, Cincinnati, OH	1430 hrs AIAA-2019-4091 **Novel Hole Shapes for Film Cooling Studies of Turbine Blades** Z. Stiegler, E. Issakhanian, Loyola Marymount University, Los Angeles, CA	1500 hrs AIAA-2019-4092 **Increase of Efficiency of Axial Uncooled Turbine by Optimization of Its Blades Shape Using CFD and Optimization Software** E. Marchukov, I. Egorov, Moscow Aviation Institute, Moscow, Russia; G. Popov, E. Goriachkin, Y. Novikova, V. Zubanov, Samara National Research University, Samara, Russia	

Tuesday, 20 August 2019				
108-HR-6	**Design and Development of Novel Hybrid Rocket Motor Concepts II**			**Room 102**
Chaired by: A. KARP, Jet Propulsion Laboratory				
1330 hrs AIAA-2019-4093 **Demonstration of an Alternating-intensity Swirling Oxisizer Flow Type Hybrid Rocket Functions** I. Nakagawa, D. Kishizato, Y. Koinuma, S. Tanaka, Tokai University, Hiratsuka, Japan	1400 hrs AIAA-2019-4094 **Experimental Investigation of ABS-Paraffin 3D Printed Hybrid Rocket Fuels** J. Bresler, B. Natan, Technion–Israel Institute of Technology, Haifa, Israel	1430 hrs AIAA-2019-4095 **Diode Laser Ignition Testing for PMMA/GOX Hybrid Motors** D. Dyrda, F. Mechentel, B. Cantwell, Stanford University, Stanford, CA	1500 hrs AIAA-2019-4096 **Robust Design of Hybrid Rocket Engine for Small Satellite Launchers** L. Casalino, F. Masseni, D. Pastrone, Technical University of Turin, Turin, Italy	1530 hrs AIAA-2019-4097 **Experimental Validation of the X-ray Determined Pore Size Distribution of Porous Hybrid Motor Grains** J. Buckley, G. Nelson, University of Alabama, Huntsville, Huntsville, AL

Tuesday, 20 August 2019				
109-HR-7	**Contemporary Hybrid Rocket Fuel Characterization, Visualization, and Controls I**			**Room 103**
Chaired by: B. MAICKE, Pennsylvania State University				
1330 hrs AIAA-2019-4098 **Spectroscopic Techniques for Measuring Regression Rates of Liquefying Hybrid Rocket Fuels** C. McDougall, C. Hill, C. Heinrichs, C. Johansen, University of Calgary, Calgary, Canada	1400 hrs AIAA-2019-4099 **Reconstruction of Attenuated Hybrid Motor Chamber Pressure Signals Using Maximum Likelihood Estimation and Optimal Deconvolution** S. Whitmore, E. Zelesnik, Utah State University, Logan, UT	1430 hrs AIAA-2019-4100 **Boundary-Layer Combustion of Wax-based Fuels at Various Chamber Pressures under Two Static Acceleration Environments** K. Ozawa, T. Yoshino, H. Wang, N. Tsuboi, Kyushu Institute of Technology, Kitakyushu, Japan	1500 hrs AIAA-2019-4101 **An Experimental Study of Factors Affecting Hypergolic Ignition of Ammonia Borane** K. Clements, M. Baier, P. Ramachandran, S. Son, Purdue University, West Lafayette, IN	1530 hrs AIAA-2019-4102 **Fuel Regression Characteristics in Hybrid Rockets Using N2O/HDPE** S. Ito, L. Kamps, K. Sakurai, L. Kageyama, T. Okuda, H. Nagata, Hokkaido University, Sapporo, Japan

Tuesday, 20 August 2019		
110-HUB-1 **1330 - 1400 hrs**	**Interview with Tory Bruno, President and Chief Executive Officer, United Launch Alliance**	**the HUB**

Tuesday, 20 August 2019				
111-INPSI-5	**Nozzle Performance**			**Room 308**
Chaired by: D. CROWE, Air Force Research Laboratory and R. THORNOCK				
1330 hrs AIAA-2019-4103 **Empirical analysis of supersonic jet control using steady minijet injection** A. Perumal, Indian Institute of Technology Jammu, Jammu, India; A. S M, SRM Institute of Science and Technology, Chennai, India; R. E, Indian Institute of Technology Kanpur, Kanpur, India	1400 hrs AIAA-2019-4104 **Analysis of Afterburner Characteristics of a Low Bypass Ratio Turbofan Engine** M. Safdar, National University of Sciences and Technology, Islamabad, Pakistan; B. Mufti, Air University, Islamabad, Pakistan; H. Naseer, National University of Sciences and Technology, Islamabad, Pakistan; A. Farooq, J. Masud, Air University, Islamabad, Pakistan	1430 hrs AIAA-2019-4105 **Experiment on Air Intake Performance of Ejector-Jet using Wax-based Fuel Hybrid Rocket.** S. Funaki, I. Nakagawa, Tokai University, Hiratsuka, Japan; T. Kanda, Chubu University, Kasugai, Japan; S. Hasegawa, Japan Aerospace Exploration Agency (JAXA), Kakuda, Japan		

Tuesday, 20 August 2019				
112-ITAR-2	**Propellants and Combustion**			**Room 209**
Chaired by: M. JACINTO, Aerojet Rocketdyne and J. MEGIVERN				
1330 hrs Oral Presentation **Overview and Challenges in Solid Propellant Development** G. Harting, Air Force Research Laboratory, Edwards AFB, CA	1400 hrs AIAA-2019-4106 **Development of Aluminum Oxide, Zirconia, and Silicon Carbide based Iridium Catalyst for the Decomposition of AF-M315E** A. Vazquez, R. Cuevas, J. Mejia, J. Valenzuela - Brok, D. Aguilar, A. Choudhuri, University of Texas, El Paso, El Paso, TX	1430 hrs AIAA-2019-4107 **Development and Testing of a 1N AF-M315E Thruster for Small Satellite Applications** J. Valenzuela Brok, J. Mejia, A. Vazquez, R. Cuevas, A. Choudhuri, University of Texas, El Paso, El Paso, TX		

Tuesday, 20 August 2019				
113-LP-11	**Liquid Propulsion Combustion Dynamics**			**Room 107**
Chaired by: J. GRUMBACH and J. LOCKE, United Technologies Research Center				
1330 hrs AIAA-2019-4108 **Unsteady and Transversely Forced Dynamics of Two-Phase Multi-Element Shear Coaxial Flows** M. Roa, Sierra Lobo, Inc., Edwards AFB, CA; D. Talley, Air Force Research Laboratory, Edwards AFB, CA	1400 hrs AIAA-2019-4109 **Computational Investigation on the Effect of the Oxidizer Inlet Temperature on Combustion Instability** M. Harvazinski, Air Force Research Laboratory, Edwards AFB, CA; T. Shimizu, Japan Aerospace Exploration Agency (JAXA), Kanagawa, Japan	1430 hrs AIAA-2019-4110 **Shutdown Investigation in a LOx-Ethanol Subscale Thrust Chamber** I. Dalmaso Brasil Dias, Technological Institute of Aeronautics (ITA), São José dos Campos, Brazil; L. Maia Araújo, L. Bartholomeu do Nascimento, Aeronautics and Space Institute (IAE), São José dos Campos, Brazil; P. Lacava, Technological Institute of Aeronautics (ITA), São José dos Campos, Brazil; C. Pagliuco, D. Soares de Almeida, Aeronautics and Space Institute (IAE), São José dos Campos, Brazil; et al.	1500 hrs AIAA-2019-4111 **Effects of the Recess Length on Flow and Combustion Stability of Gas-Centered Coaxial Swirl Injectors** Y. Wang, Y. Kim, C. Sohn, Sejong University, Seoul, South Korea	1530 hrs AIAA-2019-4112 **Conjugated Combustion and Heat Transfer Simulations of Upper and Lower Main Combustion Chambers of LE-9 Engine** Y. Daimon, H. Negishi, H. Kawashima, Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan

Tuesday, 20 August 2019				
114-LP-12	**Liquid Rocket Engines II**			**Room 106**
Chaired by: K. OKITA, JAXA and J. RICCIUS, DLR - German Aerospace Center				
1330 hrs AIAA-2019-4113 **Estimation of Model Parameters in System-Level Simulation for Liquid Rocket Engines Using the Ensemble Kalman Filter** D. Sato, S. Tsutsumi, M. Hirabayashi, K. Kawatsu, T. Kimura, Japan Aerospace Exploration Agency (JAXA), Sagamihara, Japan	1400 hrs AIAA-2019-4114 **Rocket Engine Digital Twin – Modeling and Simulation Benefits** D. Jimenez Mena, S. Pluchart, S. Mouvand, O. Broca, Siemens, Lyon, France	1430 hrs AIAA-2019-4115 **Numerical Tool Optimization for Advanced Rocket Nozzle Performance Prediction** A. Conte, A. Ferrero, F. Larocca, D. Pastrone, Technical University of Turin, Turin, Italy	1500 hrs AIAA-2019-4116 **Numerical Acoustic Prediction of a Quadratic Supersonic Jet Using CAA Hybrid Methods** E. Costa Ruiz, R. Stark, S. General, D. Schneider, F. Strauss, German Aerospace Center (DLR), Hardthausen, Germany	

Tuesday, 20 August 2019				
115-LP-13	**Liquid Rocket Propellant Injectors II**			**Room 104**
Chaired by: J. QUINLAN, Georgia Institute of Technology and J. MOORE, Penn State Altoona				
1330 hrs AIAA-2019-4117 **Design Procedure and Cold Flow Experiments of a Pintle Injector** B. Erkal, B. Sümer, TUBITAK, Ankara, Turkey; M. Aksel, Middle East Technical University, Ankara, Turkey	1400 hrs AIAA-2019-4118 **Experimental Study of Swirl Coaxial Injector Hydrodynamics Under High- Frequency Self-Pulsation** I. Ranade, R. Frederick, University of Alabama, Huntsville, Huntsville, AL	1430 hrs AIAA-2019-4119 **Investigation of the Effect of Geometrical Parameters of Pressure Swirl Atomizer on the Hollow Cone Spray** T. Tokgöz, B. Sümer, TUBITAK, Ankara, Turkey; A. Ulas, Middle East Technical University, Ankara, Turkey		

Tuesday, 20 August 2019				
116-LP-14	**Propellant Feed System Components and Modeling**			**Room 105**
Chaired by: G. COLL, Science Applications International Corporation and S. ALBERTS				
1330 hrs AIAA-2019-4120 **Comparison of Surge Pressure Mitigation Devices For Use in Propellant Feedlines During A Priming Event** R. Kelly, Valcor Engineering, Springfield, NJ	1400 hrs AIAA-2019-4121 **Shape Memory Alloy Isolation Valve (SMAIV) Development and Testing** J. Cardin, R. Bhandari, R. Rezaei, VACCO Industries, South El Monte, CA; D. Owen, Johns Hopkins University, Columbia, MD; W. Hargus, Air Force Research Laboratory, Edwards AFB, CA	1430 hrs AIAA-2019-4122 **Multi-Node Modeling of Cryogenic Tank Pressurization System Using Generalized Fluid System Simulation Program (GFSSP)** A. Bandyopadhyay, Alabama A&M University, Huntsville, AL; A. Majumdar, A. LeClair, J. Valenzuela, NASA Marshall Space Flight Center, Huntsville, AL	1500 hrs AIAA-2019-4123 **Numerical Modeling of Priming Event Peak Pressures in Liquid Propulsion Systems** J. Moore, G. Risha, Pennsylvania State University, Altoona, PA; A. Tiwari, J. Harrison, J. Zenker, Gamma Technologies, LLC, Westmont, IL	1530 hrs AIAA-2019-4124 **Assessment of Using Electric Pump on Hybrid Rockets** K. Gegeoglu, M. Kahraman, DeltaV Space Technologies, Inc., Istanbul, Turkey; A. Karabeyoglu, Koc University, Istanbul, Turkey

Tuesday, 20 August 2019		
117-PC-12 **1330 - 1530 hrs**	**Additive Manufacturing for Energetics and Propellants**	**White River A/B**
Advances in additive manufacturing have challenged traditional design, prototyping, and manufacturing methodologies. Recently, researchers have been investigating similar advances for the additive manufacturing of energetic materials. This special session will include presentations detailing research into energetic material additive manufacturing techniques as well as discussion of the current challenges that must be overcome prior to technology adoption.		

Tuesday, 20 August 2019				
118-PC-13	**Combustion Chemistry**			**White River H**
Chaired by: C. LI, Air Force Office of Scientific Research and A. STEINBERG, Georgia Institute of Technology				
1330 hrs Oral Presentation **Recent Progress in Combustion Chemistry (Kinetics) Models for Real Fuels for Propulsion Applications (Invited)** C. Li, Air Force Office of Scientific Research, Arlington, VA		1430 hrs AIAA-2019-4125 **Ignition and Combustion of Magnesium Diboride Particles in Various Equivalence Ratios of Methane-Oxygen Flames** K. Shin, K. Yu, University of Maryland, College Park, College Park, MD	1500 hrs AIAA-2019-4126 **Influence of Temperature and Mixture Gas Ratio to Autoignition of n-Octane Pyrolysis Gas** S. Ogawa, T. Miyaura, Tohoku University, Sendai, Japan; K. Kobayashi, S. Tomioka, Japan Aerospace Exploration Agency (JAXA), Kakuda, Japan	1530 hrs AIAA-2019-4127 **Ignition Delay Control in Constant Volume Combustion Systems** A. Varshney, M. Varshney, P. Singh, Aligarh Muslim University, Aligarh, India; S. Yusuf Ali, Johns Hopkins University, Baltimore, MD; S. Alam, Aligarh Muslim University, Aligarh, India

Tuesday, 20 August 2019				
119-PGC-7	**Pressure Gain Combustion: Physics Modeling and Exploration III**			**White River C/D**
Chaired by: D. PAXSON, NASA Glenn Research Center and M. GAMBA, University of Michigan				
1330 hrs AIAA-2019-4128 **Wave Dynamics of a Partially Premixed Rotating Detonation Engine** I. Dunn, K. Thurmond, K. Ahmed, S. Vasu, University of Central Florida, Orlando, FL	1400 hrs AIAA-2019-4129 **Parametric investigation of rotating detonation rocket engines using large eddy simulations** C. Lietz, Sierra Lobo, Inc., Edwards AFB, CA; Y. Desai, HyPerComp, Inc., Westlake Village, CA; W. Hargus, V. Sankaran, Air Force Research Laboratory, Edwards AFB, CA	1430 hrs AIAA-2019-4130 **Novel Approach for Modeling Non-Premixed Rotating Detonation Engine Using a 2-D CFD Analysis** J. Meadows, S. Subramanian, Virginia Polytechnic Institute and State University, Blacksburg, VA	1500 hrs AIAA-2019-4131 **Radial Injector Mixing Effects on Detonation Zone Position in Rotating Detonation Engine** C. Knowlen, J. Koch, M. Kurosaka, M. Washington, University of Washington, Seattle, Seattle, WA	1530 hrs AIAA-2019-4132 **Numerical Investigation on Characteristic Lengths for Gaseous Detonation with Dilute Water Spray** H. Watanabe, A. Matsuo, Keio University, Kanagawa, Japan; A. Chinnayya, National Center for Scientific Research (CNRS), Poitiers, France; K. Matsuoka, A. Kawasaki, J. Kasahara, Nagoya University, Aichi, Japan

Tuesday, 20 August 2019				
120-SL-1	**Space Logistics - Optimization and Trade Studies**			**Room 203**
Chaired by: P. CHAI, NASA Langley Research Center and W. TOMEK, NASA LaRC RD/CAB and J. BLOOMER, Raytheon Space & Airborne Systems				
1330 hrs AIAA-2019-4133 **Lunar Surface Logistical Capability: A Study of Spacecraft Needed to Support Human Habitation, Scientific Research, and Commercial Operations on the Lunar Surface** P. Kinsman, C. Joyner, T. Kokan, D. Levack, D. Morris, Aerojet Rocketdyne, Canoga Park, CA	1400 hrs AIAA-2019-4134 **Multi-Fidelity Space Mission Planning and Space Infrastructure Design Framework for Space Resource Logistics** H. Chen, T. Sarton du Jonchay, Georgia Institute of Technology, Atlanta, GA; L. Hou, University of Illinois, Urbana-Champaign, Urbana, IL; K. Ho, Georgia Institute of Technology, Atlanta, GA	1430 hrs AIAA-2019-4135 **Hierarchical Reinforcement Learning Framework for Space Exploration Campaign Design** H. Chen, K. Ho, Georgia Institute of Technology, Atlanta, GA		

Tuesday, 20 August 2019

121-SP-1 1330 - 1600 hrs	The Pursuit of In Space Cryogenic Propellant Storage and Transfer	Room 302/03

As NASA embarks on the Artemis Program to sustainably explore the moon with an eye toward Mars, there is renewed interest in gaining the performance and sustainability benefits of cryogenic propellants, a long term goal of the space exploration community. A major hurdle has been the lack of experience managing and transferring cryogenic propellants, for more than hours of duration, in the space environment. The perceived development risks this paradox creates have, in the past, prevented development of vehicle designs that benefit from the performance of cryogens. How can this paradox be solved?

This panel brings senior leaders and subject matter experts from NASA together to discuss the benefits cryogenic propellants bring to conceptual lunar and Mars architectures, technology advancements that can improve the efficiency of in space cryogenic fluid storage and transfer, and several approaches that NASA is implementing or considering (from fundamental science to engineering demonstrations) to work with the community to acquire the data and experience needed to enable long duration in space storage and transfer of cryogenic propellants. Finally the panel solicits questions from the audience on alternative technical and programmatic approaches.

Moderator: Michael Meyer, NASA Technical Fellow for Cryogenics

Panelists:

Thomas Brown
In-Space Transportation Systems Capability Lead for NASA
NASA Marshall Space Flight Center

Francis Chiaramonte
Division of Space Life and Physical Sciences Research and Applications
Human Exploration ad Operations Mission Directorate
NASA Headquarters

Stephen Edwards
Mission Architecture Subject Matter Expert
NASA Marshall Spaceflight Center

Dayna Ise
Program Element Manager for Technology Demonstration Mission
Space Technology Mission Directorate
NASA Headquarters

Wesley Johnson
Cryogenics Team Lead
NASA Glenn Research Center

Mohammad Kassemi
Case Western Reserve University/
NASA Glenn Research Center
Zero Boil-Off Tank experiment Principal Investigator

Tuesday, 20 August 2019

122-SR-4	Solid Rocket Simulation and Analysis Methodologies II			Room 101

Chaired by: J. MAJDALANI, Auburn University and E. TRIGGS, Auburn University

1330 hrs
AIAA-2019-4136
Effect of Oxidative Jet Flow in Throat and Divergence Section on Nozzle Performance
D. Yan, Z. Wei, K. Xie, Beijing Institute of Technology, Beijing, China

1400 hrs
AIAA-2019-4137
Quasi-one Dimensional Model of Pressure Oscillations in Aft-Finocyl Solid Rocket Motors: a Critical Evaluation of Alternative Closure Sub-Models and Calibrations
M. Laureti, M. Grossi, B. Favini, University of Rome "La Sapienza", Rome, Italy

1430 hrs
AIAA-2019-4138
Comparative Analysis and Justification of Optimal Rocket Motor Selection in NASA USLI By Applying Newton's Second Law to a Variable Mass Body
B. Roberts, A. Sam, J. Brand, T. Elliott, University of Tennessee, Chattanooga, Chattanooga, TN

1500 hrs
AIAA-2019-4139
The Numerical Simulation on the Flow Field Instability Features of a Variable Thrust Solid Rocket Motor
Y. Li, X. Sui, Beijing Institute of Technology, Beijing, China; W. Hou, China Academy of Space Technology (CAST), Tianjin, China; J. Wang, Beijing Institute of Electronic System Engineering, Beijing, China

1530 hrs
AIAA-2019-4140
0D Unsteady - 1D Quasi-Stationary Internal Ballistic coupling for ROBOOST simulation tool
F. Ponti, N. Souhair, S. Mini, University of Bologna, Bologna, Italy; A. Annovazzi, Avio S.p.A., Colleferro, Italy

Tuesday, 20 August 2019

123-ST-2	Beyond-Earth Transportation			Room 201

Chaired by: M. FULLER, Northrop Grumman Inovation Systems and W. HAMMOND

1330 hrs
AIAA-2019-4141
A Joinable Undercarriage to Maximize Payload (JUMP) Lunar Lander for Cargo Delivery to the Lunar Surface
R. Howard, NASA Johnson Space Center, Houston, TX

1400 hrs
AIAA-2019-4142
Lunar Surface Missions Enabled by Small- to Medium-Lift Launch Vehicles
W. Coogan, K. Scholtes, T. Markusic, Firefly Aerospace, Inc., Cedar Park, TX; H. Runge, RungeTech, LLC, Boyce, VA

1430 hrs
AIAA-2019-4143
CEPUS: A Configurable Electric Propulsion Utility Stage to Support Science and Exploration of the Solar System
J. Woytach, NASA Glenn Research Center, Cleveland, OH; C. Loghry, Moog, Inc., Chattsworth, CA

1500 hrs
AIAA-2019-4144
Structural, Propulsion, Mechanical, and Dynamics Guidance for Reusable Launch Vehicles
S. Fusselman, V. Goyal, A. Mehrparvar, A. Triplett, D. Sutton, The Aerospace Corporation, El Segundo, CA

Tuesday, 20 August 2019

124-HUB-2 1400 - 1445 hrs	Innovations in the Field of Energetic Materials	the HUB

Speaker
John Zevenbergen
Principal Investigator
The Netherlands Organization

The innovations presented here are the continuous additive manufacturing of energetic materials in terms of so-called 3D gradient printing, the development of cool gas generators producing nitrogen, oxygen and hydrogen gas at room temperature without active cooling and the development of larger scale production facilities based on flow chemistry principles.

Tuesday, 20 August 2019		
125-F360-8 1445 - 1600 hrs	**Tuesday Forum 360 PM: Next Steps in Supersonic and Hypersonic Propulsion: Platforms and Applications (Part II - Commercial Supersonic Propulsion Advancements)**	JW Grand Ballroom 3/4

Moderator: Peter Coen, Low Boom Flight Demonstration Mission Manager, Aeronautics Research Mission Directorate, NASA

Panelists:

Rebecca Cointin
Director, Office of Environment and Energy
FAA

Irewole "Wally" Orisamolu
Associate Director, Advanced Propulsion Technologies
Pratt & Whitney

Carlos Perez
Advanced Systems Design & Technology Lead
GE Aviation

PJ Steffen
Chief, Future Projects Engineer
Rolls-Royce Corporation

Tuesday, 20 August 2019		
126-HUB-3 1445 - 1630 hrs	**Introduction to Additive Manufacturing**	the HUB

Additive manufacturing is increasing in prevalence and importance across many industries. This tutorial will provide a thorough introduction to the technologies involved, the typical manufacturing process, common design approaches, and the qualification considerations with using this new technology.

Speakers:

Nathan Andrews
Southwest Research Institute

Paul Gradl
NASA Marshall Space Flight Center

Omar Mireles
NASA Marshall Space Flight Center

Tuesday, 20 August 2019		
127-LP-15 1500 - 1600 hrs	**Introduction to the Use of NASA Chemical Equilibrium Applications (CEA)**	Room 309/10

CEA is a program which calculates chemical equilibrium product concentrations from any set of reactants and determines thermodynamic and transport properties for the product mixture. In this tutorial, Thomas Lavelle, NASA, will provide a brief overview of the tool, some theoretical background, and basic instructions on using CEA for mixed and reactive flows.

Tuesday, 20 August 2019		
128-NW-6 1600 - 1630 hrs	**Networking Break**	Exposition Hall

Tuesday, 20 August 2019		
129-LEC-2 1630 - 1730 hrs	**von Kármán Lecture in Astronautics**	JW Grand Ballroom 5

Tuesday, 20 August 2019		
130-NW-7 1800 - 1930 hrs	**Welcome Reception (Proof of Purchase Required)**	Exposition Hall

Wednesday

Wednesday, 21 August 2019		
131-SB-3 0730 - 0800 hrs	**Wednesday Speaker Briefing**	Session Rooms

Wednesday, 21 August 2019		
132-PLNRY-3 0800 - 0900 hrs	**Wednesday Plenary: Optimizing the U.S. Air Force's Operational Energy Use through 21st Century Tools and Technologies**	JW Grand Ballroom 5

Keynote Speaker
Roberto Guerrero
Deputy Assistant Secretary of the Air Force for Operational Energy
Office of the Assistant Secretary of the Air Force for Installations, Environment and Energy

Wednesday, 21 August 2019		
133-HUB-4 0900 - 0930 hrs	**Interview with Simon Weeks, Chief Technology Officer, Aerospace Technology Institute**	the HUB

Wednesday, 21 August 2019		
134-NW-8 0900 - 0930 hrs	Networking Break	Exposition Hall

Wednesday, 21 August 2019				
135-APS-1	Emerging Lithium-Ion Battery Technologies, Space Plasma Effect on Spacecraft Surfaces			Room 202
Chaired by: M. PATEL, US Merchant Marine Academy and J. HAINES, Retired - formerly ESA/ESTEC				
0930 hrs AIAA-2019-4145 **Li-Ion Intelli-Pack® Battery: Smart, High Energy and Safe Battery for mission and safety critical Aerospace platforms** E. Burke, Space Information Laboratories, Santa Maria, CA	1000 hrs Oral Presentation **Physics-Based Modeling and Simulation of Emerging Battery Technologies for Aerospace** M. Mehta, J. Lawson, NASA Ames Research Center, Moffett Field, CA	1030 hrs AIAA-2019-4146 **Thermal Runaway Propagation Testing Study for Safe Transportation of Lithium-ion Cells and Batteries** J. Jeevarajan, Underwriter Laboratories, Inc., League City, TX; C. Lopez, Stress Engineering Services, Waller, TX; S. Azam, Underwriter Laboratories, Inc., League City, TX; S. Kinyon, Stress Engineering Services, Waller, TX	1100 hrs AIAA-2019-4147 **Kinetic modeling of parasitic currents on spacecraft surfaces due to ambient space plasmas** N. Nuwal, D. Levin, University of Illinois, Urbana-Champaign, Urbana, IL	

Wednesday, 21 August 2019				
136-AVS-2	Advanced Vehicle Designs of Launch Vehicles and Drones			Room 203
Chaired by: F. CHANDLER, Cal Poly University, Pomona CA and T. CHEN, NASA				
0930 hrs AIAA-2019-4148 **Design and Testing of a Small Launch Vehicle with Lessons Learned** F. Chandler, California State Polytechnic University, Pomona, CA	1000 hrs AIAA-2019-4149 **A Design for a Two Stage Solid Mars Ascent Vehicle** A. Prince, NASA Marshall Space Flight Center, Huntsville, AL; T. Kibbey, Jacobs, Huntsville, AL; A. Schnell, D. Yaghoubi, NASA Marshall Space Flight Center, Huntsville, AL; A. Karp, B. Nakazono, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA	1030 hrs AIAA-2019-4150 **Analysis and Comparison of Different Chemistry Models for the Computation of Reacting Flows on Re-entry and Hypersonic Vehicles** F. Dias, University of Beira Interior Covilha, Covilha, Portugal; C. Xisto, Chalmers University of Technology, Göteborg, Sweden; J. Páscoa, University of Beira Interior Covilha, Covilha, Portugal	1100 hrs AIAA-2019-4151 **Drone-Station Matching in Smart Cities through Hungarian Algorithm: Power Minimization and Management** A. Mirzaeinia, S. Bradley, M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM	1130 hrs AIAA-2019-4152 **Energy Conservation of V-Shaped Flocking Canada Geese through Leader and Tail Switching** A. Mirzaeinia, M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM

Wednesday, 21 August 2019				
137-EDU-5	Student Research Projects in Propulsion Education III			Room 301
Chaired by: D. JONES, UAH Propulsion Research Center and J. VENTERS, UAH Propulsion Research Center				
0930 hrs AIAA-2019-4153 **ITA & IAE Solid Rocket Motor RDSX** A. Bahdur, Technological Institute of Aeronautics (ITA), São José dos Campos, Brazil; W. Shimote, Aeronautics and Space Institute (IAE), São José dos Campos, Brazil; D. Tenorio, Technological Institute of Aeronautics (ITA), São José dos Campos, Brazil	1000 hrs AIAA-2019-4154 **Design of Two-Phase Injectors Using Analytical and Numerical Methods with Application to Hybrid Rockets** E. Vargas Niño, M. Razavi, University of Toronto, Toronto, Canada	1030 hrs AIAA-2019-4155 **Combustion of a TMEDA/WFNA Hypergolic in a Bipropellant Rocket Engine** J. Hollingshead, M. Litzinger, D. Kiaoulias, L. Eckenrode, J. Moore, G. Risha, Pennsylvania State University, Altoona, PA; et al.	1100 hrs AIAA-2019-4156 **Design, Fabrication, and Testing of a Non-Premixed Methane/Oxygen Diffusion Flame Burner** L. Eckenrode, M. Ianuzzi, M. Litzinger, L. Nunamaker, J. Crist, J. Moore, Pennsylvania State University, Altoona, PA; et al.	1130 hrs AIAA-2019-4157 **A Conceptual Method to Recycle Space Debris into Fuels and Artificial Soil in the ISS for Numerous Applications** A. Mariappan, Kumaraguru College of Technology, Coimbatore, India; V. Sanal Kumar, Indian Space Research Organisation, Trivandrum, India; V. Anand, Kumaraguru College of Technology, Coimbatore, India; S. Weddell, University of Canterbury, Christchurch, New Zealand; I. Jeung, Seoul National University, Seoul, South Korea

Wednesday, 21 August 2019				
138-EERE-2	Experimental and Computational Energy Efficiency Studies I			Room 201
Chaired by: D. CARRINGTON, Los Alamos National Laboratory and K. OKAI, Japan Aerospace Exploration Agency				
0930 hrs AIAA-2019-4158 **Versatile Model Selection for Pyrolysis of Lignocellulosic-Biomass Components** K. Burra, A. Gupta, University of Maryland, College Park, College Park, MD	1000 hrs AIAA-2019-4159 **Thermolyzer Technology - A Revolutionary Change in WTE Processing** H. Brandhorst, CHZ Technologies, LLC, Austintown, OH	1030 hrs AIAA-2019-4160 **Performance Evaluation of an Aerodynamic Blade Model Using a Bottom-mounted Force Balance System** C. Ebuzeme, Z. Quadri, O. Noah, E. Ogedengbe, C. Eguma, University of Lagos, Akoka-Yaba, Nigeria	1100 hrs AIAA-2019-4161 **Effect of Preheating in Alumina Reduction Using Laser Ablation Toward Aluminum Energy Cycle for the Lunar Night** S. Tanaka, S. Yamada, K. Komurasaki, H. Koizumi, University of Tokyo, Tokyo, Japan	

Wednesday, 21 August 2019				
139-EP-14	**Small Satellite Hall Thruster Systems**			**Room 204**
Chaired by: P. PETERSON, NASA Glenn Research Center and J. FOSTER, University of Michigan				
0930 hrs AIAA-2019-4162 **Development of a High-Propellant Throughput Small Spacecraft Electric Propulsion System to Enable Lower Cost NASA Science Missions** G. Benavides, H. Kamhawi, T. Liu, L. Pinero, T. Sarver-Verhey, C. Rhodes, NASA Glenn Research Center, Cleveland, OH; et al.	1000 hrs AIAA-2019-4163 **Test Results of ExoTerra's Halo Micro Electric Propulsion System for Microsatellites** M. VanWoerkom, V. Gorokhovsky, G. Pulido, A. Seidcheck, ExoTerra Resource, LLC, Littleton, CO; J. Williams, Colorado State University, Fort Collins, CO; C. Farnell, Plasma Controls, LLC, Fort Collins, CO	1030 hrs AIAA-2019-4164 **Preliminary Design of a Single Stage Bismuth SPT Hall Thruster for Small Spacecraft Applications** A. Hepburn, D. White, Embry-Riddle Aeronautical University, Prescott, AZ		

Wednesday, 21 August 2019				
140-EP-15	**Ion Thruster Flight Development**			**Room 205**
Chaired by: D. HERMAN, NASA Glenn Research Ctr and G. WILLIAMS				
0930 hrs AIAA-2019-4165 **NEXT Ion Propulsion System Risk-Mitigation Tests in Support of the Double Asteroid Redirection Test (DART) Mission** R. Thomas, M. Patterson, NASA Glenn Research Center, Cleveland, OH; J. John, Johns Hopkins University Applied Physics Laboratory, Laurel, MD; M. Crofton, The Aerospace Corporation, El Segundo, CA	1000 hrs AIAA-2019-4166 **Ion Thruster Produced Roll Torque** N. Arthur, Vantage Partners, LLC, Brook Park, OH	1030 hrs AIAA-2019-4167 **Qualification of the Flight Heaters for the NEXT-C Hollow Cathodes** N. Arthur, Vantage Partners, LLC, Brook Park, OH; T. Sarver-Verhey, G. Soulas, J. Mackey, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-4168 **Laser-Induced Fluorescence in the Plume of a Radiofrequency Ion Thruster: Measurements and Excitation Schemes** C. Eichhorn, F. Scholze, C. Bundesmann, D. Spemann, H. Neumann, Leibniz Institute of Surface Engineering (IOM), Leipzig, Germany; H. Leiter, ArianeGroup, Lampoldshausen, Germany	

Wednesday, 21 August 2019				
141-EP-16	**Electrospray and Multimode Propulsion**			**Room 208**
Chaired by: J. ZIEMER, Jet Propulsion Laboratory and N. DEMMONS, Busek Co., Inc.				
0930 hrs AIAA-2019-4169 **Review of Chemical-Electric Multimode Space Propulsion** J. Rovey, C. Lyne, A. Mundahl, N. Rasmont, University of Illinois, Urbana-Champaign, Urbana, IL; M. Glascock, M. Wainwright, Missouri University of Science and Technology, Rolla, MO; et al.	1000 hrs AIAA-2019-4170 **Solvated Ion Cluster Dissociation Rates for Ionic Liquid Electrospray Propellants** B. Prince, C. Annesley, R. Bemish, Air Force Research Laboratory, Kirtland AFB, NM; S. Hunt, Boston College, Albuquerque, NM	1030 hrs AIAA-2019-4171 **Modeling of the Dissipation and Self-Heating of the Propellant in Electrospray Thrusters** M. Magnani, M. Gamero, University of California, Irvine, Irvine, CA		

Wednesday, 21 August 2019				
142-F360-9 **0930 - 1130 hrs**	**Wednesday Forum 360 AM: Rising to the Challenge of America's Workforce Needs**			**JW Grand Ballroom 3/4**
Moderator: Lisa Teague, Head, Research and Technology, Rolls-Royce Corporation Opening Remarks: Carla Sands, Program Manager, Workforce, Aviation Week Network Panelists:				
David L. Dimmett Senior Vice President and Chief Engagement Officer Project Lead The Way	**Shaun Humes** Senior Manager, Program Management Collins Aerospace	**Teresa Lubbers** Commissioner Indiana Commission for Higher Education	**Gerry McCartney** Executive Vice President Purdue Online	**Carla Sands** Program Manager, Workforce Aviation Week Network

Wednesday, 21 August 2019		
143-GTE-16 **0930 - 1200 hrs**	**Undergraduate Engine Design Competition**	**Room 305/06**
Students will be presenting their projects for judging and awards		

Wednesday, 21 August 2019				
144-GTE-17	**Turbomachinery**			**Room 312**
Chaired by: V. HASTI				
0930 hrs AIAA-2019-4172 **3D Optimization of the Fir-tree Design on the Turbine Disk/Blade attachment** J. Lee, Y. Yi, W. Chow, Nanyang Technological University, Singapore, Singapore	1000 hrs AIAA-2019-4173 **Multiple Scale Analysis of the Forced Response of a Mistuned Bladed Disk with Nonlinear Friction Forces** J. Martín Bautista, C. Martel, Technical University of Madrid, Madrid, Spain	1030 hrs AIAA-2019-4174 **The Effects of Non-Uniform Blade Spacing on Compressor Rotor Flutter Stability** Y. Leng, N. Key, Purdue University, West Lafayette, IN	1100 hrs AIAA-2019-4175 **Numerical investigation of Non-Synchronous vibration using Scale Adaptive Simulation turbulence model** P. Patel, University of Miami, Coral Gables, FL; H. Im, Doosan ATS America, Palm Beach Gardens, FL; G. Zha, University of Miami, Coral Gables, FL	1130 hrs AIAA-2019-4176 **Computational Finite Element Analysis of Adaptive Gas Turbine Stator-Rotor Flow Interactions for Future Vertical Lift Propulsion** N. Kozak, Iowa State University, Ames, IA; L. Bravo, M. Murugan, A. Ghoshal, Army Research Laboratory, Aberdeen Proving Ground, MD; Y. Khine, CREATE Kestrel Team, Aberdeen, MD; Y. Bazilevs, Brown University, Providence, RI; et al.

Wednesday, 21 August 2019				
145-GTE-18	**Gas Turbine Heat Transfer I**			**Room 311**
Chaired by: M. RICKLICK, Embry Riddle Aeronautical University				
0930 hrs AIAA-2019-4177 **Effect of Surface Pattern for Harbor Seal Whisker Inspired Pin Geometries for Enhanced Heat Transfer** A. Prasad, M. Ricklick, Embry-Riddle Aeronautical University, Daytona Beach, FL	1000 hrs AIAA-2019-4178 **Experimental and Numerical Investigation of Fully Turbulent Flow in a Rectangular Channel with Dimples and Protrusions** G. Gupta, E. Fernandez, M. Otto, J. Kapat, University of Central Florida, Orlando, FL	1030 hrs AIAA-2019-4179 **Investigation of Unsteady Flow Structures in a Rectangular Channel with Pin Fin Array** P. Tran, E. Fernandez, J. Kapat, University of Central Florida, Orlando, FL	1100 hrs AIAA-2019-4180 **Strongly Heated Turbulent Boundary Layer in Channel with Staggered Pin Fins** C. Lee, Purdue University, West Lafayette, IN	

Wednesday, 21 August 2019				
146-GTE-19	**Hybrid-Electric and Mechanical Systems**			**White River J**
Chaired by: D. CULLEY, NASA Glenn Research Center and C. PERULLO, Georgia Institute of Technology				
0930 hrs AIAA-2019-4181 **Fuel burn evaluation of a turbo-electric propulsive fuselage aircraft** P. Giannakakis, Y. Maldonado, Safran Group, Châteaufort, France; N. Tantot, C. Frantz, Safran Group, Villaroche, France; M. Belleville, Airbus, Toulouse, France	1000 hrs AIAA-2019-4182 **Dynamic Analysis of the STARC-ABL Propulsion System** J. Kratz, G. Thomas, NASA Glenn Research Center, Cleveland, OH	1030 hrs AIAA-2019-4183 **Electrical Power System Sizing within the Numerical Propulsion System Simulation** J. Csank, D. Sadey, T. Lavelle, NASA Glenn Research Center, Cleveland, OH; J. Garcia, General Electric Company, Queretaro, Mexico; J. Bergeson, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-4184 **The Optimal Design of Damper Rings for Aviation Gears** Z. Li, Y. Wang, X. Jiang, Y. Wu, W. Yang, Beihang University, Beijing, China	1130 hrs AIAA-2019-4185 **Estimation of the Hydraulic Losses in the Work Shaft of a Gas Turbine Engine of a Gas Compressor Unit under Various Operating Conditions** O. Baturin, D. Kolmakova, A. Krivcov, V. Zubanov, G. Popov, Samara National Research University, Samara, Russia

Wednesday, 21 August 2019				
147-HR-8	**Green Propellants, Contemporary Materials, Modern Applications, and Advanced Manufacturing Techniques**			**Room 104**
Chaired by: T. ELLIOTT, University of Tennessee at Chattanooga and A. KARP, Jet Propulsion Laboratory				
0930 hrs AIAA-2019-4186 **Medical Grade N2O/O2 Mixtures as Inexpensive and Volumetrically Efficient Oxidizers for Small Spacecraft Hybrid Propulsion Systems** S. Whitmore, R. Stoddard, Utah State University, Logan, UT	1000 hrs AIAA-2019-4187 **Development and Preliminary Testing of Paraffin Hybrid Rocket Fuel Grains with Helical Port Structures** L. Pabarcius, Wesleyan University, Middletown, CT	1030 hrs AIAA-2019-4188 **Characteristics of Solid Fuel Based on WAX with Added Polypropylene for Hybrid Rocket** K. Kinoshita, Y. Matsumoto, K. Takahashi, Nihon University, Narashinodai, Japan	1100 hrs AIAA-2019-4189 **Aluminum Powder Effects with Aft-chamber Extension and Baffle Plate Installation for Hybrid Rocket** Y. Kanbayashi, K. Takahashi, A. Takahashi, Nihon University, Funabashi, Japan	1130 hrs AIAA-2019-4190 **Sweating Hybrid Rocket Fuels; Inclusion and Temperature Activated Release of Liquid Fuels in Solid Binders** M. McClain, C. Farrell, M. Paik, T. Pourpoint, Purdue University, West Lafayette, IN

Wednesday, 21 August 2019				
148-HR-9	**Contemporary Hybrid Rocket Fuel Characterization, Visualization, and Controls II**			**Room 103**
Chaired by: G. STORY, NASA Marshall Space Flight Center				
0930 hrs AIAA-2019-4191 **Modification of Paraffin-based Hybrid Rocket Fuels Using Structural Lattices** C. Hill, C. McDougall, T. Messinger, C. Johansen, University of Calgary, Calgary, Canada	1000 hrs AIAA-2019-4192 **Optically Resolved Fuel Regression of a Clear PMMA Hybrid Rocket Motor** F. Mechentel, B. Hord, B. Cantwell, Stanford University, Stanford, CA	1030 hrs AIAA-2019-4193 **Data Clustering of Hybrid Rocket Combustion Flame** A. Petrarolo, German Aerospace Center (DLR), Hardthausen, Germany; A. Ruettgers, German Aerospace Center (DLR), Cologne, Germany; M. Kobald, German Aerospace Center (DLR), Hardthausen, Germany	1100 hrs AIAA-2019-4194 **Numerical investigation of a low thrust Paraffin/N2O hybrid rocket** A. Ingenito, University of Rome "La Sapienza", Rome, Italy	1130 hrs AIAA-2019-4195 **Recent advancements in experimental and numerical characterization of paraffin-based fuels for hybrid rocket application** G. Di Martino, G. Gallo, S. Mungiguerra, C. Carmicino, R. Savino, University of Naples "Federico II", Naples, Italy; D. Cardillo, Italian Aerospace Research Center (CIRA), Capua, Italy; et al.

Wednesday, 21 August 2019				
149-HSABP-7	**High-Speed Injection and Mixing**			**Room 309/10**
Chaired by: J. EDWARDS and T. SMITH, Boeing Engineering Operations & Technology				
0930 hrs AIAA-2019-4196 **Numerical Investigation and Optimization of a Flushwall Injector for Scramjet Applications at Hypervelocity Flow Conditions** T. Drozda, R. Shenoy, E. Axdahl, R. Baurle, NASA Langley Research Center, Hampton, VA	1000 hrs AIAA-2019-4197 **Reacting Dynamic Hybrid Reynolds-Averaged Navier-Stokes/Large-Eddy Simulations of a Mach 3 Cavity** E. Hassan, D. Peterson, Air Force Research Laboratory, Wright-Patterson AFB, OH	1030 hrs AIAA-2019-4198 **Effect of Mach Number on the Flow Characteristics of Free and Confined Pulsed Jets** C. Leos, G. Acosta, O. Rodriguez, R. Freeman, I. Choutapalli, University of Texas, Rio Grande Valley, Edinburg, TX	1100 hrs AIAA-2019-4199 **CFD Evaluation Of Lean-Direct Injection Combustors for Commercial Supersonics Technology** K. Ajmani, Vantage Partners, LLC, Cleveland, OH; P. Lee, Woodward FST, Inc., Zeeland, MI; C. Chang, M. Kudlac, NASA Glenn Research Center, Cleveland, OH	

Wednesday, 21 August 2019		
150-HUB-5 **0930 - 1030 hrs**	**Meet the AIAA Technical Committees**	**the HUB**
Stop by this interactive session with some of AIAA's technical committee members. Learn what exactly technical committees do, what initiatives they're currently working on, when they meet, and how you can bring your YP perspective to them!		

Wednesday, 21 August 2019				
151-INPSI-6	**Inlets: Integration and Performance I**			**Room 308**
Chaired by: D. RITTENBERG, Siemens PLM Software and J. SLATER, NASA Glenn Research Center				
0930 hrs AIAA-2019-4200 **Experimental assessment of a non-conventional fighter aircraft: effects of canard on the performance of a dorsal intake** B. Ribeiro, P. Bravo Mosquera, F. Catalano, University of São Paulo, São Carlos, Brazil	1000 hrs AIAA-2019-4201 **An assessment on the unsteady flow distortion generated by an S-duct intake** M. Migliorini, P. Zachos, D. MacManus, Cranfield University, Bedford, United Kingdom	1030 hrs AIAA-2019-4202 **The impact of inlet boundary layer thickness on the unsteady aerodynamics of S-duct intakes** M. Migliorini, P. Zachos, D. MacManus, Cranfield University, Bedford, United Kingdom		

Wednesday, 21 August 2019				
152-ITAR-3	**Hypersonics**			**Room 209**
Chaired by: B. MUZEK and M. JACINTO, Aerojet Rocketdyne				
0930 hrs Oral Presentation **Combined-Cycle Engine Large Scale Inlet for Mode Transition Experiments (CCE-LIMX) Program Overview (Invited)** T. Stueber, NASA Glenn Research Center, Cleveland, OH	1000 hrs AIAA-2019-4203 **Integration of a Real-Time Dual-Mode Ramjet Simulation with the Combined Cycle Engine Large Scale Inlet for Mode Transition Experiments Testbed** T. Stueber, G. Kopasakis, D. Le, R. Thomas, NASA Glenn Research Center, Cleveland, OH; T. Sowers, Vantage Partners, LLC, Cleveland, OH	1030 hrs AIAA-2019-4204 **Real-Time Computational model for a Dual-Mode Ramjet Engine Simulation** G. Kopasakis, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-4205 **Bantam Afterburning Rocket Engine Propulsion System for a Reusable Hypersonic Test Bed** J. Castro, W. Sack, Aerojet Rocketdyne, Jupiter, FL	

Wednesday, 21 August 2019		
153-LP-16 0930 - 1200 hrs	Liquid Propulsion History	White River A/B

This session will present video recordings made in 2006 discussing the development and operation of the F-1, J-2, Lunar Module Descent Engine, and Lunar Module Ascent Engine by engineers that responsible for propulsion systems.

Wednesday, 21 August 2019		
154-PC-15 0930 - 1130 hrs	Intelligent Data Analysis for Combustion and Flow Dynamics	Room 102

Tutorial by Sukesh Roy, Spectral Energies, Inc.

Modern computational and experimental capabilities are making it possible to explore increasingly complex combustion dynamic behavior but at the expense of swamping analytical systems with vast amounts of data. The presentation will provide a brief overview of various non-linear data analysis tools that can significantly improve the post-processing speed, enable intelligent data mining of large numerical or experimental data sets, and provide reduced-order modeling (ROM) and adaptive intelligent control strategies. It will also cover the development of a comprehensive software for the above-mentioned analysis.

Wednesday, 21 August 2019				
155-PC-16	High Fidelity Combustion Modeling II			White River G
Chaired by: J. OEFELEIN, Georgia Institute of Technology and M. ANAND, Rolls-Royce Corp				
0930 hrs Oral Presentation **Future Directions for Multiphysics LES of Aero-Propulsion Systems (Invited)** J. Oefelein, Georgia Institute of Technology, Atlanta, GA		1030 hrs AIAA-2019-4206 **Validation of a Moment-Based Soot Model on Benchmark and Production Aircraft Engine Combustors** H. Koo, Rolls-Royce Group plc, Indianapolis, IN; R. Eggels, Rolls-Royce Group plc, Blankenfelde-Mahlow, Germany; M. Anand, Rolls-Royce Group plc, Indianapolis, IN	1100 hrs AIAA-2019-4207 **Numerical Simulation of Underwater Burst Events Using Sharp Interface Capturing Methods** N. Kakumanu, J. Edwards, North Carolina State University, Raleigh, NC; J. Choi, Yonsei University, Seoul, South Korea	1130 hrs AIAA-2019-4208 **Influence of compressibility effect on supersonic combustion modeling** L. Chen, W. Yao, X. Fan, Chinese Academy of Sciences, Beijing, China

Wednesday, 21 August 2019				
156-PC-17	Solid Propulsion Modeling			White River H
Chaired by: T. JACKSON, University of Florida and V. SANKARAN, US Air Force/AFRL/RQRC				
0930 hrs Oral Presentation **Recent Advances in the Modeling and Simulation of AP-based Solid Propellants (Invited)** T. Jackson, University of Florida, Gainesville, Gainesville, FL		1030 hrs AIAA-2019-4209 **Studies on Flame Spread Acceleration and Detonation Kernel in a Dual-thrust Rocket** V. Sanal Kumar, Indian Space Research Organisation, Trivandrum, India; A. Sukumaran, Kumaraguru College of Technology, Coimbatore, India; N. C, V. S, Indian Institute of Science, Bengaluru, India; A. Mariappan, A. Moorthi, Kumaraguru College of Technology, Coimbatore, India; et al.	1100 hrs AIAA-2019-4210 **Modeling of HMX Monopropellant Combustion with Detailed Condensed-Phase Kinetics** L. Patidar, M. Khichar, S. Thynell, Pennsylvania State University, University Park, PA	

Wednesday, 21 August 2019				
157-PGC-8	Pressure Gain Combustion: Performance, Integration and Applications I			Room 105
Chaired by: D. SCHWER, Naval Research Lab and V. TANGIRALA, General Electric				
0930 hrs AIAA-2019-4211 **Geometry Effects on the Pressure, Velocity Field and Operation of an Airbreathing Constant-Volume Combustion Chamber** B. Boust, Q. Michalski, M. Bellenoue, National Center for Scientific Research (CNRS), Poitiers, France	1000 hrs AIAA-2019-4212 **Experimental Performance Characterization of an RDE Using Equivalent Available Pressure** C. Brophy, J. Codoni, Naval Postgraduate School, Monterey, CA	1030 hrs AIAA-2019-4213 **Minimization of Pressure Fluctuations in an Axial Turbine Stage Under Periodic Inflow Conditions** D. Topalovic, S. Wolff, A. Heinrich, D. Peitsch, R. King, Technical University of Berlin, Berlin, Germany	1100 hrs AIAA-2019-4214 **Performance Characterization of a Natural Gas-Air Rotating Detonation Engine at Elevated Pressure** I. Walters, C. Journell, A. Lemcherfi, R. Gejji, S. Heister, C. Slabaugh, Purdue University, West Lafayette, IN	

Wednesday, 21 August 2019				
158-PGC-9	**Pressure Gain Combustion: Measurement Techniques and Test Facilities II**			**White River C/D**
Chaired by: M. GAMBA, University of Michigan and A. AGRAWAL, The University of Alabama				
0930 hrs AIAA-2019-4215 **Characterization of CH4-O2 Detonation in Unwrapped RDE Channel Combustor** J. Burr, K. Yu, University of Maryland, College Park, College Park, MD	1000 hrs AIAA-2019-4216 **Injector Flowfield-Detonation Wave Interaction in Unwrapped RDE Channel** S. Redhal, J. Burr, K. Yu, University of Maryland, College Park, College Park, MD	1030 hrs AIAA-2019-4217 **OH PLIF Visualization of an Optically Accessible Rotating Detonation Combustor** F. Chacon, M. Gamba, University of Michigan, Ann Arbor, Ann Arbor, MI	1100 hrs AIAA-2019-4218 **Ultrahigh-Speed Imaging of a Propagating Detonation Wave in a High Aspect Ratio Rectangular Channel** C. Slabaugh, R. Gejji, M. Frederick, Purdue University, West Lafayette, IN; J. Shepherd, California Institute of Technology, Pasadena, CA	1130 hrs AIAA-2019-4219 **Effect of air flow rate on the mode of combustion in rotating detonation engines** Y. Wang, Beijing University of Chemical Technology, Beijing, China; J. Le, China Aerodynamics Research and Development Center, Mianyang, China

Wednesday, 21 August 2019				
159-SR-5	**Solid Rocket Propellant Characterization and Motor Ballistics**			**Room 106**
Chaired by: D. SCARBOROUGH and R. YOUNG, Northrop Grumman Innovation Systems				
0930 hrs AIAA-2019-4220 **Combustion of Aluminized Solid Propellants with Bimodal Oxidizer Particle Size Distribution** B. Elzein, Reaction Dynamics, Montréal, Canada; J. Xing, University of Toronto, Toronto, Canada; O. Jobin, E. Robert, Polytechnique Montréal, Montréal, Canada	1000 hrs AIAA-2019-4221 **Examination of Flow Field Inside Grain Port and Grain Regression Characteristics of a Nozzleless Solid Propellant Rocket Motor** A. Özer, B. Sümer, TUBITAK, Ankara, Turkey; Y. Özyörük, Middle East Technical University, Ankara, Turkey			

Wednesday, 21 August 2019		
160-SR-6 **0930 - 1030 hrs**	**Risk Management for University Research in Solid Propellant**	**Room 107**
Discussion will be focused on topics affecting the development, instrumentation, and utilization of solid rocket experimental testing facilities. This includes the risk management, design, fire safety, and university level protocols in place, proposed, and desired to foster and maintain a safe and effective solid rocket program.		

Wednesday, 21 August 2019				
161-TM-5	**Heat Transfer and Transport II**			**Room 307**
Chaired by: M. CHOI, NASA-Goddard Space Flight Center and D. ZAKAR, NRL				
0930 hrs AIAA-2019-4222 **Stabilizing Loop Heat Pipe Operation with Control Heaters** T. Holman, R. Baldauff, D. Khrustalev, Naval Research Laboratory, Washington, D.C.	1000 hrs AIAA-2019-4223 **Characterization of spray structures formed during water injection into a free supersonic air jet** S. Menon, H. Jones, W. Zhao, Louisiana State University, Baton Rouge, LA	1030 hrs AIAA-2019-4224 **Simulation of Thermal Management in a Surgical Operating Theatre and Its Experimental Verification** E. Khalil, A. ElDegwy, Cairo University, Cairo, Egypt	1100 hrs AIAA-2019-4225 **Numerical Simulation of Phase Change Materials to Predict the Energy Storage Process Accurately** A. Khademi, M. Darbandi, M. Behshad Shafii, Sharif University of Technology, Tehran, Iran; G. Schneider, University of Waterloo, Waterloo, Canada	1130 hrs AIAA-2019-4226 **On the Modeling of Smoke Management of Sprinklers In a Medium Sized Sprinklered Car Park** D. Khalil, Dar Al-Handasah, Cairo, Egypt; E. Khalil, Cairo University, Cairo, Egypt

Wednesday, 21 August 2019		
162-HUB-6 **1130 - 1200 hrs**	**Extended Q&A with Roberto Guerrero, Deputy Assistant Secretary of the Air Force for Operational Energy, Office of the Assistant Secretary of the Air Force for Installations, Environment and Energy**	**the HUB**

Wednesday, 21 August 2019		
163-HUB-7 **1200 - 1230 hrs**	**OmegA Rocket – Affordable, Reliable Access to Space**	**the HUB**
Speaker: Thomas Carroll, Director of Business Development, Commercial Launch Services The OmegA rocket uses solely solid propulsion for the boost phases of flight, and RL-10 engines or the upper stage. Northrop Grumman is rapidly developing and qualifying the intermediate/heavy lift OmegA rocket to be affordable and low risk—essential characteristics for launching critical national security payloads and large commercial satellites.		

Wednesday, 21 August 2019		
164-LUNCH-1 1230 - 1400 hrs	Excellence in Aerospace Award Luncheon (Proof of Purchase Required)	JW Grand Ballroom 5

Wednesday, 21 August 2019		
165-HUB-8 1300 - 1400 hrs	Rocket Shot Contest	the HUB
Grab a foam rocket launcher and take aim at the bulls eye for your chance to win a prize! Rockets are provided.		

Wednesday, 21 August 2019				
166-AMP-1	Additive Manufacturing: Test Results and Feasibility I			Room 301
Chaired by: E. JENS, Jet Propulsion Laboratory and F. CHANDLER, Cal Poly University, Pomona CA				
1400 hrs AIAA-2019-4227 **Development of a Low-Cost 0.1N High Test Peroxide Thruster Using Additive Manufacturing** E. Fonda-Marsland, G. Roberts, University of Southampton, Southampton, United Kingdom; D. Gibbon, Surrey Satellite Technology, Ltd., Guildford, United Kingdom; C. Ryan, University of Southampton, Southampton, United Kingdom	1430 hrs AIAA-2019-4228 **GRCop-42 Development and Hot-fire Testing Using Additive Manufacturing Powder Bed Fusion for Channel-cooled Combustion Chambers** P. Gradl, C. Protz, K. Cooper, NASA Marshall Space Flight Center, Huntsville, AL; D. Ellis, L. Evans, NASA Glenn Research Center, Cleveland, OH; C. Garcia, NASA Marshall Space Flight Center, Huntsville, AL	1500 hrs AIAA-2019-4229 **Development and Testing of Conventional and Additively Manufactured Aerospike Nozzles for Small Satellite Propulsion** S. Whitmore, I. Armstrong, Utah State University, Logan, UT	1530 hrs AIAA-2019-4230 **Usage Of Consumer Grade Additive Manufacturing Of PLA For Hybrid Rockets** P. Yli-Opas, J. Kattelus, A. Ikäheimo, E. Kittilä, V. Vilenius, M. Manninen, Aalto University, Espoo, Finland; et al.	1600 hrs AIAA-2019-4231 **Performance of a Small-Orifice Rocket Injector Utilizing Additive Manufacturing** N. Gloria, W. Bassett, I. Vorbach, J. Kolano, A. Gupta, I. Rall, Stanford University, Stanford, CA; et al.

Wednesday, 21 August 2019				
167-APC-4	Advanced Propulsion Concepts III			Room 311
Chaired by: J. ROBINSON and T. GIEL, Jacobs Technology				
1400 hrs AIAA-2019-4232 **Performance Enhancement of An Ethylene-Fueled Scramjet Combustor Using A Porous Cylindrical Burner** W. Lee, K. Pan, National Taiwan University, Taipei, Taiwan	1430 hrs AIAA-2019-4233 **A Small Multi-Inter Turbine Burner-Enabled Turboshaft Engine for UAV Applications** C. Spytek, Spytek Aerospace Corporation, Bensenville, IL	1500 hrs AIAA-2019-4234 **Propulsion Requirements for Future Generation Space Habitats** K. MacLeod, J. Martin, Space Propulsion Synergy Team (SPST), Cocoa, FL		

Wednesday, 21 August 2019				
168-APS-2	Aircraft and Spacecraft Power System Technologies			Room 202
Chaired by: J. HAINES, Retired - formerly ESA/ESTEC and M. PATEL, US Merchant Marine Academy				
1400 hrs AIAA-2019-4235 **Mission to Saturn: An Exemplary Collaboration between NASA and International Rectifier HiRel Products** A. Gohardani, International Rectifier HiRel Products, El Segundo, CA; M. Staab, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA	1430 hrs AIAA-2019-4236 **Solar Power for Deep-Space Applications: State of Art and Development** A. Boca, C. MacFarland, R. Kowalczyk, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA	1500 hrs AIAA-2019-4237 **AC to DC Converter for Turboelectric Propulsion** T. Sitton, K. Furmanczyk, Crane Aerospace and Electronics, Lynnwood, WA		

Wednesday, 21 August 2019		
169-EATS-1 1400 - 1630 hrs	Rolling Recap on Aircraft Electrified Propulsion and Power/NASA Urban Air Grand Challenge	White River A/B

The Rolling Recap session's objective is to disseminate information in the rapidly emerging and exciting area of Aircraft Electrified Propulsion and Power technology to forum attendees. The session presents a summary of papers/panel sessions from previous AIAA conferences on electric aircraft and propulsion, and keeps the community informed. The session also presents an opportunity to discuss relevant technology developments and activities in the industry.

Starr Ginn will discuss the NASA Aeronautics Research Mission Directorate's (ARMD) plans to host a series of Urban Air Mobility (UAM) "Grand Challenges." The Grand Challenge (GC) series is designed to promote public confidence in UAM safety, facilitate community-wide learning while capturing the public's imagination, and give prospective manufacturers and operators insights into the evolving regulatory and operational environment. The Grand Challenge series will focus on Vehicle performance, safety assurance, airspace interoperability, readiness for civil use, and noise.

Wednesday, 21 August 2019				
170-EERE-3	**Experimental and Computational Energy Efficiency Studies II**			**Room 201**
Chaired by: D. CARRINGTON, Los Alamos National Laboratory and D. PEPPER, UNLV				
1400 hrs AIAA-2019-4238 **Study of industrial energy assessments for different sectors** R. Amano, A. Abbas, A. Salem, A. AbdelHadi, M. Qandil, University of Wisconsin, Milwaukee, Glendale, WI	1430 hrs AIAA-2019-4239 **Energy Consumption, Energy-saving and Emissions Reduction of Wastewater Treatment Plants (WWTPs) in Wisconsin** R. Amano, A. Abbas, M. Al-Haddad, M. Qandil, University of Wisconsin, Milwaukee, Glendale, WI	1500 hrs AIAA-2019-4240 **Investigation of Experimental Jet Array For Impinging Cooling of Blades** R. Amano, F. Nourin, A. Salem, N. DiPasquale, University of Wisconsin, Milwaukee, Glendale, WI	1530 hrs AIAA-2019-4241 **Temperature Field Calculations of an Equipment Panel in Remote Sensing Spacecraft** E. Khalil, Cairo University, Cairo, Egypt; A. Farag, Egyptian Armed Forces, Cairo, Egypt	

Wednesday, 21 August 2019		
171-EP-17 **1400 - 1530 hrs**	**The Next Step for In-Space Electric Propulsion**	**White River C/D**

The Electric Age for Spacecraft propulsion has arrived. Moderately powered electric thrusters (1-5 kW) are routinely flown on commercial and government missions, and industry projections suggest that in the next decade, over half of all future spacecraft will have electric thrusters on them. This recent success invites new questions about the future of this field. What comes next? With the Advanced Electric Propulsion System (AEPS) we may soon be able to achieve 10's of kilowatts of electric propulsion in orbit. Is there a government or commercial demand for higher power electric thrusters in space? Pushing the envelope to 100's of kilowatts - perhaps even megawatts – more ambitious robotic and even crewed missions become possible. Is there a pull for this technology? What types of scientific and technical advances are required to enable this future? Leaving aside questions of power, there are recent proposals for launching constellations of hundreds or even thousands of moderately-powered electric propulsion systems. What are the practical and technical challenges for achieving this? This panel brings together experts from industry, government, and academia to discuss the need for high-power EP over the next 50 years. Particular emphasis will be placed on answering the question how do research and development performed today meet the needs for electric propulsion systems of tomorrow?

Panelists:

Rostislav Spektor	**John Brophy**	**Joe Cassidy**	**Daniel Herman**	**Justin Koo**
The Aerospace Corporation	NASA Jet Propulsion Laboratory	Aerojet Rocketdyne	NASA Glenn Research Center	Air Force Office of Scientific Research

Wednesday, 21 August 2019				
172-EP-18	**Small Satellite Electric Propulsion**			**Room 204**
Chaired by: T. LIU, NASA Glenn Research Center and M. GLASCOCK				
1400 hrs AIAA-2019-4242 **Characterization of the Dielectric Barrier Discharge Thruster for Microsatellite Applications** K. Vereen, K. Durkee, A. Kullman, S. Fraser, J. Correy, R. Winglee, University of Washington, Seattle, Seattle, WA	1430 hrs AIAA-2019-4243 **Micro-Nozzle Design for an Electrothermal Plasma Thruster** T. Croteau, A. Greig, California Polytechnic State University, San Luis Obispo, CA	1500 hrs AIAA-2019-4244 **Experimental Characterization of Nozzle Performance at Low Reynolds Numbers for Water Resistojet Thrusters** K. Nishii, H. Koizumi, K. Komurasaki, University of Tokyo, Bunkyo, Japan	1530 hrs AIAA-2019-4245 **Experimental Investigation on Discharge Degradation Characteristics for Micro-cathode Arc Thruster** S. Chen, X. Liu, Y. Ling, J. Qureshi, W. Wang, N. Wang, Beijing Institute of Technology, Beijing, China; et al.	

Wednesday, 21 August 2019				
173-EP-19	**Cathodes**			**Room 205**
Chaired by: J. POLK, Jet Propulsion Laboratory and M. MARTIN, Lynntech Inc.				
1400 hrs AIAA-2019-4246 **Scaling Relationships for the Total Pressure in Orificed Hollow Cathodes** P. Taunay, C. Wordingham, E. Choueiri, Princeton University, Princeton, NJ	1430 hrs AIAA-2019-4247 **Characterization of Propellant Flow and Bias Required to Initiate an Arc Discharge in a Heaterless Hollow Cathode** R. Ham, J. Williams, Colorado State University, Fort Collins, CO; S. Hall, Vantage Partners, LLC, Cleveland, OH; G. Benavides, T. Sarver-Verhey, NASA Glenn Research Center, Cleveland, OH	1500 hrs AIAA-2019-4248 **Evaluation of the Effects of Sea-Level Ambient Environmental Exposure on Emission Performance of Impregnated Dispenser-Type inserts** W. Ohlinger, Self, Babson Park, FL; B. Vancil, eBeam, Inc., Beaverton, OR	1530 hrs AIAA-2019-4249 **High-energy ion generation due to the plasma wave driven by current-carrying instabilities** K. Hara, Texas A&M University, College Station, TX	1600 hrs AIAA-2019-4250 **Low-frequency cathode plume oscillations in a 5-30A LaB_6 cathode** G. Becatti, M. Saravia, University of Pisa, Pisa, Italy; D. Pedrini, SITAEL S.p.A., Pisa, Italy; F. Paganucci, University of Pisa, Pisa, Italy; T. Andreussi, M. Andrenucci, SITAEL S.p.A., Pisa, Italy

Wednesday, 21 August 2019		
174-F360-10 1400 - 1515 hrs	Wednesday Forum 360 PM: Challenges and Opportunities in Continuing Advancement of Gas Turbine Technologies (Part I - Funding Agencies)	JW Grand Ballroom 3/4

Moderator: Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

Panelists:

Robert Hancock
Principal Scientist, Turbine Engine Division
Air Force Research Laboratory

Steven Martens
Program Officer, Power, Propulsion and Thermal Management
Office of Naval Research

Simon Weeks
Chief Technology Officer
Aerospace Technologies Institute

Wednesday, 21 August 2019				
175-GTE-21	Gas Turbine Heat Transfer II			White River I
Chaired by: G. PANIAGUA, Purdue University				
1400 hrs AIAA-2019-4251 **Effects of Longitudinal Vortices on Turbulent Junction Flow Heat Transfer** J. Zuccarello, E. Lange, S. Lynch, Pennsylvania State University, University Park, PA	1430 hrs AIAA-2019-4252 **3D Design of Turbulated Rib to Enhance Gas Turbine Internal Cooling** Y. Yu, C. Ng, W. Chow, Nanyang Technological University, Singapore, Singapore	1500 hrs AIAA-2019-4253 **Efficient calibration of a turbine disc heat transfer model under uncertainty** A. White, S. Mahadevan, Vanderbilt University, Nashville, TN; Z. Grey, University of Colorado, Boulder, Boulder, CO; J. Schmucker, A. Karl, Rolls-Royce Group plc, Indianapolis, IN	1530 hrs AIAA-2019-4254 **Flow and heat transfer characteristics of jets impinging on a narrowly confined concave surface** Y. Yang, J. Mao, H. Qian, X. Han, Z. Tu, Nanjing University of Aeronautics and Astronautics, Nanjing, China	1600 hrs AIAA-2019-4255 **Experimental Investigation of an Oscillating Jet Induced by Cylinder Wakes** K. Krishna, M. Ricklick, Embry-Riddle Aeronautical University, Daytona Beach, FL

Wednesday, 21 August 2019				
176-GTE-22	Combustion and Thermal Management			White River J
Chaired by: S. MARTIN, Embry-Riddle Aeronautical University				
1400 hrs AIAA-2019-4256 **The Nature of Combustor Turbulence** M. Folk, R. Miller, University of Cambridge, Cambridge, United Kingdom	1430 hrs AIAA-2019-4257 **Design and Challenges of Lean Fully Premixed Injectors for Gas Turbine Engines** P. Palies, R. Acharya, A. Hoffie, CFD Research Corporation (CFDRC), Huntsville, AL	1500 hrs AIAA-2019-4258 **Design of Pre-diffuser Cone for Dump Diffusers for Aero Gas Turbine Engines** A. S, S. G, A. Sukumaran, A. Mariappan, S. K, Kumaraguru College of Technology, Coimbatore, India; V. Sanal Kumar, Indian Space Research Organisation, Trivandrum, India	1530 hrs AIAA-2019-4259 **Numerical modelling of a realistic annular effusion cooling system** G. Crouzy, F. Desarnaud, Safran Group, Magny-les-Hameaux, France; E. Laroche, P. Millan, ONERA, Toulouse, France	1600 hrs AIAA-2019-4260 **Efficient Gas Turbine Combustor Simulation Using Full Simulation Methodology (FSM)** R. Kelly, A. Jemcov, University of Notre Dame, Notre Dame, IN; S. Rida, Honeywell International, Inc., Phoenix, AZ; J. Basani, Honeywell International, Inc., Bengaluru, India

Wednesday, 21 August 2019		
177-GTE-24 1400 - 1600 hrs	Introduction to Propulsion Simulation Using NPSS and OTAC	Room 106

Propulsion system simulation is relevant at all stages of development, from preliminary design through production testing. This tutorial will provide insight into the modeling and analysis of propulsion systems using one of the more common simulation environments. In addition, this tutorial will cover a recent turbomachinery modeling development by NASA Glenn Research Center.

Wednesday, 21 August 2019				
178-HR-10	Internal Ballistics Modeling			Room 102
Chaired by: M. KOBALD, DLR-German Aerospace Center				
1400 hrs AIAA-2019-4261 **Predictive CFD Model for Internal Ballistics of Hybrid Rocket Engines using Supercritical Paraffin-wax and Oxygen** M. Migliorino, D. Bianchi, F. Nasuti, University of Rome "La Sapienza", Rome, Italy	1430 hrs AIAA-2019-4262 **Evaluation of Discretization Schemes in Biglobal Stability Analysis of Cylindrically-Shaped Solid and Hybrid Rockets** T. Elliott, A. Sam, T. Grider, University of Tennessee, Chattanooga, Chattanooga, TN; J. Majdalani, Auburn University, Auburn, AL	1500 hrs AIAA-2019-4263 **CFD Analysis of Paraffin-Based Hybrid Rockets with Coupled Nozzle Erosion Characterization** D. Bianchi, M. Migliorino, F. Nasuti, M. Onofri, University of Rome "La Sapienza", Rome, Italy	1530 hrs AIAA-2019-4264 **Investigation of Graphite Nozzle Erosion in Hybrid Rockets Using N2O/HDPE** L. Kamps, K. Sakurai, Hokkaido University, Sapporo, Japan; K. Ozawa, Kyushu Institute of Technology, Kitakyushu, Japan; H. Nagata, Hokkaido University, Sapporo, Japan	

Wednesday, 21 August 2019				
179-HR-11	**Combustion Stability, Motor Performance, and Related Issues II**			**Room 103**
Chaired by: B. EVANS, Space Propulsion Group, Inc.				
1400 hrs AIAA-2019-4265 **Basic research on improvement of combustion efficiency of Wax fuel hybrid rocket** I. Nakagawa, K. Yasuda, Tokai University, Hiratuka, Japan	1430 hrs AIAA-2019-4266 **Real-Time Deep Throttling Tests of a Hydrogen Peroxide Hybrid Rocket Motor** A. Ruffin, E. Paccagnella, M. Santi, F. Barato, D. Pavarin, University of Padua, Padua, Italy	1500 hrs AIAA-2019-4267 **Flight testing of technology demonstrator with hydrogen peroxide hybrid rocket** Y. Yun, Korea Advanced Institute of Science and Technology, Daejeon, South Korea; J. Seo, Satellite Technology Research Center, Daejeon, South Korea; K. Park, NARA Space Technology, Inc., Seoul, South Korea; J. Jeong, J. Kim, S. Kwon, Korea Advanced Institute of Science and Technology, Daejeon, South Korea	1530 hrs AIAA-2019-4268 **Development of a 2D Optically Accessible Hybrid Rocket Motor** S. Boyle, D. Scarborough, Auburn University, Auburn, AL	

Wednesday, 21 August 2019				
180-HSABP-8	**Flameholding and Combustion**			**Room 309/10**
Chaired by: Z. HONG, National Research Council Canada and V. TANGIRALA, General Electric				
1400 hrs AIAA-2019-4269 **A Theory for Momentum, Energy, and Mass Transport in Supersonic Spray Combustion** F. Ladeinde, Stony Brook University, Stony Brook, NY	1430 hrs AIAA-2019-4270 **Premixed Ethylene-Air Combustion in a Dual-Mode Scramjet Cavity Combustor with a Turbulent Inflow** G. Goodwin, R. Johnson, D. Kessler, Naval Research Laboratory, Washington, D.C.; H. Chelliah, University of Virginia, Charlottesville, Charlottesville, VA	1500 hrs AIAA-2019-4271 **Experimental data from ramjet/scramjet combustion and numerical validation perspectives** G. Riva, G. Daminelli, National Research Council (CNR), Milan, Italy; L. Galfetti, F. Maggi, G. Colombo, S. Carlotti, Technical University of Milan, Milan, Italy; et al.	1530 hrs AIAA-2019-4272 **Flame Sustainability and Thermal Choking Study of Supersonic Combustion of Hydrogen, Methane, and Ethylene** W. Li, F. Ladeinde, TTC Technologies, Inc., Centereach, NY	1600 hrs AIAA-2019-4273 **A Comparative Study of Subgrid Models, Reaction Mechanisms and Combustion Models in LES of Supersonic Combustion** C. Fureby, Swedish Defense Research Agency (FOI), Stockholm, Sweden

Wednesday, 21 August 2019				
181-INPSI-8	**Inlets: Integration and Performance II**			**Room 308**
Chaired by: E. LOTH, University of Virginia and S. HIRT, NASA Glenn Research Center				
1400 hrs AIAA-2019-4274 **A CFD Investigation of a Diverterless Supersonic Inlet of Ellipsoidal Entrance Shape** F. Chandler, R. Montes, California State Polytechnic University, Pomona, CA	1430 hrs AIAA-2019-4275 **Unsteady swirl distortion characteristics for S-ducts using Lattice Boltzmann and time-resolved, stereo PIV methods** M. Guerrero-Hurtado, P. Zachos, D. MacManus, M. Migliorini, Cranfield University, Cranfield, United Kingdom; G. Trapani, Dassault Group, Madrid, Spain	1500 hrs AIAA-2019-4276 **Flow Field Analysis Inside First Stage Rotor (LPC) of Low By Pass Ratio Turbofan Engine With Integrated Aircraft Intake Data** A. Farooq, J. Masud, M. Shehzad, Air University, Islamabad, Pakistan		

Wednesday, 21 August 2019		
182-ITAR-4 **1400 - 1600 hrs**	**Scramjet School**	**Room 209**

Wednesday, 21 August 2019				
183-LP-17	**Green Propulsion Systems for Space Applications I**			**Room 107**
Chaired by: B. RHODES, The Aerospace Corporation and C. GATTO, Jet Propulsion Laboratory				
1400 hrs AIAA-2019-4277 **Design and Testing of a 3D Printed 10 N Hydrogen Peroxide Monopropellant Thruster** M. Santi, I. Dorgnach, F. Barato, D. Pavarin, University of Padua, Padua, Italy	1430 hrs AIAA-2019-4278 **Development and characterization of a catalyst for the decomposition of hydrogen peroxide** S. Casu, R. Kiemel, B. Geiger, Heraeus Group, Hanau, Germany; J. Anthoine, J. Lestrade, ONERA, Mauzac, France	1500 hrs AIAA-2019-4279 **Design and first results of an injector test setup for green hypergolic propellants** F. Lauck, J. Witte, M. Negri, D. Freudenmann, S. Schlechtriem, German Aerospace Center (DLR), Hardthausen, Germany		

Wednesday, 21 August 2019				
184-LP-19	**Propellant Storage and Management I**			**Room 104**
Chaired by: M. MEYER, NASA Langley Research Center and P. BEHRUZI, ArianeGroup				
1400 hrs AIAA-2019-4280 **Thermal Modeling of Zero Boil Off Tank Experiment** E. Tesny, D. Hauser, NASA Glenn Research Center, Cleveland, OH	1430 hrs AIAA-2019-4281 **SINDA/FLUINT and Thermal Desktop Multi-Node Settled and Unsettled Propellant Tank Modeling of Zero Boil Off Test** B. Sakowski, D. Hauser, NASA Glenn Research Center, Cleveland, OH; M. Kassemi, Case Western Reserve University, Cleveland, OH	1500 hrs AIAA-2019-4282 **CFD Jet Mixing Model Validation against Zero-Boil-Off Tank (ZBOT) Microgravity Experiment** O. Kartuzova, M. Kassemi, Case Western Reserve University, Cleveland, OH	1530 hrs AIAA-2019-4283 **Synopsis of LOX/Liquid Methane and Liquid Natural Gas Rocket Propellant Explosion Hazards** A. Sutton, N. Sedano, Air Force Research Laboratory, Edwards AFB, CA	

Wednesday, 21 August 2019				
185-NFF-6	**The Future of Nuclear and Breakthrough Propulsion**			**Room 101**
Chaired by: J. CAVERA, Blue Origin LLC and G. WILLIAMS				
1400 hrs AIAA-2019-4284 **Development of a pulse-recharge magnetic nozzle for PuFF** N. Schilling, J. Cassibry, University of Alabama, Huntsville, Huntsville, AL	1430 hrs AIAA-2019-4285 **New Experimental Results for Mach Effect Gravitation Assist (MEGA) drives** H. Fearn, J. Woodward, California State University, Fullerton, CA	1500 hrs AIAA-2019-4286 **Flow features of annular-laser pulse induced explosions and the impulsive performance on a sphere** C. Xie, D. Tran, K. Mori, Nagoya University, Nagoya, Japan	1530 hrs AIAA-2019-4287 **Fusion Research Development at the University of Alabama in Huntsville** R. Wagner, S. Westrich, E. Burns, J. Cassibry, University of Alabama, Huntsville, Huntsville, AL	1600 hrs AIAA-2019-4288 **An Examination of Warp Theory and Technology to Determine the State of the Art and Feasibility** J. Agnew, University of Alabama, Huntsville, Huntsville, AL

Wednesday, 21 August 2019				
186-PC-18	**High-Pressure Combustion**			**White River G**
Chaired by: V. SANKARAN, US Air Force/AFRL/RQRC and M. HARVAZINSKI, AFRL/RQRC				
1400 hrs AIAA-2019-4289 **Characteristics of a Premixed Reacting Jet-in-Crossflow at Elevated Pressures** M. Otero, T. Genova, K. Ahmed, B. Stiehl, S. Vasu, University of Central Florida, Orlando, FL; S. Martin, Embry-Riddle Aeronautical University, Daytona Beach, FL	1430 hrs AIAA-2019-4290 **Exploration of a Reacting Jet-in-Crossflow in a High-Pressure Axial Stage Combustor** T. Genova, M. Otero, B. Stiehl, J. Reyes, University of Central Florida, Orlando, FL; S. Martin, Embry-Riddle Aeronautical University, Daytona, FL; K. Ahmed, University of Central Florida, Orlando, FL	1500 hrs AIAA-2019-4291 **Validation of LES for High-Pressure Gaseous H_2-O_2 Coaxial Jet Flame: Comparison with PLIF Measurements** S. Matsuyama, Japan Aerospace Exploration Agency (JAXA), Chofu, Japan	1530 hrs AIAA-2019-4292 **Molecular Dynamics Investigation of Sub-to-supercritical Transition of n-Alkane Fuel Mixtures in Nitrogen** S. Chakraborty, L. Qiao, Purdue University, West Lafayette, IN	1600 hrs AIAA-2019-4293 **Numerical Simulation of a GH_2/LO_x Rocket Combustor with Multiple Injectors Using Real Gas Flamelet Model** W. Hwang, Pusan National University, Pusan, South Korea; W. Han, K. Huh, Pohang University of Science and Technology, Pohang, South Korea; S. Goo, B. Lee, Seoul National University, Seoul, South Korea; J. Choi, Pusan National University, Pusan, South Korea

Wednesday, 21 August 2019				
187-PC-19	**Solid Propulsion Diagnostics**			**White River H**
Chaired by: C. LI, Air Force Office of Scientific Research and C. DENNIS, Naval Air Warfare Center				
1400 hrs Oral Presentation **Optical Diagnostics for Solid Propellant Combustion Systems (Invited)** C. Dennis, Naval Air Warfare Center, China Lake, CA		1500 hrs AIAA-2019-4294 **Linear Burn Rate of Ionic Liquid Multimode Monopropellant** N. Rasmont, E. Broemmelsiek, A. Mundahl, J. Rovey, University of Illinois, Urbana-Champaign, Urbana, IL	1530 hrs AIAA-2019-4295 **Sensitivity Analysis of Solid Propellant Burn Rate Measurements Using Ultrasound Technique by Different Data Deduction Methods** A. M, Indian Institute of Technology Madras, Chennai, India; S. B S, Defence Research and Development Organisation, Hyderabad, India; C. S R, R. Rathi, G. S, J. K, Indian Institute of Technology Madras, Chennai, India	1600 hrs AIAA-2019-4296 **Comparative analysis of vaporization and thermal decomposition from simultaneous thermal analysis studies of cyclotrimethylenetrinitramine (RDX)** M. Khichar, L. Patidar, S. Thynell, Pennsylvania State University, University Park, PA

Wednesday, 21 August 2019

188-PGC-10/LP-20	Pressure Gain Combustion: Performance, Integration and Applications II			Room 105
Chaired by: W. HARGUS, USAF/AFRL/RQRC and S. CLAFLIN, Aerojet Rocketdyne				
1400 hrs AIAA-2019-4297 **Operational Characteristics of a Rocket-type RDE Using C_2H_4/GO_2** H. Han, J. Choi, Pusan National University, Busan, South Korea	1430 hrs AIAA-2019-4298 **An Experimental Study of In-Space Rotating Detonation Rocket Engine with Cylindrical Configuration** A. Kawasaki, R. Yokoo, K. Goto, J. Kim, K. Matsuoka, J. Kasahara, Nagoya University, Nagoya, Japan; et al.	1500 hrs AIAA-2019-4299 **Performance of a Rotating Detonation Rocket Engine with Various Convergent Nozzles** J. Bennewitz, Air Force Research Laboratory, Edwards AFB, CA; B. Bigler, ERC, Inc., Edwards, CA; S. Danczyk, W. Hargus, Air Force Research Laboratory, Edwards AFB, CA; R. Smith, GHKN Engineering LLC, Kirland, WA		

Wednesday, 21 August 2019

189-TM-4	Thermal Systems and Components			Room 307
Chaired by: M. CHOI, NASA-Goddard Space Flight Center and D. ZAKAR, NRL				
1400 hrs AIAA-2019-4300 **Using Paraffin PCM for Thermal Management of BOLAS Planetary CubeSats with Ion Thrusters** M. Choi, NASA Goddard Space Flight Center, Greenbelt, MD	1430 hrs AIAA-2019-4301 **Experimental Studies of an Air Cooled, Two-phase Water, Graphitic Foam Heat Exchanger** J. Thayer, J. Mizerak, Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, MA	1500 hrs AIAA-2019-4302 **A Novel Method of Cooling Channel Optimization for Active-Cooled Structure Using the Calculus of Variations** X. Li, Y. Lu, K. Wu, X. Fan, Chinese Academy of Sciences, Beijing, China		

Wednesday, 21 August 2019

190-UAS-1	Unmanned Aircraft Systems: Propulsion, Energy and Applications I			Room 305/06
Chaired by: L. CHEN, Texas A&M University				
1400 hrs AIAA-2019-4303 **Modeling of Hybrid-Electric Powertrain for Unmanned Aerial Systems** D. Dehesa , S. Menon, Louisiana State University, Baton Rouge, LA	1430 hrs AIAA-2019-4304 **Preliminary sizing correlations for UAVs' propulsion system** V. Alulema, E. Valencia, E. Cando, D. Rodriguez, National Polytechnic University, Quito, Ecuador	1500 hrs AIAA-2019-4305 **Design of a Distributed Hybrid Electric Propulsion System for a Light Aircraft based on genetic algorithm** J. Economou, A. Tsourdos, S. Wang, Cranfield University, Wiltshire, United Kingdom	1530 hrs AIAA-2019-4306 **Hybrid Powertrain Improvements for Increased Flight Duration in Multirotor Unmanned Aerial Systems** J. Benbrook, C. Hagen, Oregon State University, Corvallis, OR	1600 hrs AIAA-2019-4307 **Energy Saving of Echelon Flocking Northern bald ibises with Variable wingtips spacing: Possibility of New Swarming for Drones** A. Mirzaeinia, Q. Bradfield, S. Bradley, M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM

Wednesday, 21 August 2019

191-HUB-9 1500 - 1530 hrs	Allison Engine's Apollo Lunar Excursion Module	the HUB
Rolls-Royce will have at its booth one of the fuel/oxidizer tanks used for the Apollo Lunar Excursion Module (LEM), manufactured in the 1960's by Allison. Come join us in the HUB to hear about the tank from the Rolls-Royce Heritage Trust – Allison Branch and from some of the people who worked on the program and helped make the lunar landings a success.		

Wednesday, 21 August 2019

192-F360-11 1515 - 1630 hrs	Wednesday Forum 360 PM: Challenges and Opportunities in Continuing Advancement of Gas Turbine Technologies (Part II - OEMs)	JW Grand Ballroom 3/4

Moderator: Barbara Esker, Deputy Director, Advanced Air Vehicles Program, Aeronautics Research Mission Directorate, NASA

Panelists:

Eric Ducharme
Chief Engineer and General Manager
GE Aviation

Mark Wilson
Chief Operating Officer
Rolls-Royce LibertyWorks

Michael Winter
Senior Fellow, Advanced Technology
Pratt & Whitney

Wednesday, 21 August 2019

193-NW-9 1600 - 1630 hrs	Networking Break	Exposition Hall

Thursday

Thursday, 22 August 2019

194-SB-4 0730 - 0800 hrs	Thursday Speaker Briefing	Session Rooms

Thursday, 22 August 2019

195-PLNRY-4 0800 - 0900 hrs	Thursday Plenary: Toward Sustainable Aviation	JW Grand Ballroom 5

Keynote Speaker
Alan Newby
Director, Aerospace Technology and Future Programmes
Rolls-Royce Corporation

Thursday, 22 August 2019

196-HUB-10 0900 - 0930 hrs	ASCEND: Accelerating Space Commerce, Exploration, and New Discovery	the HUB

Speaker: Stanley Borowski, 2019 Wyld Propulsion Award Recipient, NASA Glenn Research Center

Join us in the HUB during the coffee break to learn more about ASCEND! Launching 16–18 November 2020, in Las Vegas, Nevada, ASCEND will convene luminaries from across the space community to discuss, debate, and develop a shared vision for the future of the space economy and human exploration. As a taste of what to expect at ASCEND, we are proud to feature Dr. Stanley Borowski, the 2019 Wyld Propulsion Award winner for sustained outstanding contributions in advanced propulsion, including the development and application of nuclear thermal propulsion for future human lunar and Mars exploration missions. He will deliver an encore presentation of his paper entitled, "Commercialization and Human Settlement of the Moon and Cislunar Space - A Look Ahead at the Possibilities Over the Next 50 Years."

Thursday, 22 August 2019

197-NW-10 0900 - 0930 hrs	Networking Break	Exposition Hall

Thursday, 22 August 2019

198-AMP-2	Additive Manufacturing: Test Results and Feasibility II			Room 311

Chaired by: F. CHANDLER, Cal Poly University, Pomona CA and E. JENS, Jet Propulsion Laboratory

0930 hrs AIAA-2019-4308 **PermiAM: Porous Additively Manufactured L-PBF Flow Property Characterization for Rocket Engines** M. Kuhns, Masten Space Systems, Inc., Mojave, CA; J. Nuechterlein, J. Iten, Elementum3D, Erie, CO; G. Rixon, T. Roberson, Masten Space Systems, Inc., Mojave, CA; A. Polizzi, Elementum3D, Erie, CO; et al.	1000 hrs AIAA-2019-4309 **Additive Manufacturing of Propellant Tank and Structural Supports of CubeSat Cold Gas Propulsion System** J. Easley, J. Young, M. Priddy, H. Doude, Mississippi State University, Starkville, MS	1030 hrs AIAA-2019-4310 **Minimizing hydraulic losses in additively manufactured swirl coaxial injectors** D. Morrow, A. Nair, R. Spearrin, University of California, Los Angeles, Los Angeles, CA		

Thursday, 22 August 2019

199-APC-5	Advanced Propulsion Concepts IV			Room 301

Chaired by: T. GIEL, Jacobs Technology and J. ROBINSON

0930 hrs AIAA-2019-4311 **CFD-based Fluidic Thrust Vectoring model for fighter aircraft** E. Capello, A. Ferrero, R. Marsilio, M. Ferlauto, Technical University of Turin, Turin, Italy	1000 hrs AIAA-2019-4312 **Silent Strong Compression, Nearly-Complete Air-Insulation, and High Thrust Repeatedly Obtained by Pulsed Rocket Engine Based on Colliding Supermulti-jets** R. Konagaya, S. Kawaguchi, J. Mikoda, K. Kinoshita, H. Makimoto, Y. Kobayashi, Waseda University, Tokyo, Japan; et al.	1030 hrs AIAA-2019-4313 **Field Cooling Magnetization and Losses of an Improved Architecture of Trapped-Field Superconducting Rotor for Aircraft Applications** V. Climente-Alarcon, A. Smara, A. Patel, B. Glowacki, University of Cambridge, Cambridge, United Kingdom; A. Baskys, European Organization for Nuclear Research (CERN), Meyrin, Switzerland; T. Reis, Oswald Electromotoren GmbH, Miltenberg, Germany	1100 hrs AIAA-2019-4314 **A Simplified Model for the Simulation of Synergistic Air-Breathing Rocket Engine** X. Yang, W. Dong, Q. Yang, Shanghai Jiao Tong University, Shanghai, China; R. Mao, Aero Engine Corporation of China (AECC), Shanghai, China	

Thursday, 22 August 2019				
200-ECD-3	**MHD and Solar Energy Conversion Systems**			**Room 204**
Chaired by: N. SCHIFER, NASA				
0930 hrs AIAA-2019-4315 **Numerical Study of Plasma Ignition in Frozen Inert Gas Plasma Magnetohydrodynamic Generator** S. Ito, T. Fujino, University of Tsukuba, Tsukuba, Japan; Y. Okuno, Tokyo Institute of Technology, Yokohama, Japan	1000 hrs AIAA-2019-4316 **Numerical model of back powered channel for MHD generator application** H. Kim, National Energy Technology Laboratory, Albany, OR; E. Huckaby, National Energy Technology Laboratory, Morgantown, WV; C. Woodside, D. Oryshchyn, M. Fein, National Energy Technology Laboratory, Albany, OR	1030 hrs AIAA-2019-4317 **Diffusion Characterization and Modelling of *Mimosa pudica* Extract towards the Production of Organic Solar Module** M. Shitta, E. Ogedengbe, O. Familoni, O. Ogundipe, University of Lagos, Akoka-Yaba, Nigeria		

Thursday, 22 August 2019		
201-ECS-4 **0930 - 1030 hrs**	**Launch System Explosive Devices - How They are Tested and Qualified for Missions**	**Room 208**

This panel will focus on key criteria to certify safe and reliable performance of ECS, and incorporate history and lessons learned from space and launch vehicle programs; an introductory for young engineers interested in ordnance applications and rocket science. Panelists are Energetic Components and Systems (ECS) subject matter experts and authors of the AIAA S-113A-2016 that guides the design, manufacture, test and performance certification of explosive systems.

Panelists:

T. Blachowski	J. Burchett	S. Goldstein	J. Gormley	D. Jackson	B. Neyer	L. Yang
Consultant	NSWC	The Aerospace Corporation	LMSS	Consultant	Excelitas Tech	Consultant

Thursday, 22 August 2019					
202-EERE-4	**Experimental and Computational Energy Efficiency Studies III**				**Room 201**
Chaired by: D. CARRINGTON, Los Alamos National Laboratory and M. DE LEMOS, Instituto Tecnológico de Aeronáutica					
0930 hrs AIAA-2019-4318 **Heat transfer effects on aerodynamic performance of a S809 airfoil for wind turbine application** D. Garcia Ribeiro, P. Bravo Mosquera, H. Cerón-Muñoz, University of São Paulo, São Carlos, Brazil	1000 hrs AIAA-2019-4319 **Performance Analysis of a Bioinspired Albatross Airfoil with Heated Top Wing Surface: Experimental Study** V. Pellerito, Lawrence Technological University, Macomb, MI; M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM; A. Sedaghat, F. Sabri, L. Borvayeh, S. Sadeghi, Australian College of Kuwait, Kuwait, Kuwait	1030 hrs AIAA-2019-4320 **Performance Enhancement of an External Compression Intake by the Boundary Layer Suction** J. Sepahi-Younsi, S. Esmaeili, B. Forouzi Feshalami, Ferdowsi University of Mashhad, Mashhad, Iran; V. Pellerito, Lawrence Technological University, Southfield, MI; M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM	1100 hrs AIAA-2019-4321 **Mathematical Modeling and Simulation of Heat Pipe Evacuated Tube Solar Thermal Collectors** A. Farag, Egyptian Armed Forces, Cairo, Egypt; E. Khalil, Cairo University, Cairo, Egypt	1130 hrs AIAA-2019-4322 **Harvesting Energy by Base Excitations of Troops' Backpacks for Charging Drones** U. Javed, American University of Iraq, Sulaimania, Iraq; H. Abdelmoula, Gowell International, Houston, TX; M. Hassanalian, A. Mirzaeinia, New Mexico Institute of Mining and Technology, Socorro, NM; M. Naghdi, University of Mississippi, Oxford, Oxford, MS; B. Majeed, National University of Sciences and Technology, Islamabad, Pakistan

Thursday, 22 August 2019		
203-F360-12 **0930 - 1130 hrs**	**Thursday Forum 360: Electrified Aircraft Propulsion Technologies – Air Taxis to Airliners**	**JW Grand Ballroom 3/4**

Moderator: Marty Bradley, Technical Fellow, The Boeing Company

Panelists:

Barbara Esker	Andrew Gibson	Hao Huang	John Nairus
Deputy Director, Advanced Air Vehicles Program Aeronautics Research Mission Directorate NASA	President Empirical Systems Aerospace, Inc.	Technology Chief, Electrical Power GE Aviation	Chief Engineer, Power & Control Division Air Force Research Laboratory

Thursday, 22 August 2019

204-FPG-1	Fuels and Power Generation I			Room 202
Chaired by: L. QIAO, School of Aeronautics & Astronautics, Purdue University				
0930 hrs AIAA-2019-4323 **Laser Diagnostics of Highly Turbulent Premixed Methane-Air Flow Over a Backward Facing Step Using PIV and OH-PLIF** M. Islam, M. Hossain, M. De la Torre, A. Acosta-Zamora, A. Choudhuri, University of Texas, El Paso, El Paso, TX	1000 hrs AIAA-2019-4324 **Semi-intrusive temperature measurement technique in supercritical carbon dioxide** N. Sullivan, M. Ricklick, Embry-Riddle Aeronautical University, Daytona Beach, FL	1030 hrs AIAA-2019-4325 **Design and Test of a Pintle Injector for Oxy-Coal Combustion** A. Rios, M. Chowdhury, M. Khan, A. Choudhuri, University of Texas, El Paso, El Paso, TX	1100 hrs AIAA-2019-4326 **Effect of Fuel Dilution in a Hydrogen-Methane Blended Fuel Under Oxy-Distributed Combustion** S. Karyeyen, J. Feser, A. Gupta, University of Maryland, College Park, College Park, MD	

Thursday, 22 August 2019

205-GTE-25 0930 - 1100 hrs	Analysis and Reduction of Losses for Low Pressure Turbine Secondary Flows	Room 307
This will talk cover the background of LPT endwall flows, related analysis techniques and loss reduction techniques used historically.		

Thursday, 22 August 2019

206-GTE-26	Gas Turbine Combustion			White River J
Chaired by: J. SMITH, GE Aviation				
0930 hrs AIAA-2019-4327 **Suggestions on High Temperature Rise Combustor** J. Chin, Self, Laguna Woods, CA	1000 hrs AIAA-2019-4328 **A Combined Experimental and Computational Study of Jet Engine Combustion – Baseline Engine Operation** K. Danel, N. Zettervall, C. Fureby, Swedish Defense Research Agency (FOI), Stockholm, Sweden	1030 hrs AIAA-2019-4329 **Enabling aero-engine thermal model calibration using active subspaces** Z. Grey, P. Constantine, University of Colorado, Boulder, Boulder, CO; A. White, Rolls-Royce Group plc, Indianapolis, IN	1100 hrs AIAA-2019-4330 **Evaluation of Hot Sand Models Applied on Moderate and Heavy Deposition Cases** K. Hsu, B. Barker, B. Varney, Rolls-Royce Group plc, Indianapolis, IN	

Thursday, 22 August 2019

207-GTE-27	Gas Turbine Fuels			White River I
Chaired by: S. DRENNAN, Convergent Science, Inc. and G. KUMAR, Convergent Science, Inc.				
0930 hrs AIAA-2019-4331 **Soot formation behind reflected shock waves in ethylene and oxygenated biofuels** S. Barak, S. Neupane, E. Ninnemann, R. Rahman, A. Laich, S. Vasu, University of Central Florida, Orlando, FL	1000 hrs AIAA-2019-4332 **Comparative assessment of manufacturing setups for blended sugar-to-aviation fuel production from non-food feedstocks for green aviation** S. Jagtap, Imperial College London, London, United Kingdom	1030 hrs AIAA-2019-4333 **Effect of Reduced Surface Tension on Size and Velocity Distributions of Ethanol-water Drop Fragments Formed via Multi-mode and Sheet-thinning Breakup** D. Obenauf, L. Yao, W. Shang, P. Sojka, J. Chen, Purdue University, West Lafayette, IN		

Thursday, 22 August 2019

208-HR-13	Combustion Dynamics and Mixing Efficiencies			Room 103
Chaired by: Y. CHEN, TiSPACE Incorporated and S. WHITMORE, Utah State University				
0930 hrs AIAA-2019-4334 **Effect of Aft Chamber Volume on Hybrid Rocket Combustion Efficiency** L. Kageyama, L. Kamps, H. Nagata, Hokkaido University, Sapporo, Japan	1000 hrs AIAA-2019-4335 **Performance of solid state emulsions of isoamyl alcohol in EVA-stabilized low-MW polyethylene, structured by laser-sintered nylon scaffolds as fuels in N_2O hybrid rocket engine** D. Zdybal, Cranfield University, Cranfield, United Kingdom; W. Klos, P. Drozdz, Z. Rydz, K. Kobus, B. Wyciszkiewicz, AGH University of Science and Technology, Kracow, Poland; et al.	1030 hrs AIAA-2019-4336 **Experimental Findings on Pre- and Post-combustion Chamber Effects in a Laboratory-scale Motor** F. Mechentel, B. Cantwell, Stanford University, Stanford, CA	1100 hrs AIAA-2019-4337 **Thermochemical structure of a hybrid rocket reaction layer based on laser absorption tomography** F. Bendana, J. Castillo, C. Hagström, R. Spearrin, University of California, Los Angeles, Los Angeles, CA	1130 hrs AIAA-2019-4338 **Hypergolic Hybrid Rocket Motor Characterization with MON-25 at Atmospheric and Reduced Pressures** A. Benhidjeb-Carayon, J. McCormick, C. Yilmaz, J. Gabl, B. Whitehead, T. Pourpoint, Purdue University, West Lafayette, IN

Thursday, 22 August 2019

209-INPSI-9 0930 - 1200 hrs	Hands-On OpenFOAM Aerospace/Propulsion Tutorial	White River A/B
OpenCFD is pleased to offer this OpenFOAM demonstration, based on the IFCPT S-Duct from the 4th Propulsion Aerodynamics Workshop. The demonstration will show the use of OpenFOAM for industrial applications through the use of Visual-CFD, the officially endorsed pre-processor for OpenFOAM, and execution of the latest release of OpenFOAM v1906. It will be delivered by OpenCFD staff, IP and Trademark holders for the official OpenFOAM version released every six months as open-source software fully QAed under ISO-9001:2015.		

Thursday, 22 August 2019				
210-INPSI-10	**Inlet Particle Ingestion and Separation**			**Room 305/06**
Chaired by: D. RITTENBERG, Siemens PLM Software				
0930 hrs AIAA-2019-4339 **Turbine Engine Ingested Particle Monitoring: A Novel Application of Quantum Cascade IR Laser Extinction** C. Moon, G. Byun, T. Lowe, Virginia Polytechnic Institute and State University, Blacksburg, VA; C. Smth, Rolls-Royce Group plc, Indianapolis, IN	1000 hrs AIAA-2019-4340 **Scaling Effects on Inertial Particle Separator Performance** C. Goss, B. Connolly, E. Loth, University of Virginia, Charlottesville, Charlottesville, VA; C. Smth, Rolls-Royce Group plc, Indianapolis, IN	1030 hrs AIAA-2019-4341 **Drag and Bounce of Irregular Particles and Test Dust** B. Connolly, E. Loth, University of Virginia, Charlottesville, Charlottesville, VA; C. Smth, Rolls-Royce Group plc, Indianapolis, IN	1100 hrs AIAA-2019-4342 **Unsteady Simulation of an Inertial Particle Separator** B. Connolly, E. Loth, University of Virginia, Charlottesville, Charlottesville, VA; C. Smth, Rolls-Royce Group plc, Indianapolis, IN	

Thursday, 22 August 2019				
211-INPSI-11	**Nozzle Thrust Vectoring**			**Room 309/10**
Chaired by: M. FERLAUTO, Politecnico di Torino				
0930 hrs AIAA-2019-4343 **Influence of the External Flow Conditions to the Jet-Vectoring Performances of a SVC Nozzle** M. Ferlauto, R. Marsilio, Technical University of Turin, Turin, Italy	1000 hrs AIAA-2019-4344 **Performance Analyses of Fluidic Thrust Vector Control System Using Dual Throat Nozzle** Y. Maruyama, Okayama University of Science, Okayama, Japan; M. Sakata, Chuo Engineering Company, Ltd., Tokyo, Japan; Y. Takahashi, Okayama University of Science, Okayama, Japan	1030 hrs AIAA-2019-4345 **Source Term Model For Efficient Thrust Reverser CFD Analysis** S. Sato, R. Moody, S. Subramaniyam, R. Pandya, The Boeing Company, Seattle, WA	1100 hrs AIAA-2019-4346 **Design and Performance Analysis of a Scaled 3-Bearing Swivel Duct Nozzle** W. Xiangyang, Tsinghua University, Beijing, China; Y. Zhang, Naval Aviation University, YanTai, China; R. Xue, Aero Engine Corporation of China (AECC), Beijing, China; J. Zhu, H. Qi, Tsinghua University, Beijing, China	

Thursday, 22 August 2019				
212-ITAR-5	**Advanced Intelligent Controls II**			**Room 209**
Chaired by: A. BEHBAHANI, Air Force Research Laboratory				
0930 hrs AIAA-2019-4347 **Gain Scheduled Robust Control System Development for Future Variable Geometry Gas Turbine Engine** M. Pakmehr, optoXense, Inc., San Ramon, CA; K. Wilcher, T. Yucelen, University of South Florida, Tampa, FL; A. Behbahani, Air Force Research Laboratory, Wright-Patterson AFB, OH	1000 hrs AIAA-2019-4348 **Developing Optimal Control Architecture for Energy Optimization in Hybrid Electric UAVs** M. Pakmehr, optoXense, Inc., San Ramon, CA; O. Sanni, E. Feron, Georgia Institute of Technology, Atlanta, GA; A. Behbahani, M. Nicholson, Air Force Research Laboratory, Wright-Patterson AFB, OH	1030 hrs AIAA-2019-4349 **Integrated Intelligent Control of Hybrid-Electric Unmanned Air Vehicles** J. Valverde, N. Nigam, A. Tyagi, Intelligent Automation, Inc., Rockville, MD; J. Lieh, M. Nicholson, A. Behbahani, Air Force Research Laboratory, Wright-Patterson AFB, OH	1100 hrs AIAA-2019-4350 **5000+ Hours Operation of High Temperature Digital Smart Node for Distributed Jet Engine Control** S. Gogineni, C. Ruscher, Spectral Energies, LLC, Beavercreek, OH; V. Chodavarapu, G. Subramanyam, University of Dayton, Dayton, OH; K. Semega, A. Behbahani, Air Force Research Laboratory, Wright-Patterson AFB, OH	

Thursday, 22 August 2019				
213-LP-21	**Liquid Rocket Propulsion Test Facilities**			**Room 107**
Chaired by: D. COOTE, NASA Stennis Space Center and J. LOCKE, United Technologies Research Center				
0930 hrs AIAA-2019-4351 **A Test Apparatus for the Characterization of Ignitability and Flammability of Metals in High Pressure Oxygen** L. Gevorkyan, S. McCall, J. Smolke, R. Driscoll, The Aerospace Corporation, El Segundo, CA	1000 hrs AIAA-2019-4352 **Particle-Impact Ignition of Metals in High-Pressure, Oxygen-Rich Environments** K. Lam, M. Crofton, D. Arnold, J. Morehart, The Aerospace Corporation, El Segundo, CA	1030 hrs AIAA-2019-4353 **Development and Characterization of the Purdue Altitude Chamber Facility for 100 lbf Scale Thrusters** B. Whitehead, C. Yilmaz, J. McCormick, J. Gabl, T. Pourpoint, Purdue University, West Lafayette, IN	1100 hrs AIAA-2019-4354 **Propulsion Testing in Commercial Re-usable Sub-orbital Rockets** S. Collicott, A. Alexeenko, Purdue University, West Lafayette, IN	1130 hrs AIAA-2019-4355 **Design Methodology for a Central Injection Type Supersonic Air Ejector and Diffuser System for Altitude Simulation** A. Aydogdu, B. Sümer, B. Yazici, TUBITAK, Ankara, Turkey; A. Ulas, Middle East Technical University, Ankara, Turkey

Thursday, 22 August 2019

214-LP-22	Propellant Storage and Management II			Room 105
Chaired by: J. MOORE, Penn State Altoona and K. PHILIPPART				
0930 hrs AIAA-2019-4356 **Modeling for Design of a Sub-orbital Payload Supporting Cryogenic Gauging Demonstration** S. Alberts, S. Collicott, Purdue University, West Lafayette, IN	1000 hrs AIAA-2019-4357 **Asymmetric Propellant Positioning in Symmetric Tanks and PMDs** S. Collicott, Purdue University, West Lafayette, IN; B. Yendler, YSPM, LLC, Saratoga, CA	1030 hrs AIAA-2019-4358 **CFD Modelling of Phase Change in Cryogenic Rocket Tanks** P. Behruzi, ArianeGroup, Bremen, Germany	1100 hrs AIAA-2019-4359 **Composite Overwrap Pressure Vessel Class 3 Acceptance Testing – A Recommended Strategy of Airbus Defence & Space Ltd.** A. Konietzke, D. Catherall, Airbus, Stevenage, United Kingdom	1130 hrs AIAA-2019-4360 **Simulation of Aircraft Fuel System with Complex 3D Tank Geometry Using a 1D Flow Solution** A. Tiwari, J. Harrison, Gamma Technologies, LLC, Westmont, IL

Thursday, 22 August 2019

215-LP-23	Novel Manufacturing and Advanced Materials for Liquid Rocket Engines			Room 106
Chaired by: C. COWLES, SpaceX and J. SAUER, Sierra Nevada Corporation				
0930 hrs AIAA-2019-4361 **Bimetallic Channel Wall Nozzle Development and Hot-fire Testing Using Additively Manufactured Laser Wire Direct Closeout Technology** P. Gradl, S. Greene, T. Wammen, NASA Marshall Space Flight Center, Huntsville, AL	1000 hrs AIAA-2019-4362 **Additive Manufacturing and Hot-fire Testing of Liquid Rocket Channel Wall Nozzles Using Blown Powder Directed Energy Deposition Inconel 625 and JBK-75 Alloys** P. Gradl, C. Protz, T. Wammen, NASA Marshall Space Flight Center, Huntsville, AL	1030 hrs AIAA-2019-4363 **The Effect of Surface Roughness on LCH4 Boiling Heat Transfer Performance of Conventionally and Additively Manufactured Rocket Engine Regenerative Cooling Channels** L. Hernandez, R. Palacios, D. Ortega, J. Adams, L. Bugarin, M. Rahman, University of Texas, El Paso, El Paso, TX; et al.		

Thursday, 22 August 2019

216-LP-24 0930 - 1200 hrs	Conceptual Design and Analysis of Turbines	Room 205
Bogdan Marcu, Aerojet Rocketdyne		
Turbine conceptual principles are presented based on fundamental thermodynamics and fluid mechanics leading to the basic Euler equation. Based on the conceptual principles, the consequent generation of stage geometry at concept level is presented for a generic stage of an axial and (possibly, time allowing) radial turbine. Furthermore, using the axial turbine as a working case, the h-s (Molierre) diagrams are presented in conjunction with an example design case and analysis.		

Thursday, 22 August 2019

217-PC-20	Solid Propellant Chemistry			White River G
Chaired by: K. BROWN and G. HARTING, Air Force Research Laboratory				
0930 hrs AIAA-2019-4364 **Thermal Decomposition Behavior and Burning Characteristics of Ammonium Nitrate/ Polytetrahydrofuran Propellants with Glycerol Propoxylate as a Crosslinking Agent** M. Kohga, National Defense Academy, Yokosuka, Japan	1000 hrs AIAA-2019-4365 **Manufacturing and Burning of Composite AP/ HTPB/AP Laminate Propellants** J. Thomas, F. Rodriguez, T. Sammet, C. Dillier, E. Petersen, E. Petersen, Texas A&M University, College Station, TX	1030 hrs AIAA-2019-4366 **Combustion Behavior of Ammonium Perchlorate at High Pressures** E. Petersen, F. Rodriguez, J. Thomas, C. Dillier, E. Petersen, Texas A&M University, College Station, TX	1100 hrs AIAA-2019-4367 **Thermal Decomposition of Hydroxylammonium Nitrate: ReaxFF Training Set Development for Molecular Dynamics Simulations** D. Depew, J. Wang, S. Parmar, University of Southern California, Los Angeles, CA; S. Chambreau, ERC, Inc., Edwards, CA; D. Bedrov, University of Utah, Salt Lake City, Salt Lake City, UT; A. van Duin, Pennsylvania State University, University Park, PA; et al.	1130 hrs AIAA-2019-4368 **Very-High-Pressure Burning Rates of AP/HTPB-Composite Propellants with Varying AP Particle Sizes and Distributions** C. Dillier, E. Petersen, T. Sammet, F. Rodriguez, J. Thomas, E. Petersen, Texas A&M University, College Station, TX

Thursday, 22 August 2019

218-PC-21	Air-Breathing Combustion			White River H
Chaired by: V. SANKARAN, US Air Force/AFRL/RQRC and A. COMER, University of Michigan, Ann Arbor				
0930 hrs AIAA-2019-4369 **Reaction Zone Characterization of a Low Emission Reverse- Cross Flow Combustor** S. Gupta, Indian Institute of Technology Kanpur, Kanpur, India; S. Pramanik, Indian Institute of Science, Bengaluru, India; V. Arghode, Indian Institute of Technology Kanpur, Kanpur, India; R. Ravikrishna, Indian Institute of Science, Bengaluru, India	1000 hrs AIAA-2019-4370 **Evaluation of Air-Blast Atomizers for Mixing and Combustion in Supersonic Flows** H. Ballance, B. Ochs, B. Oleksander, D. Ranjan, S. Menon, Georgia Institute Of Technology, Atlanta, GA	1030 hrs AIAA-2019-4371 **Pilot Injector Redesign to Reduce N+3 Cycle Emissions For A Gas-Turbine Combustor** K. Ajmani, Vantage Partners, LLC, Cleveland, OH; P. Lee, Woodward FST, Inc., Zeeland, MI; C. Chang, K. Tacina, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-4372 **The Effect of Swirl Intensity on Spray Characteristics in Single Element Lean Direct Injection Combustor** L. Li, J. Suo, D. Xu, H. Liang, L. Zheng, Northwestern Polytechnical University, Xi'an, China	

Thursday, 22 August 2019				
219-PC-22	**Reduced-Order Combustion Modeling**			**Room 104**
Chaired by: R. MUNIPALLI, HyPerComp, Incorporated				
0930 hrs AIAA-2019-4374 **A low order modeling approach to transverse combustion instability** S. D'Alessandro, B. Favini, F. Nasuti, University of Rome "La Sapienza", Rome, Italy	1000 hrs AIAA-2019-4375 **Study of Combustion Instabilities in Transverse Instability Chamber Using Flame Transfer Functions** G. Tamanampudi, S. Sardeshmukh, W. Anderson, Purdue University, West Lafayette, IN	1030 hrs AIAA-2019-4376 **Low-order Network Model of a Duct with Non-Uniform Cross-Section and Varying Mean Temperature in the Presence of Mean Flow** F. Schaefer, W. Polifke, Technical University of Munich, Garching, Germany		

Thursday, 22 August 2019				
220-PGC-11	**Pressure Gain Combustion: Measurement Techniques and Test Facilities III**			**White River C/D**
Chaired by: D. PAXSON, NASA Glenn Research Center and P. AKBARI, Cal Poly University				
0930 hrs AIAA-2019-4377 **Analysis of RDC operation by Dynamic Mode Decomposition (DMD)** M. Bohon, R. Bluemner, C. Paschereit, Technical University of Berlin, Berlin, Germany; E. Gutmark, University of Cincinnati, Cincinnati, OH	1000 hrs AIAA-2019-4378 **Numerical analysis on the effect of CTAP measurements in pulse and rotating detonation combustors** Z. Liu, J. Braun, J. Saavedra, G. Paniagua, Purdue University, West Lafayette, IN	1030 hrs AIAA-2019-4379 **Time-Resolved PIV Measurements of Flow Field at the Exit of a Diffuser Mounted on a Rotating Detonation Combustor** D. Depperschmidt, J. Tobias, R. Miller, A. Agrawal, University of Alabama, Tuscaloosa, Tuscaloosa, AL	1100 hrs AIAA-2019-4380 **Rainbow Schlieren Imaging of Density Field in the Exhaust Flow of Rotating Detonation Combustion** R. Miller, J. Tobias, D. Depperschmidt, K. Bell, D. Langner, A. Agrawal, University of Alabama, Tuscaloosa, Tuscaloosa, AL	1130 hrs AIAA-2019-4381 **Experimental wall heat transfer measurements for various combustion regimes: Deflagration, Autoignition and Detonation** H. Quintens, Q. Michalski, J. Moussou, C. Strozzi, J. Sotton, M. Bellenoue, National Center for Scientific Research (CNRS), Chasseneuil du Poitou, France; et al.

Thursday, 22 August 2019				
221-SR-7	**Solid Rocket Design and Development**			**Room 101**
Chaired by: K. NAUMANN, Bayern-Chemie GmbH and W. RYAN, NASA John F Kennedy Space Center				
0930 hrs AIAA-2019-4382 **The Optimum Rocket Nozzle Expansion Ratio: An Air – to – Air Missile Demonstration** R. Hiers, R. Knapke, Arnold Engineering Development Complex, Arnold AFB, TN	1000 hrs AIAA-2019-4383 **Design of a Dual Thrust Solid Motor Using Star Grain** H. Belal, M. Elnagger, Military Technical College, Cairo, Egypt	1030 hrs AIAA-2019-4384 **Quench Collection and Artificial Neural Network Prediction of Micro and Ultra-fine Aluminum Agglomeration Phenomena in Combustion of Solid Rocket Propellants: Experiments and Modeling** T. K, V. Vemana, Defence Research and Development Organisation, Hyderabad, India; J. K, Indian Institute of Technology Madras, Chennai, India		

Thursday, 22 August 2019		
222-ECS-5 **1100 - 1200 hrs**	**Modeling and Testing of Nitrous Oxide Systems for Explosive Decomposition**	**Room 208**
Tutorial Presented by Arif Karabeyoglu, Space Propulsion Group, Inc. Even though nitrous oxide (N2O) is a widely used energetic liquid, the number of decomposition related accidents is quite limited, due to its abnormally slow decomposition kinetics. However, hazards do exist especially in propulsion systems for which large quantities are stored in flight weight tanks and the ignition sources are readily available. Safety related recommendations unique to N2O operations will be shared. The general conclusion is that despite its potential decomposition hazard, if handled properly, N2O could be one of the safest oxidizers being used in rocket propulsion systems.		

Thursday, 22 August 2019		
223-HUB-11 **1100 - 1145 hrs**	**USC's Student Rocketry Success** **Example of hands-on undergraduate training that provides students with experience-based engineering before graduation**	**the HUB**
USC has three major efforts to provide students hands on training before graduation in the Department of Astronautical Engineering. The hands on activities to augment the academic curriculum specifically in space systems before graduation, while challenging from resources and laboratory facilities, provide benefits to students and industry upon transition. USC will present one successful group, the Rocket Propulsion Laboratory that has been in existence for 15 years.		

Thursday, 22 August 2019		
224-LUNCH-2 **1200 - 1330 hrs**	**Networking Boxed Luncheon (Proof of Purchase Required)**	**Exposition Hall**

Thursday, 22 August 2019		
225-EATS-21 1230 - 1330 hrs	Electric Aircraft Technologies Symposium Keynote	Room 137-139 (Conference Center)

Thursday, 22 August 2019		
226-HUB-12 1245 - 1330 hrs	Controlled Explosives in Aerospace Applications…How We Learned to Love Things That Go Boom!	the HUB

Speaker: John G. Scott, United Launch Alliance

So you are thinking of where you want to take your career? Energetic components allow you to touch every portion of space launch, beginning to end…...Within the energetics industry there is a whole host of products in the space launch, tactical missile, automotive and commercial ordnance produced at very high reliability and low relative costs. High energy density of pyrotechnics provides a lot of work (large energy source / high mechanical power) in a small package – that is the boom! We now know that the successful engineer or scientist in the industry gets to apply everything from classical statics/dynamics through in depth chemical engineering to pure statistics! We get to do it all…

Thursday, 22 August 2019				
227-AIIPC-1	Advanced Intelligent Controls I			Room 209
Chaired by: A. BEHBAHANI, Air Force Research Laboratory				
1330 hrs AIAA-2019-4385 **Towards AI-driven Predictive Modeling of Gas Turbines Using Big Data** S. Raj, S. Fernandes, A. Michel, S. Jha, University of Central Florida, Orlando, FL	1400 hrs AIAA-2019-4386 **A High Efficiency Trim Method for the Aerodynamic Analysis of XH-59A Rotor in Forward Flight** Y. Zhang, X. Zhao, N. Huang, Northwestern Polytechnical University, Xi'an, China; X. Wu, Franklin W. Olin College of Engineering, Needham, MA	1430 hrs AIAA-2019-4387 **Developing Concepts for Optimal Scheduling in Distributed Turbine Engine Control Systems** M. Pakmehr, optoXense, Inc., San Ramon, CA; R. Chakravarthy Muralidhar, L. Sutter, R. Cohen, E. Feron, Georgia Institute of Technology, Atlanta, GA; A. Behbahani, Air Force Research Laboratory, Wright-Patterson AFB, OH	1500 hrs AIAA-2019-4388 **Extreme Environment Sensor System Development: Optical Turbine Inlet Temperature (TIT) Sensing for Jet Engine** M. Pakmehr, J. Costa, optoXense, Inc., San Ramon, CA; A. Behbahani, K. Semega, Air Force Research Laboratory, Wright-Patterson AFB, OH	1530 hrs AIAA-2019-4389 **Modular Smart Nodes for High Temperature Distributed Engine Controls** M. Francis, Ozark Integrated Circuits, Inc., Fayetteville, AR

Thursday, 22 August 2019				
228-AMP-3	Additive Manufacturing Technology			Room 311
Chaired by: E. JENS, Jet Propulsion Laboratory and K. MARK, Jet Propulsion Laboratory				
1330 hrs AIAA-2019-4390 **Additive Manufacturing and Hot-fire Testing of Bimetallic GRCop-84 and C-18150 Channel-Cooled Combustion Chambers Using Powder Bed Fusion and Inconel 625 Hybrid Directed Energy Deposition** P. Gradl, C. Protz, NASA Marshall Space Flight Center, Huntsville, AL; K. Zagorski, V. Doshi, H. McCallum, Virgin Orbit, Long Beach, CA	1400 hrs AIAA-2019-4391 **Geometry and Distortion Evaluations of Additively Manufactured IN718 Internally Cooled Radial Turbines** C. Krouse, N. Andrews, G. Musgrove, Southwest Research Institute, San Antonio, TX	1430 hrs AIAA-2019-4392 **Design and Additive Manufacturing Considerations for Liquid Rocket Engine Development** N. Patel, S. Standbridge, M. Van Den Berghe, V. Devalaraju, University of Southern California, Los Angeles, CA		

Thursday, 22 August 2019				
229-APC-6	Unique Propulsion Systems			Room 301
Chaired by: J. ROBINSON and T. GIEL, Jacobs Technology				
1330 hrs AIAA-2019-4393 **Air and Space Thermal Rocket Engine with Turbojet (ASTRET)** D. Nikitaev, University of Alabama, Huntsville, Huntsville, AL	1400 hrs AIAA-2019-4394 **Weakly-pulsated center combustion engine: resulting in nearly-complete air-insulation effect caused by wall reflection of pressure-wave** T. Kobayashi, J. Mikoda, K. Kinoshita, H. Makimoto, Y. Kobayashi, S. Lujiang, Waseda University, Tokyo, Japan; et al.	1430 hrs AIAA-2019-4395 **Helical Engine** D. Burns, NASA Marshall Space Flight Center, Huntsville, AL		

Thursday, 22 August 2019

230-EATS-2	Topic Area 1: Electrified Aircraft System Studies			Room 134 (Convention Center)
Chaired by: P. ANSELL, University of Illinois at Urbana-Champaign and B. SCHILTGEN				
1330 hrs AIAA-2019-4396 **Fuel Burn and Energy Consumption Reductions of a Single-Aisle Class Parallel Hybrid Propulsion System** C. Lents, L. Hardin, United Technologies Corporation, East Hartford, CT	1400 hrs AIAA-2019-4397 **Hybrid-Electric Regional Jet Aircraft Operation Efficiency** G. Wroblewski, P. Ansell, University of Illinois, Urbana-Champaign, Urbana, IL	1430 hrs AIAA-2019-4398 **Evaluation of a Regional Aircraft with Fuselage Boundary Layer Ingestion** M. Secchi, P. Lacava, Technological Institute of Aeronautics (ITA), São José dos Campos, Brazil; G. Trapp, R. Ribeiro, Embraer, São José dos Campos, Brazil	1500 hrs Oral Presentation **An Introduction to the AIAA Guidelines for Analysis of Hybrid/Electric Aircraft System Studies** A. Isikveren, Safran Group, Magny-Les-Hameaux, France; K. Haran, P. Ansell, University of Illinois, Urbana-Champaign, Urbana, IL; J. Gladin, Georgia Institute of Technology, Atlanta, GA; B. Schiltgen, Empirical Systems Aerospace, Inc., San Luis Obispo, CA	

Thursday, 22 August 2019

231-EATS-3	Topic Area 2: Motor Power Electronics and System Fault Detection			Room 135 (Conference Center)
Chaired by: C. JONES, University of Strathclyde and X. WU, United Technologies Research Center				
1330 hrs AIAA-2019-4399 **Advanced Electric Drives for Aerospace Electric and Hybrid Propulsion** E. Ganev, A. Salam, Honeywell International, Inc., Torrance, CA	1400 hrs AIAA-2019-4400 **Development of an 11 kW lightweight, high efficiency motor controller for NASA X-57 Distributed Electric Propulsion using SiC MOSFET Switches** M. Garrett, D. Avanesian, M. Granger, S. Kowalewski, J. Maroli, NASA Glenn Research Center, Cleveland, OH; W. Miller, Vantage Partners, LLC, Brook Park, OH; et al.	1430 hrs AIAA-2019-4401 **Common Mode EMI Filter Design for Si and SiC Inverters in an Aerospace Drive System** W. Perdikakis, Ohio State University, Columbus, OH; M. Scott, Miami University, Oxford, OH; C. Kitzmiller, UES, Inc., Beavercreek, OH; B. Hall, Ohio State University, Columbus, OH; K. Yost, A. Sheets, Air Force Research Laboratory, Wright-Patterson AFB, OH	1500 hrs AIAA-2019-4402 **Grounding Topologies for Resilient, Integrated Composite Electrical Power Systems for Future Aircraft Applications** C. Jones, M. Sztykiel, R. Pena-Alzola, P. Norman, G. Burt, University of Strathclyde, Glasgow, United Kingdom	

Thursday, 22 August 2019

232-EATS-4	Topic Area 3: Component Integration and System Architectures			Room 136 (Conference Center)
Chaired by: T. O'CONNELL, P.C. Krause and Associates				
1330 hrs AIAA-2019-4403 **A Tool for Modeling and Analysis of Electrified Aircraft Power Systems** P. Hanlon, G. Thomas, J. Csank, D. Sadey, NASA Glenn Research Center, Cleveland, OH	1400 hrs AIAA-2019-4404 **Heavy-duty UAV Electric Propulsion Architectures and Multi-timescale Multi-physics Modeling** Y. Cao, A. Thurlbeck, Oregon State University, Corvallis, OR	1430 hrs AIAA-2019-4405 **Thermal Integration of a High-Frequency High-Specific-Power Motor within Electrically Variable Engine** X. Yi, K. Haran, University of Illinois, Urbana-Champaign, Urbana, IL	1500 hrs AIAA-2019-4406 **Using Multi-physics System Simulation to Predict Battery Pack Thermal Performance and Risk of Thermal Runaway During eVTOL Aircraft Operations** J. Harrison, Gamma Technologies, LLC, Westmont, IL; D. Charles, Airbus, Santa Clara, CA; J. Zenker, Gamma Technologies, LLC, Westmont, IL; E. Frank, Airbus, Santa Clara, CA	1530 hrs Oral Presentation **Low loss superconducting stator for aero propulsion motors operating at above 40K** A. Otto, L. Saraco, Solid Material Solutions, LLC, North Chelmsford, MA

Thursday, 22 August 2019

233-EATS-5 1330 - 1600 hrs	Electric Propulsion - Challenges and Opportunities, A NASA University-Led Initiative	Room 205

Introduction and Overview, M.J. Benzakein, The Ohio State University

Panelists:

System Integration	Energy Storage	Power Electronics	Electric Machines	Thermal Management
Chris Perullo Georgia Institute of Technology	**Marcello Canova** The Ohio State University **Vikas Prakash** Case Western Reserve University	**Jin Wang** The Ohio State University	**Thomas Jahns** University of Wisconsin, Madison	**Patrick McCluskey** University of Maryland **John Kizito** North Carolina A&T State University

Thursday, 22 August 2019		
234-EATS-22 1330 - 1530 hrs	Electric Propulsion: Challenges and Opportunities, A NASA Led Initiative	Room 137-139 (Conference Center)

Thursday, 22 August 2019		
235-EDU-6 1330 - 1500 hrs	Process Hazards Analysis for Propulsion Education	Room 208
This session features a panel discussion of propulsion laboratory safety related to government and university settings. Topics include process hazards analysis, documentation, training, and lessons learned.		

Thursday, 22 August 2019				
236-EERE-5	Experimental and Computational Energy Efficiency Studies IV			Room 201
Chaired by: R. AMANO, University of Wisconsin-Milwaukee and A. GUPTA, University of Maryland				
1330 hrs AIAA-2019-4407 **Development of a Renewable Energy Sizing Calculator for Building Energy Audit and Appliance' Performance Assessment** D. Nkwaze, J. Aruwajoye, P. Aderoju, M. Shitta, E. Ogedengbe, V. Odumuyiwa, University of Lagos, Akoka-Yaba, Nigeria	1400 hrs AIAA-2019-4408 **Study of a Cavitation Treatment in Kaplan Hydro-turbine** R. Amano, T. ElGammal, University of Wisconsin, Milwaukee, Glendale, WI	1430 hrs AIAA-2019-4409 **Large Scale Thermal Acoustic Generator** E. Wilson, Rolls-Royce Group plc, Indianapolis, IN	1500 hrs AIAA-2019-4410 **Proposed New Experimental Setup for Direct/ Indirect Evaporative Cooling Performance Analyses** M. ElGawady, E. Khalil, Cairo University, Cairo, Egypt	

Thursday, 22 August 2019				
237-FPG-2	Fuels and Power Generation II			Room 202
Chaired by: M. DE LEMOS, Instituto Tecnológico de Aeronáutica				
1330 hrs AIAA-2019-4411 **The Feasibility of Hydrogen Assisted Combustors and Fuel Reformation Technologies** B. Khandelwal, C. Wijesinghe, P. King, A. Carneiro dos Santos, A. Al-Sheboul, University of Sheffield, Sheffield, United Kingdom	1400 hrs AIAA-2019-4412 **Evaluation of blended Fischer-Tropsch jet fuel feedstocks for minimizing human and environmental health impacts of aviation** S. Jagtap, Imperial College London, London, United Kingdom	1430 hrs AIAA-2019-4413 **Prediction of the Autoignition of a Fuel Jet in a Confined Turbulent Hot Coflow Using Machine Learning Methods** S. Li, H. Liu, W. Qian, M. Zhu, Tsinghua University, Beijing, China; C. Markides, Imperial College London, London, United Kingdom		

Thursday, 22 August 2019					
238-HR-14	Contemporary Hybrid Rocket Combustion Simulation, Characterization, Instrumentation, and Visualization				Room 102
Chaired by: B. EVANS, Space Propulsion Group, Inc.					
1330 hrs AIAA-2019-4414 **CFD Modeling of a Hybrid Rocket Using a Generalized One-dimensional Model of the Flame Temperature** N. Uddanti, Y. Crispin, Embry-Riddle Aeronautical University, Daytona Beach, FL	1400 hrs AIAA-2019-4415 **Numerical Simulation of Combustion in a Hybrid Rocket with Liquefying Fuels** M. Gurunadhan, A. Baran, S. Menon, Louisiana State University, Baton Rouge, LA	1430 hrs AIAA-2019-4416 **Study of Regression Rates in a Hybrid Rocket Motor** J. Dhanasekaran, North Carolina State University, Raleigh, NC; V. Ramanan, Indian Institute of Technology Madras, Chennai, India	1500 hrs AIAA-2019-4417 **The Development of a Powder-Filled, ABS Matrix for Use as Fuel in a Hybrid Rocket Motor** T. Aarant, J. Bass, T. Grizzel, S. Holladay, M. McVey, W. Putthoff, University of Tennessee, Knoxville, Knoxville, TN; et al.	1530 hrs AIAA-2019-4418 **Burning Behavior Investigation of a Vortex Flow Pancake Hybrid Rocket Engine** C. Paravan, R. Bisin, F. Lisi, L. Galfetti, P. Massimo, Technical University of Milan, Milan, Italy

Thursday, 22 August 2019				
239-HSABP-10	Performance of Components and Systems			Room 312
Chaired by: A. DRAKE, Northrop Grumman				
1330 hrs AIAA-2019-4419 **Effects of Momentum Flux Ratio on Combustion in the Hyshot Scramjet Engine** F. Ladeinde, Stony Brook University, Stony Brook, NY	1400 hrs AIAA-2019-4420 **Design of a Solid Fuel Ramjet Ground Launch Demonstrator** A. Martinez, S. Kubicki, J. Rohwer, Purdue University, West Lafayette, IN	1430 hrs AIAA-2019-4421 **Development and optimization of a hypersonic civil aircraft propulsion plant with regenerator system** P. Goncalves, A. Ispir, B. Saracoglu, von Kármán Institute for Fluid Dynamics, Rhode-Saint-Genèse, Belgium		

Thursday, 22 August 2019				
240-INPSI-12	**Supersonic Inlets**			**Room 305/06**
Chaired by: S. OCHS, United Technologies Research Center				
1330 hrs AIAA-2019-4422 **Effect of Side Gust on the Performance of Supersonic Inlet with Bleed System** H. Halwas, S. Aggarwal, University of Illinois, Chicago, Chicago, IL	1400 hrs AIAA-2019-4423 **Refinement of Vortex Generators in a Streamline-Traced, External-Compression Supersonic Inlet** J. Slater, NASA Glenn Research Center, Cleveland, OH	1430 hrs AIAA-2019-4424 **Wind Tunnel Tests of Rectangular Supersonic Air Inlet at ITU** I. Karpuzcu, ROKETSAN Missile Industries, Inc., Ankara, Turkey; K. Yuceil, Istanbul Technical University, Ankara, Turkey; U. Poyraz, E. Arisoy, U. Olgun, ROKETSAN Missile Industries, Inc., Ankara, Turkey; H. Tabanli, Istanbul Technical University, Ankara, Turkey	1500 hrs AIAA-2019-4425 **Numerical Assessment of Intake Buzz with Nano-Particles across a Supersonic External Compression Intake** R. Jagannathan, C. Johansen, University of Calgary, Calgary, Canada	

Thursday, 22 August 2019				
241-LP-25	**Green Propulsion Systems for Space Applications II**			**Room 104**
Chaired by: C. GATTO, Jet Propulsion Laboratory and B. RHODES, The Aerospace Corporation				
1330 hrs AIAA-2019-4426 **Thermoanalytical Study of Hydroxylammonium Nitrate Decomposition at High Pressures** A. Esparza, E. Shafirovich, University of Texas, El Paso, El Paso, TX	1400 hrs AIAA-2019-4427 **Safe 0.5N Green Monopropellant Thruster for Small Satellite Propulsion Systems** S. Igarashi, Y. Matsuura, IHI Corporation, Tomioka, Japan; H. Ikeda, K. Hatai, Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan	1430 hrs AIAA-2019-4428 **Influence of Propellant Composition on the Performance of a Gel Rocket Combustion Chamber** C. Kirchberger, D. Freudenmann, H. Ciezki, German Aerospace Center (DLR), Lampoldshausen, Germany	1500 hrs AIAA-2019-4429 **An Experimental Study of a Nitrous Oxide / Ethanol (NOEL) Propulsion System** S. Tokudome, K. Goto, T. Yagishita, N. Suzuki, T. Yamamoto, Japan Aerospace Exploration Agency (JAXA), Sagamihara, Japan	

Thursday, 22 August 2019				
242-LP-27	**Liquid Rocket Engine Turbomachinery**			**Room 106**
Chaired by: F. LASSOUDIERE, Ariane Group and J. RICCIUS, DLR - German Aerospace Center				
1330 hrs AIAA-2019-4430 **The Development Status of LE-9 Engine Turbopumps for H3 Launch Vehicle** N. Azuma, M. Kojima, T. Kobayashi, K. Okita, Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan; T. Motomura, IHI Corporation, Mizuho, Japan; et al.	1400 hrs AIAA-2019-4431 **Numerical Modeling of Different Designs for a Rocket Propellant Turbopump Inducer** J. Torres Zanardi, F. Bacchi, A. Scarabino, National University of La Plata, La Plata, Argentina	1430 hrs AIAA-2019-4432 **Design and Testing of Centrifugal Fuel Pump for Liquid Propellant Rocket Engine L75** R. Reis, L. Silva, C. Pagliuco, D. Almeida, Aeronautics and Space Institute (IAE), São José dos Campos, Brazil	1500 hrs AIAA-2019-4433 **Numerical Study of Tip Clearance Effects in a Centrifugal Pump with Unshrouded Impeller for Liquid Rocket Engines** H. Negishi, Japan Aerospace Exploration Agency (JAXA), Tsukuba, Japan; S. Ohno, Ryoyu Systems Company, Ltd., Minato, Japan	1530 hrs AIAA-2019-4434 **Development of a hydrostatic journal bearing with micro porous CMC material** H. Seiler, M. Ortelt, German Aerospace Center (DLR), Stuttgart, Germany; M. Böhle, Technical University of Kaiserslautern, Kaiserslautern, Germany

Thursday, 22 August 2019				
243-LP-28	**Propellant Storage and Management III**			**Room 105**
Chaired by: J. MOLINSKY, Northrop Grumman Innovation Systems and C. RADKE, NASA Johnson Space Center				
1330 hrs AIAA-2019-4435 **SSPD Restore-L Propellant Transfer Subsystem Progress** G. Coll, G. Webster, O. Pankiewicz, K. Schlee, NASA Goddard Space Flight Center, Greenbelt, MD; T. Aranyos, B. Nufer, NASA Kennedy Space Center, Cape Canaveral, FL; et al.	1400 hrs AIAA-2019-4436 **Critical Review of Damping Prediction Methods for Annular Ring Slosh Baffles** S. Coogan, S. Green, Southwest Research Institute, San Antonio, TX	1430 hrs AIAA-2019-4437 **Dynamics of Low-Gravity Sloshing in Spherical Tanks during Touchdown Phases of Landers** K. Anii, T. Himeno, Y. Sakuma, T. Watanabe, University of Tokyo, Bunkyo, Japan; M. Baba, M. Otsuki, Japan Aerospace Exploration Agency (JAXA), Sagamihara, Japan; et al.	1500 hrs AIAA-2019-4438 **Effect of Temperature and Pressure Measurement Uncertainties on Phase Change Calculations with Liquid Hydrogen** P. Srikanth, S. Collicott, Purdue University, West Lafayette, IN	1530 hrs AIAA-2019-4439 **Numerical Simulation on Liquid Hydrogen Chill-down Process of Vertical Pipeline** Y. Umemura, Japan Aerospace Exploration Agency (JAXA), Ibaraki, Japan; T. Himeno, University of Tokyo, Tokyo, Japan; K. Kinefuchi, Y. Saito, Japan Aerospace Exploration Agency (JAXA), Ibaraki, Japan; B. Sakowski, D. Hauser, NASA Glenn Research Center, Cleveland, OH; et al.

Thursday, 22 August 2019				
244-PC-23	**Solid Propellant Development**			**White River G**
Chaired by: V. SANKARAN, US Air Force/AFRL/RQRC and R. MUNIPALLI, HyPerComp, Incorporated				
1330 hrs AIAA-2019-4440 **Burning Rate Characterization of Ammonium Perchlorate Pellets Containing Catalytic Additives** F. Rodriguez, J. Thomas, T. Sammet, E. Petersen, C. Dillier, E. Petersen, Texas A&M University, Orlando, TX	1400 hrs AIAA-2019-4441 **Effect of CuO-Graphene Foam (GF) Microstructures on the Decomposition of AP-NC Composite Solid Propellant** S. Jain, S. Chakraborty, L. Qiao, Purdue University, West Lafayette, IN	1430 hrs AIAA-2019-4442 **The Effect of Encapsulated Nanoscale and Micron-scale Catalyst Particles on the Decomposition of Ammonium Perchlorate Crystals** S. Fehlberg, S. Son, M. Örnek, T. Manship, Purdue University, West Lafayette, IN	1500 hrs AIAA-2019-4443 **Solid Propellant with Embedded Additively Manufactured Reactive Components** D. Collard, M. McClain, T. Fleck, N. Rahmann, J. Rhoads, T. Meyer, Purdue University, West Lafayette, IN; et al.	1530 hrs AIAA-2019-4444 **Investigation of the Influence of the Perfluorooctanoate Ferric Salt on Combustion Agglomeration in Aluminized HTPB Solid Composite Propellant** X. Zhou, F. Zhen, L. Meng, F. Xiao, R. Yang, L. Wang, Beijing Institute of Technology, Beijing, China; et al.

Thursday, 22 August 2019				
245-PC-24	**Combustion Diagnostics**			**White River H**
Chaired by: C. LI, Air Force Office of Scientific Research and A. COMER, University of Michigan, Ann Arbor				
1330 hrs AIAA-2019-4445 **Reacting Jets in Vitiated Crossflow at High Speeds: The Development of an Optically-Accessible Secondary Combustion Zone** N. Rodrigues, C. McDonald, T. Busari, W. Senior, Purdue University, West Lafayette, IN; A. North, Siemens, Orlando, FL; Y. Chen, Siemens, Mülheim an der Ruhr, Germany; et al.	1400 hrs AIAA-2019-4446 **Determination of Nitric Oxide Concentrations in Mixtures with Nitrogen Tetroxide via IR Spectrometry** C. Yilmaz, Z. Truckenbrod, J. Marcum, T. Pourpoint, Purdue University, West Lafayette, IN	1430 hrs AIAA-2019-4447 **Small-volume, High-throughput Techniques for Fuel Physical Property Measurements** W. Dang, S. Menon, Louisiana State University, Baton Rouge, LA		

Thursday, 22 August 2019				
246-PGC-12	**Pressure Gain Combustion: Physics Modeling and Exploration IV**			**White River C/D**
Chaired by: D. FERGUSON, National Energy Technology Laboratory and G. MEHOLIC, The Aerospace Corporation				
1330 hrs AIAA-2019-4448 **Conjugate heat transfer analysis of rotating detonation engines** U. Yelken, O. Tuncer, Istanbul Technical University, Istanbul, Turkey; B. Saracoglu, von Kármán Institute for Fluid Dynamics, Brussels, Belgium	1400 hrs AIAA-2019-4449 **Thermodynamic and Operability Implications of Product Recirculation in Rotating Detonation Engines** R. Fievisohn, National Academy of Sciences, Washington, D.C.; J. Hoke, Innovative Scientific Solutions, Inc., Dayton, OH; A. Holley, Air Force Research Laboratory, Wright-Patterson AFB, OH	1430 hrs AIAA-2019-4450 **Impact of Inlet Area Ratio on the Operation of an Axial Air Inlet Configuration Rotating Detonation Combustor** F. Chacon, A. Feleo, M. Gamba, University of Michigan, Ann Arbor, Ann Arbor, MI		

Thursday, 22 August 2019				
247-SNP-2	**Space Nuclear Power Systems**			**Room 203**
Chaired by: G. SEMRAU, Moog, Inc., Space, Advanced Programs				
1330 hrs AIAA-2019-4451 **Selection of a Space Reactor Moderator Using Lessons Learned from SNAP and ANP Programs** V. Mehta, P. McClure, Los Alamos National Laboratory, Los Alamos, NM; D. Kotlyar, Georgia Institute of Technology, Atlanta, GA	1400 hrs AIAA-2019-4452 **Hydrogen Loss Effects on Microreactors for Space and Planetary Nuclear Power Production** V. Mehta, P. McClure, Los Alamos National Laboratory, Los Alamos, NM; D. Kotlyar, Georgia Institute of Technology, Atlanta, GA	1430 hrs AIAA-2019-4453 **NTP Design Derivatives and Enhancements for Lunar and Mars Missions** C. Joyner, Aerojet Rocketdyne, Jupiter, FL; M. Eades, Ultra Safe Nuclear Corporation, Seattle, WA; D. Hanks, Aerojet Rocketdyne, Canoga Park, CA; T. Jennings, Aerojet Rocketdyne, Jupiter, FL; T. Kokan, Aerojet Rocketdyne, Huntsville, AL; D. Levack, Aerojet Rocketdyne, Canoga Park, CA; et al.	1500 hrs AIAA-2019-4454 **Development of a deep space nuclear electric propulsion (NEP) system – a NuAER plasma NEP reactor** J. Kalyan Raj I., Technion–Israel Institute of Technology, Haifa, Israel; G. Parks, University of Cambridge, Cambridge, United Kingdom	

Thursday, 22 August 2019		
248-SP-2 **1330 - 1430 hrs**	**Deep Space Talk Show**	**JW Grand Ballroom 5**

Thursday, 22 August 2019				
249-TM-6	**Thermal Modeling, Simulation, and Analysis**			**Room 204**
Chaired by: D. ZAKAR, NRL and M. CHOI, NASA-Goddard Space Flight Center				
1330 hrs AIAA-2019-4455 **Numerical Analysis For Smoke Spread In An Aircraft Hangar** E. Khalil, A. Morsy, Cairo University, Cairo, Egypt; E. AbdelGhany, Aviation Institute, Cairo, Egypt; H. Kayed, Cairo University, Cairo, Egypt	1400 hrs AIAA-2019-4456 **Reducing the Time-to-Solution for Finite Element Analysis of Gas Turbine Engines** T. Simons, J. Ong, Rolls-Royce Group plc, Indianapolis, IN; R. Lucas, F. Rouet, R. Grimes, Livermore Software Technology Corporation, Livermore, CA; E. Gulyeruz, University of Illinois, Urbana-Champaign, Urbana, IL; et al.	1430 hrs AIAA-2019-4457 **Thermal management and Building Codes Nexus** E. Khalil, Cairo University, Cairo, Egypt	1500 hrs AIAA-2019-4458 **Analytical Modeling of Minimum Hot Surface Ignition Temperature for Aviation Fluids** M. Ulcay, L. Dillard, J. Gore, Purdue University, West Lafayette, IN	1530 hrs AIAA-2019-4459 **New Results from Reduced-Order CFD-Based Multi-Rating of Aviation Heat Exchangers** F. Ladeinde, Stony Brook University, Stony Brook, NY

Thursday, 22 August 2019				
250-UAS-3	**Unmanned Aircraft Systems: Propulsion, Energy and Applications II**			**Room 308**
Chaired by: L. CHEN, Texas A&M University				
1330 hrs AIAA-2019-4460 **Design, Characterization, and Integration of a Turboelectric Power System for Small Unmanned Multirotor Aircraft** K. Moody, C. Replogle, K. Rouser, Oklahoma State University, Stillwater, OK	1400 hrs AIAA-2019-4461 **Experimental Performance Assessment of an Electric UAV with an Alternative Distributed Propulsion Configuration Implemented for Wetland Monitoring** E. Valencia, M. Oña, D. Rodriguez, A. Oña, National Polytechnic University, Quito, Ecuador	1430 hrs AIAA-2019-4462 **Autonomous Routing and Power Management of Drones in GPS-Denied Environments through Dijkstra Algorithm** A. Mirzaeinia, J. Shahmoradi, P. Roghanchi, M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM	1500 hrs AIAA-2019-4463 **Particle Swarm Optimization for Wireless Charging of Swarming Drones through Ambient Radio Frequencies** A. Mirzaeinia, New Mexico Institute of Mining and Technology, Socorro, NM; M. Mirzaeinia, Amirkabir University of Technology, Tehran, Iran; Q. Bradfield, S. Bradley, M. Hassanalian, New Mexico Institute of Mining and Technology, Socorro, NM	1530 hrs AIAA-2019-4464 **Modeling a propulsion system for the trajectory correction of weather balloons** D. Vera, E. Valencia, E. Lopez, National Polytechnic University, Quito, Ecuador; W. Banda, University of Hamburg, Hamburg, Germany

Thursday, 22 August 2019		
251-EATS-6 **1600 - 1730 hrs**	**Safety, Standards, and Regulations for Electrified Aircraft**	**Room 134 (Convention Center)**

Moderator: Phil Krein, University of Illinois at Urbana-Champaign

Panelists:

Herb Schlickenmaier	Mark DeAngelo	Nick Borer	Bob Bayles	Bill Schinstock
HS Advanced Concepts	SAE	NASA	Collins Aerospace	FAA

Thursday, 22 August 2019		
252-EATS-23 **1600 - 1730 hrs**	**Safety, Standards, and Regulations for Electrified Aircraft**	**Room 137-139 (Conference Center)**

Friday

Friday, 23 August 2019		
253-EATS-24 **0800 - 0900 hrs**	**The Many Possible Futures of Electric Flight**	**Room 137-139 (Conference Center)**

Friday, 23 August 2019		
254-NW-12 **0900 - 0930 hrs**	**Electric Aircraft Technologies Symposium Networking Break**	**Room 137-139 (Conference Center)**

Friday, 23 August 2019				
255-EATS-7	**Topic Area 1: Electrified Aircraft Design and Novel Concepts**			**Room 134 (Convention Center)**
Chaired by: H. KIM and G. CINAR				
0930 hrs AIAA-2019-4465 **Aircraft Conceptual Design and Optimization Including Powertrain Architecture and Distributed Propulsion** F. Orefice, P. Della Vecchia, D. Ciliberti, F. Nicolosi, University of Naples "Federico II", Naples, Italy	1000 hrs AIAA-2019-4466 **Parallel Hybrid Propulsion System for a Regional Turboprop: Conceptual Design and Benefits Analysis** P. Bertrand, Pratt & Whitney, Montréal, Canada; T. Spierling, Collins Aerospace, Rockford, IL; C. Lents, United Technologies Corporation, East Hartford, CT	1030 hrs AIAA-2019-4467 **A High Efficiency Low Noise VTOL/ESTOL Concept Using CoFLow Jet Airfoil** G. Zha, Y. Ren, J. Gan, D. Espinal, University of Miami, Miami, FL	1100 hrs Oral Presentation **Foundation of the Center for High-Efficiency Electrical Technologies for Aircraft, a NASA University Leadership Initiative Study** P. Ansell, University of Illinois, Urbana-Champaign, Urbana, IL	

Friday, 23 August 2019				
256-EATS-8	**Topic Area 2: Energy Storage Systems**			**Room 136 (Conference Center)**
Chaired by: L. TAYLOR, NASA Glenn Research Center				
0930 hrs AIAA-2019-4468 **On the Feasibility of a LiS Battery for Aircraft Electric Propulsion** R. Hess, BAE Systems, Endicott, NY	1000 hrs AIAA-2019-4469 **A simulation tool for battery life prediction of a Turbo-Hybrid-Electric Regional Jet for the NASA ULI Program** M. D'Arpino, M. Cancian, A. Sergent, M. Canova, M. Benzakein, Ohio State University, Columbus, OH; C. Perullo, Georgia Institute of Technology, Atlanta, GA	1030 hrs Oral Presentation **Superconducting-Magnetic-Energy-Storage (SMES) for Electric Aircraft Propulsion** T. Haugan, T. Bullard, Air Force Research Laboratory, Wright-Patterson AFB, OH	1100 hrs Oral Presentation **Boost Capacitor Simulation and test results with discussion of future military technologies** R. Brewer, Lockheed Martin Corporation, Fort Worth, TX	1130 hrs AIAA-2019-4470 **A New Development Strategy of Light Wight Solid Oxide Fuel Cells for Electrified Airplane System** S. Hashimoto, Chubu University, Kasugai, Japan; R. Miyata, K. Kobayashi, K. Yashiro, H. Takamura, K. Yoshimi, Tohoku University, Sendai, Japan; et al.

Friday, 23 August 2019				
257-EATS-9	**Topic Area 3: Power Converters**			**Room 135 (Conference Center)**
Chaired by: K. RAJASHEKARA, University of Houston and R. RODRIGUEZ, Rolls-Royce North American Technologies, Inc.				
0930 hrs AIAA-2019-4471 **Control of a DC-DC Converter as an Active Filter in Combination with Switched Reluctance Generators for Gas Turbine Applications** D. Pham, A. Klein-Hessling, R. De Doncker, RWTH Aachen University, Aachen, Germany	1000 hrs Oral Presentation **Mega-watt Class Ultra-high Density DC-DC Converters for Future Electric Aircraft Systems** P. Channegowda, S. Du, P. Kshirsagar, S. Dwari, United Technologies Corporation, East Hartford, CT	1030 hrs AIAA-2019-4472 **Development of A High Power Density Megawatt-Scale Medium-Voltage Power Converter for Aircraft Hybrid-Electric Propulsion Systems** D. Zhang, J. He, D. Pan, M. Dame, M. Schutten, General Electric Company, Niskayuna, NY	1100 hrs AIAA-2019-4473 **MW-Class Cryogenically-Cooled Inverter for Electric Aircraft Applications** F. Wang, R. Chen, H. Gui, J. Niu, L. Tolbert, D. Costinett, University of Tennessee, Knoxville, Knoxville, TN; et al.	1130 hrs AIAA-2019-4474 **Health Management and Prognostics for Electric Aircraft Powertrain** C. Kulkarni, M. Corbetta, Stinger Ghaffarian Technologies, Inc., Moffett Field, CA

Friday, 23 August 2019		
258-EATS-25 **1200 - 1300 hrs**	**Electric Aircraft Technologies Symposium Lunch**	**Room 137-139 (Conference Center)**

Friday, 23 August 2019		
259-EATS-10 **1300 - 1430 hrs**	**Electrified Propulsion Technologies for Emerging Small Aircraft Markets**	**Room 134 (Convention Center)**

Moderator: Starr Ginn, NASA

Panelists:

Rich Ouellette The Boeing Company	**Sean Clarke** NASA	**Carey Cannon** Bell Helicopter

Friday, 23 August 2019		
260-EATS-26 **1300 - 1430 hrs**	**Electrified Propulsion Technologies for Emerging Small Aircraft Markets**	**Room 137-139 (Conference Center)**

Friday, 23 August 2019		
261-NW-11 **1430 - 1500 hrs**	**Electric Aircraft Technologies Symposium Networking Break**	**Room 137-139 (Conference Center)**

Friday, 23 August 2019				
262-EATS-11	**Topic Area 2: Electromechanical Interactions and Modeling**			**Room 135 (Conference Center)**
Chaired by: H. HUANG, GE Aviation and K. YOST, Air Force Research Laboratory				
1500 hrs AIAA-2019-4475 **Electromagnetic Mass and Efficiency of Magnetic Gears for Electrified Aircraft** T. Tallerico, J. Scheidler, Z. Cameron, NASA Glenn Research Center, Cleveland, OH	1530 hrs AIAA-2019-4476 **Hardware-Based Formulation and Validation of Synchronous Machine Models for Aerospace Electric Power Systems** B. Robbins, W. Perdikakis, PC Krause and Associates, Indianapolis, IN; C. Kitzmiller, UES, Inc., Dayton, OH; K. Yost, Air Force Research Laboratory, Wright-Patterson AFB, OH	1600 hrs AIAA-2019-4477 **Design of a Magnetic Gear for NASA's Vertical Lift Quadrotor Concept Vehicle** T. Tallerico, Z. Cameron, J. Scheidler, NASA Glenn Research Center, Cleveland, OH	1630 hrs AIAA-2019-4478 **Study of electro-mechanical interaction in micro gas turbine engine generator system for more electric applications** S. K N, K. Sakinala, D. Kashireddy, S. Hosamane, V. Upadya, D. Kumar, Honeywell International, Inc., Bengaluru, India; et al.	1700 hrs AIAA-2019-4479 **Hybrid Assisted Regenerative Turbofan Engine: A case study for XWB-84 modification** R. Yousaf, A. Sarosh, H. Talat, National University of Sciences and Technology, Islamabad, Pakistan; R. Wajid, Oregon State University, Corvallis, OR

Friday, 23 August 2019				
263-EATS-12	**Topic Area 2: Design and Test of Electric Motor Systems**			**Room 134 (Convention Center)**
Chaired by: D. RITTENBERG, Siemens PLM Software and A. PROVENZA, NASA Glenn Research Center				
1500 hrs AIAA-2019-4480 **Aviation Electrification - Choosing Your Motor Topology and Material Advancements** A. Williams, Arnold Magnetic Technologies, Rochester, NY	1530 hrs AIAA-2019-4481 **Development of a Maxwell X-57 High Lift Motor Reference Design** D. Hall, J. Chin, A. Anderson, A. Smith, R. Edwards, K. Duffy, NASA Glenn Research Center, Cleveland, OH	1600 hrs AIAA-2019-4482 **Designing an Advanced Electrical Motor for Propulsion of Electric Aircraft** D. Golovanov, Z. Xu, D. Gerada, University of Nottingham, Nottingham, United Kingdom; A. Page, T. Sawata, Collins Aerospace, Solihull, United Kingdom	1630 hrs AIAA-2019-4483 **Design of High-Speed Permanent Magnet Machine for Aerospace Propulsion** J. Swanke, D. Bobba, T. Jahns, B. Sarlioglu, University of Wisconsin, Madison, Madison, WI	1700 hrs AIAA-2019-4484 **A Micro Electrostatic Motor with Multiple Driving Stages** J. Leng, M. Qi, X. Zhang, D. Huang, Z. Liu, X. Yan, Beihang University, Beijing, China

Friday, 23 August 2019				
264-EATS-13	**Topic Area 3: System Optimization**			**Room 136 (Conference Center)**
Chaired by: D. HALL, Aurora Flight Sciences and I. ORISAMOLU, Pratt & Whitney				
1500 hrs AIAA-2019-4485 **Power Allocation and Generator Sizing Optimisation of More-Electric Aircraft On-board Electrical Power during Different Flight Stages** X. Wang, J. Atkin, C. Hill, S. Bozhko, University of Nottingham, Nottingham, United Kingdom	1530 hrs AIAA-2019-4486 **Electric Propulsion System Optimization for a Long-Endurance Solar-Powered Unmanned Aircraft** O. Dantsker, S. Imtiaz, University of Illinois, Urbana-Champaign, Urbana, IL; M. Caccamo, Technical University of Munich, Garching, Germany	1600 hrs AIAA-2019-4487 **Hierarchical Model Predictive Control for Real-Time Energy-Optimized Operation of Aerospace Systems** Z. Jiang, S. Raziei, University of Dayton, Dayton, OH	1630 hrs AIAA-2019-4488 **Scalable Graph Theory Approach for Electric Aircraft Power System Optimization** D. Lawhorn, V. Rallabandi, D. Ionel, University of Kentucky, Lexington, Lexington, KY	1700 hrs AIAA-2019-4489 **Optimized LV loads allocation for MEA electrical power systems** C. Spagnolo, V. Madonna, S. Sumsurooah, C. Hill, S. Bozhko, University of Nottingham, Nottingham, United Kingdom

Saturday

Saturday, 24 August 2019		
265-EATS-27 **0800 - 0900 hrs**	**Electric Aircraft Technologies Symposium Keynote**	**Room 137-139 (Conference Center)**

Saturday, 24 August 2019				
266-EATS-14	**Topic Area 1: Electrified Aircraft Subsystem Simulations and Methods**			**Room 134 (Convention Center)**
Chaired by: A. GIBSON, Empirical Systems Aerospace and P. CORNELL, NASA Glenn Research Center				
0900 hrs AIAA-2019-4490 **Sizing and Performance Analysis of a Turbo-Hybrid-Electric Regional Jet for the NASA ULI Program** C. Perullo, A. Alahmad, J. Wen, Georgia Institute of Technology, Atlanta, GA; M. D'Arpino, M. Canova, Ohio State University, Columbus, OH; D. Mavris, Georgia Institute of Technology, Atlanta, GA; et al.	0930 hrs AIAA-2019-4491 **Further Development and Validation of NASA X-57 Maxwell Mission Planning Tool for Mods III and IV** S. Schnulo, D. Hall, J. Chin, NASA Glenn Research Center, Cleveland, OH	1000 hrs AIAA-2019-4492 **Commercial Hybrid Electric Aircraft Thermal Management System Design, Simulation, and Operation Improvements** J. Rheaume, M. MacDonald, C. Lents, United Technologies Corporation, East Hartford, CT	1030 hrs AIAA-2019-4493 **An assessment of the uncertainty involved in predictions of energy consumption and carbon emissions from future fully-electrified aircraft** J. Smith, E. Mastorakos, University of Cambridge, Cambridge, United Kingdom	1100 hrs AIAA-2019-4494 **An analysis of electrical arc behavior with radiated field for airborne application in HVDC** J. Rivenc, D. Chassaigne, C. Marot, R. Perraud, G. Peres, L. Ybanez, Airbus, Toulouse, France

Saturday, 24 August 2019				
267-EATS-15	**Topic Area 2: Superconducting Materials**			**Room 135 (Conference Center)**
Chaired by: T. HAUGAN, U.S. Air Force Research Laboratory				
0900 hrs AIAA-2019-4495 **AC Loss of Superconducting Materials- refined loss estimates for very high density motors and generators for hybrid-electric aircraft: MgB2 wires, Coated conductor tapes and wires** M. Sumption, Ohio State University, Columbus, OH	0930 hrs AIAA-2019-4496 **Progress Toward the Critical Design of the Superconducting Rotor for NASA's 1.4~MW High-Efficiency Electric Machine** J. Scheidler, T. Tallerico, NASA Glenn Research Center, Cleveland, OH; W. Miller, Vantage Partners, LLC, Cleveland, OH; W. Torres, Wolf Creek Federal Services, Cleveland, OH	1000 hrs Oral Presentation **Potential for Superconducting Stators to Enable All Cryogenic Motors and Generators for Aircraft** M. Tomsic, M. Rindfleisch, D. Panik, Hyper Tech Research, Columbus, OH; M. Sumption, M. Majoros, Ohio State University, Columbus, OH	1030 hrs AIAA-2019-4497 **Influence of thermal and electrical turn-to-turn sharing on quench protection in superconducting coils for very high density motors and generators for hybrid-electric aircraft** M. Sumption, Ohio State University, Columbus, OH	1100 hrs AIAA-2019-4498 **Exploring options for integrated cryogenic circulation loop of superconducting power devices on electric aircraft** P. Cheetham, I. Barnola, C. Kim, S. Pamidi, Center for Advanced Power Systems, Tallahassee, FL

Saturday, 24 August 2019				
268-EATS-16	**Topic Area 3: Power Management Systems**			**Room 136 (Conference Center)**
Chaired by: D. TORREY, GE Global Research				
0900 hrs AIAA-2019-4499 **A Control Strategy for Turbine Electrified Energy Management** J. Kratz, D. Culley, G. Thomas, NASA Glenn Research Center, Cleveland, OH	0930 hrs AIAA-2019-4500 **A Method for Determining Optimal Power Management Schedules for Hybrid Electric Airplanes** D. Trawick, Rolls-Royce Group plc, Indianapolis, IN; K. Milios, J. Gladin, D. Mavris, Georgia Institute of Technology, Atlanta, GA	1000 hrs AIAA-2019-4501 **Exergy/energy dynamics-based integrative modeling and control for difficult hybrid aircraft missions** M. Ilic, R. Jaddivada, Massachusetts Institute of Technology, Cambridge, MA	1030 hrs AIAA-2019-4502 **Evaluation of Electrical System Requirements for Implementing Turbine Electrified Energy Management** J. Kratz, D. Culley, G. Thomas, NASA Glenn Research Center, Cleveland, OH	1100 hrs AIAA-2019-4503 **Fault Detection and Identification for Multirotor Aircraft by Data-Driven Statistical Learning Methods** A. Dutta, M. McKay, F. Kopsaftopoulos, F. Gandhi, Rensselaer Polytechnic Institute, Troy, NY

Saturday, 24 August 2019				
269-EATS-17 **1130 - 1300 hrs**	**Progress in Energy Storage and Conversion for Aeropropulsion**			**Room 134 (Convention Center)**
Moderator: Kaushik Rajashekara, University of Houston Panelists: **Ajay Misra** NASA	**Venkat Srinivasan** ANL	**Marianne Mata** The Boeing Company	**Mike Armstrong** Electric Power Systems	

Saturday, 24 August 2019				
270-EATS-28 **1130 - 1300 hrs**	**Progress in Energy Storage & Conversion for Aeropropulsion**			**Room 137-139 (Conference Center)**

Saturday, 24 August 2019				
271-EATS-18	**Topic Area 1: Challenges and Opportunities in Electrified Aircraft Systems**			**Room 134 (Convention Center)**
Chaired by: N. MADAVAN, NASA-Ames Research Center and E. MUGICA, Boeing Company				
1300 hrs AIAA-2019-4504 **Challenges in Vehicle Safety and Occupant Protection for Autonomous electric Vertical Take-off and Landing (eVTOL) Vehicles** J. Littell, NASA Langley Research Center, Hampton, VA	1330 hrs Oral Presentation **Boeing Electrified Aircraft Propulsion Overview** E. Mugica, The Boeing Company, Huntington Beach, CA	1400 hrs AIAA-2019-4505 **Current Capabilities and Challenges of NDARC and SUAVE for eVTOL Aircraft Design and Analysis** J. Vegh, U.S. Army, Moffett Field, CA; E. Botero, M. Clarke, J. Trent, J. Alonso, Stanford University, Stanford, CA	1430 hrs AIAA-2019-4506 **Design of More Electric Aircraft DC Power Distribution Architectures considering Reliability Performance** A. Recalde, S. Bozhko, J. Atkin, University of Nottingham, Nottingham, United Kingdom	1500 hrs AIAA-2019-4507 **Electric Propulsion and other options to reinvigorate General Aviation** R. Rezende, Alltec, Pooler, GA; J. Barros, Federal University of Minas Gerais, Belo Horizonte, Brazil

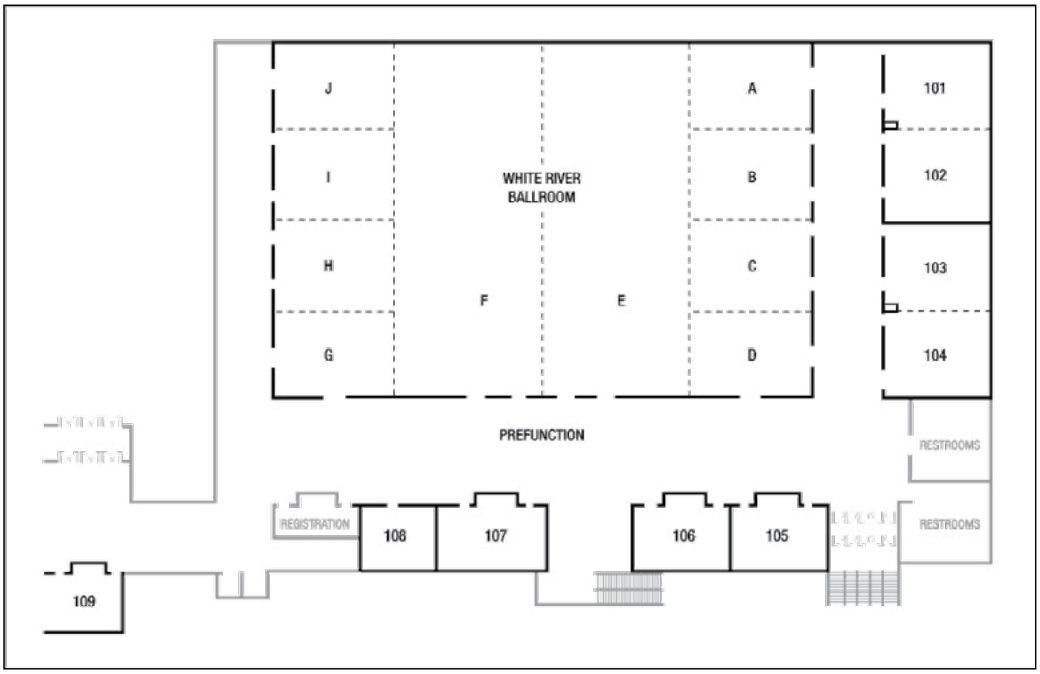
Saturday, 24 August 2019				
272-EATS-19	**Topic Area 2: Electric Motor Wire and Power Transmission Insulation**			**Room 135 (Conference Center)**
Chaired by: T. LEBEY, Université de Toulouse and A. WOODWORTH, NASA Glenn Research Center				
1300 hrs AIAA-2019-4508 **Pot-ability Assessment of Litz Wires for High Power Density Electric Motor** E. Shin, Ohio Aerospace Institute, Cleveland, OH	1330 hrs AIAA-2019-4509 **Thermal Analysis of Potted Litz Wire for High Power Density Aerospace Electric Machines** A. Woodworth, W. Sixel, R. Edwards, R. Jansen, NASA Glenn Research Center, Cleveland, OH; S. McCormick, NASA Langley Research Center, Hampton, VA; M. Robbie, Vantage Partners, LLC, Brook Park, OH; et al.	1400 hrs AIAA-2019-4510 **Highly thermally conductive insulation for high power density electric machines** W. Yin, A. Yakimov, H. Comanzo, O. Siclovan, P. Smigelski, K. Bodla, General Electric Company, Niskayuna, NY; et al.	1430 hrs AIAA-2019-4511 **Development of High Voltage Micro-Multilayer Multifunctional Electrical Insulation (MMEI) System** E. Shin, Ohio Aerospace Institute, Cleveland, OH	1500 hrs AIAA-2019-4512 **Partial Discharge Management and Arc Detection for High Voltage Aircraft Distribution Systems** X. Wu, R. Mahmoudi, L. Xing, C. Lents, United Technologies Corporation, East Hartford, CT

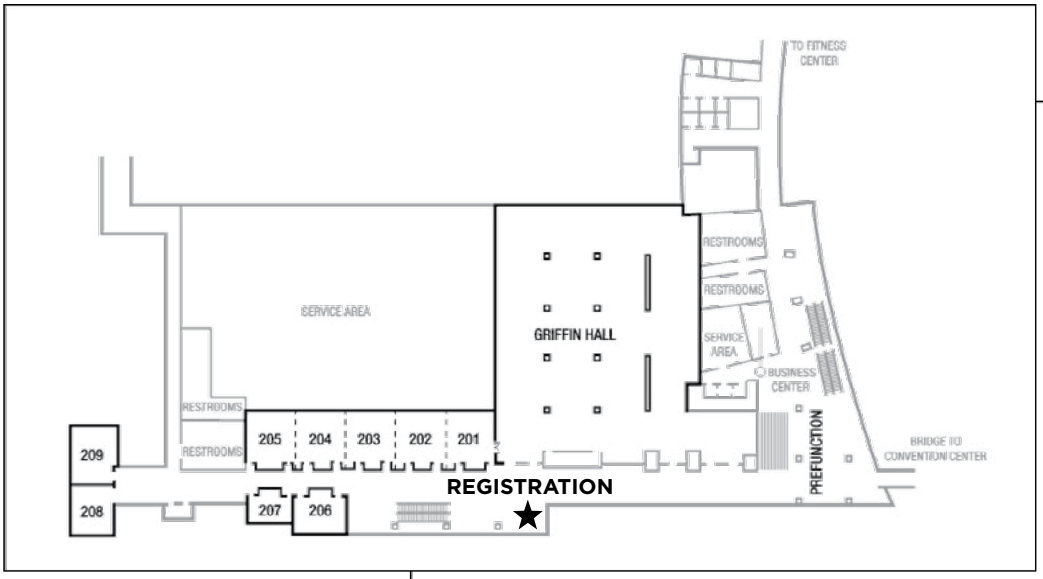
Saturday, 24 August 2019				
273-EATS-20	**Topic Area 2: Megawatt-Scale Motor Systems**			**Room 136 (Conference Center)**
Chaired by: J. NAIRUS, US Air Force Research Laboratory				
1300 hrs AIAA-2019-4513 **High Efficiency Megawatt Motor Preliminary Design** R. Jansen, P. Kascak, R. Dyson, A. Woodworth, J. Scheidler, A. Smith, NASA Glenn Research Center, Cleveland, OH; et al.	1330 hrs AIAA-2019-4514 **Experimental Validation of Rotor Eccentricity Model of a Slotless PM Synchronous Machine** A. Yoon, Y. Wang, A. Anderson, D. Lee, K. Haran, University of Illinois, Urbana-Champaign, Urbana, IL	1400 hrs AIAA-2019-4515 **High Efficiency Megawatt Motor Rotating Cryocooler Conceptual Design** R. Dyson, P. Passe, K. Duffy, R. Jansen, NASA Glenn Research Center, Cleveland, OH	1430 hrs AIAA-2019-4516 **Direct Drive Electric Motor for STARC-ABL Tail-Cone Propulsor** A. Yoon, D. Lohan, F. Arastu, J. Xiao, K. Haran, Hinetics, LLC, Champaign, IL	1500 hrs AIAA-2019-4517 **Propulsion motor concepts for airplanes** S. Kalsi, Kalsi Green Power Systems, LLC, Princeton, NJ; J. Storey, K. Hamilton, R. Badcock, Victoria University of Wellington, Lower Hutt, New Zealand

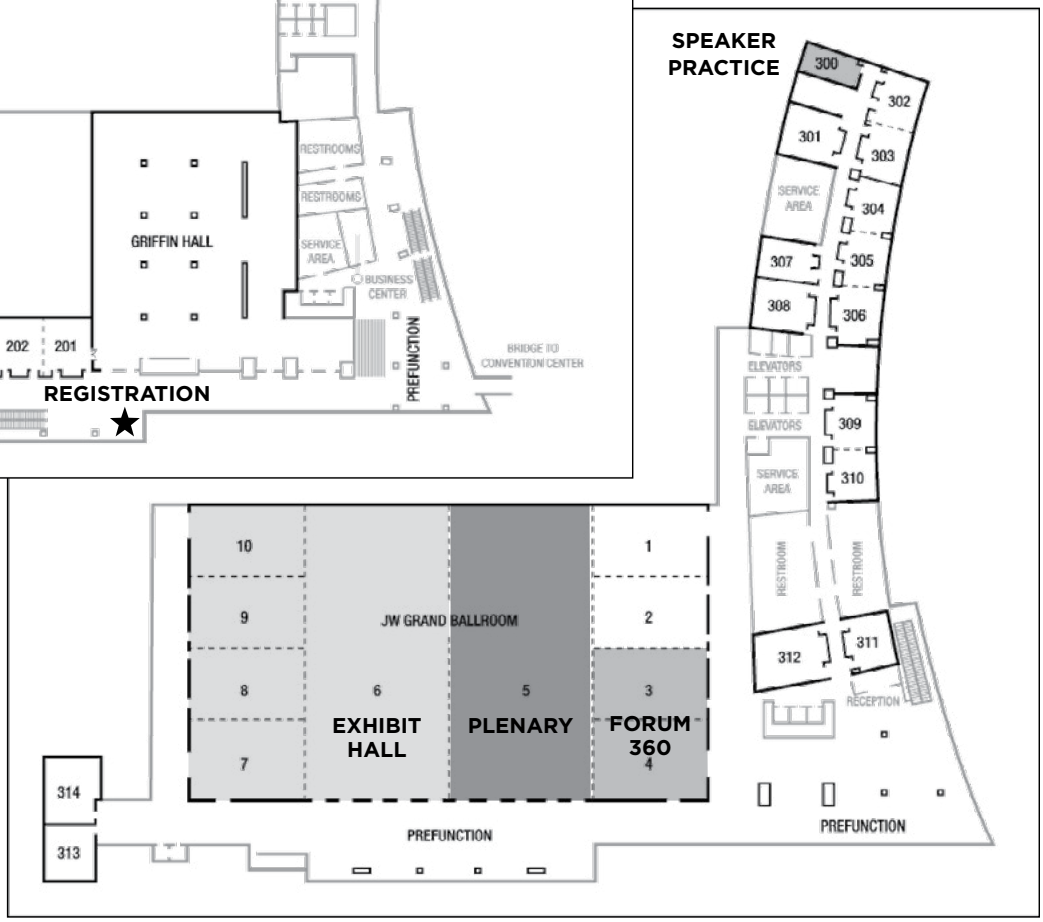
Saturday, 24 August 2019		
274-EATS-29 **1530 - 1600 hrs**	**Electric Aircraft Technologies Symposium Closing Remarks**	**Room 137-139 (Conference Center)**

VENUE MAP

JW MARRIOTT INDIANAPOLIS





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