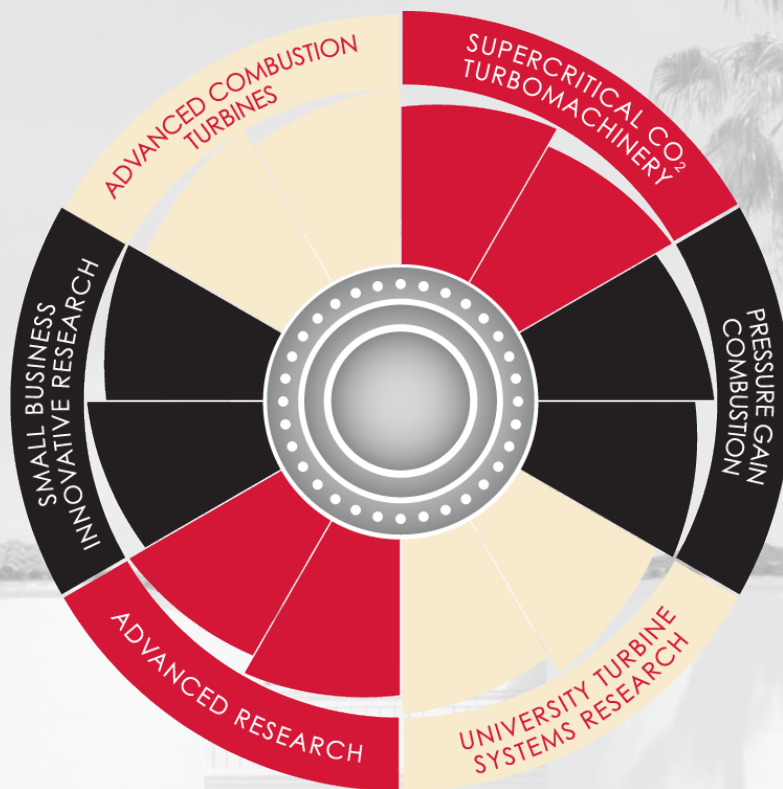




University Turbine Systems Research

2022 Project Review Meeting

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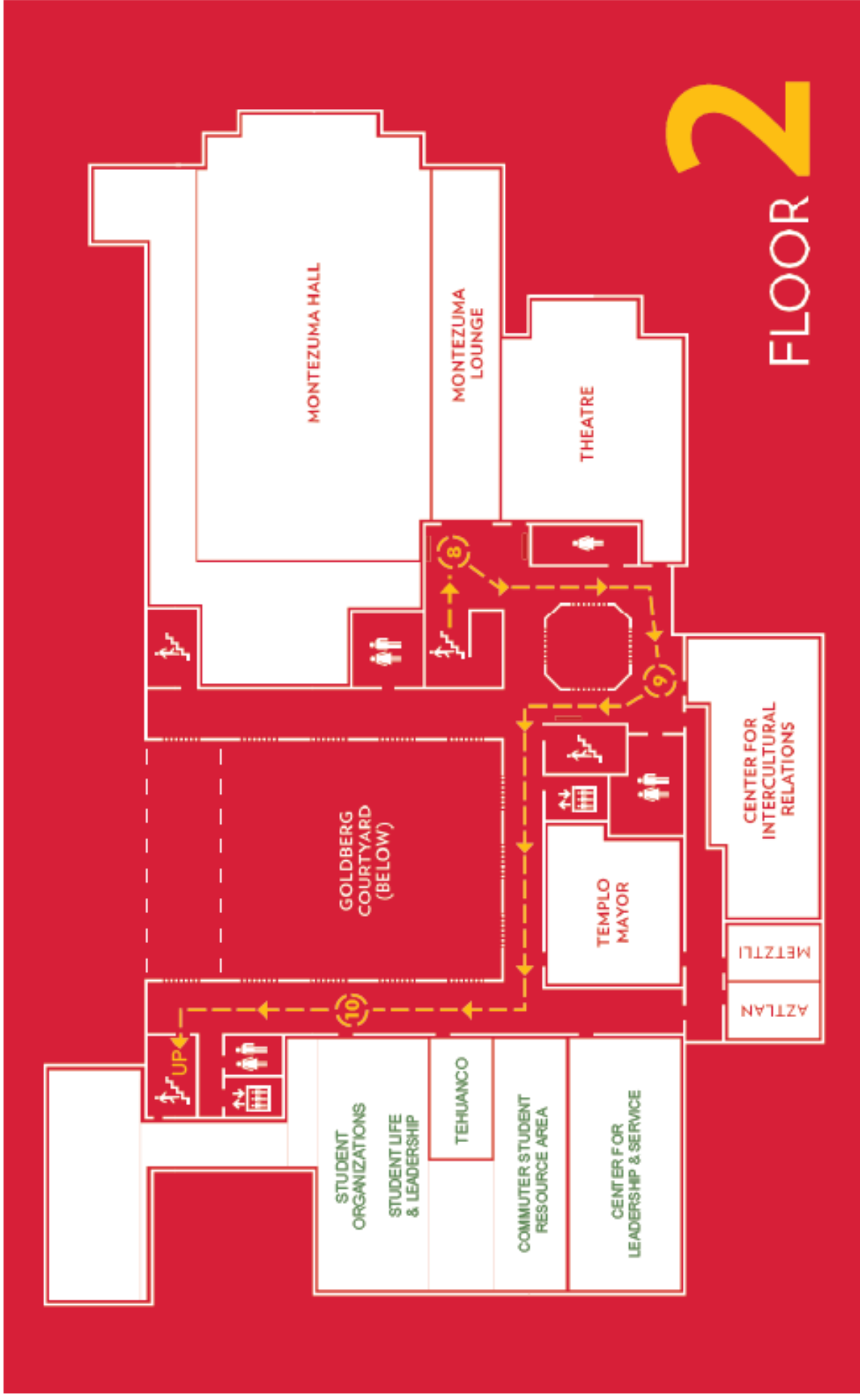
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San Diego State University Map



About the University Turbine Systems Research and Advanced Turbines Program Review Meeting

The National Energy Technology Laboratory University Turbine Systems Research (NETL-UTSR) program manages a portfolio of university-based turbine research projects funded by the US DOE Office of Fossil Energy and Carbon Management (FECM). FECM sponsors the annual UTSR meeting where projects within the Advanced Turbines Program are publicly reviewed. The UTSR program offers a Gas Turbine Industrial Fellowship funded by sponsoring gas turbine manufacturers. This fellowship has helped to facilitate the transition of the best students from academia to the gas turbine industry, thereby helping to maintain U.S. leadership in this important area of technology.

The success of the UTSR program has been made possible by a network of universities, the collaborating gas turbine industry, and the DOE Advanced Turbines program - all of which are facilitated by an annual UTSR project review meeting, which is open to the public and brings together experts from academia, industry, and government to present and discuss ongoing turbine research sponsored by the DOE Office of Fossil Energy and Carbon Management UTSR program under existing cooperative agreements.

The UTSR program committee selects meeting venues at or close to leading universities directly involved in UTSR research. The 2022 UTSR project review meeting, co-hosted by San Diego State University, will be held at the San Diego State University campus on September 27 – 29, 2022. The theme of this year's review meeting is "The Role of Turbine Technologies in Low-Carbon Power Production." Three speakers will provide keynote addresses:

- **Mr. John Mason**, Director of Turbomachinery Technology and Product Development, Solar Turbines – "Solar Turbines' Carbon-Neutral Fuels Future"
- **Dr. Tim Lieuwen**, Regents' Professor, the David S. Lewis, Jr. Professor and the Executive Director of the Strategic Energy Institute, Georgia Institute of Technology – "Hydrogen Use in Gas Turbines: Emissions, Operability, and Efficiency Impacts"
- **Dr. Chiping Li**, Program Officer of Energy and Combustion Science portfolio, Air Force Office of Scientific Research (AFOSR) – "Detonation Based Engines: Fundamentals, Opportunities and Challenges"

The meeting will feature a panel discussion on the topic "Utilization and Combustion of Carbon Free Fuels - Challenges and Opportunities" by Luke Cowell, Group Manager for Combustion Technology Development and New Product Introduction at Solar Turbines; Dr. Subith Vasu, Professor affiliated with the Center for Advanced Turbomachinery and Energy Research (CATER) at the University of Central Florida; Dr. Keith McManus, Technology Manager for Combustion at GE Research; and Nate Weiland, Senior Fellow at the National Energy Technology Laboratory (NETL).

Project reviews will be organized into three parallel technology tracks: (1) Combustion and Carbon

Free Fuels; (2) Supercritical CO₂ and Aero/Heat Transfer; and (3) Pressure Gain Combustion and Ceramic Matrix Composites/Additive Manufacturing. The meeting will feature a broad range of DOE-sponsored projects in the form of oral and poster presentations, including the majority of NETL's extramural projects within the Advanced Turbines Program, as well as internal NETL R&D projects.

UTSR Technology Summary

Since the inception of the DOE turbine program, the NETL-UTSR program has sought to support the underlying scientific research necessary to develop advanced turbines and turbine-based systems in support of the DOE's turbine program's strategic goals and program mission needs. The UTSR program has two primary goals. One is to produce results that resolve technical issues associated with DOE's Office of Fossil Energy and Carbon Management Advanced Turbines Program and the other is to maintain and enhance university-based turbine engineering capabilities in the United States.

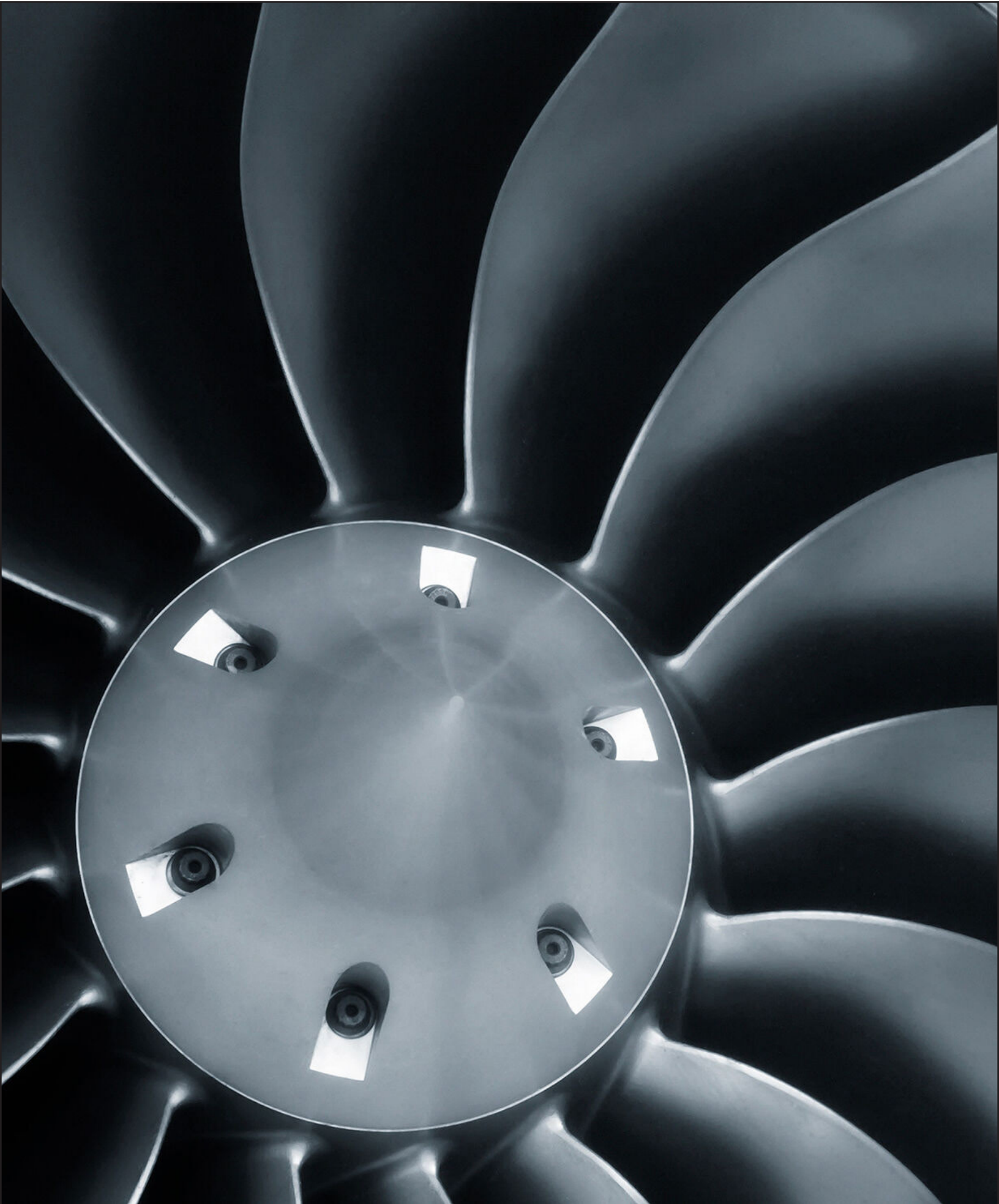
These two UTSR Program goals will continue to be realized through the involvement of professors and students in research and development on advanced turbine technical issues, while enhancing the education of future scientists and engineers in the U.S.

This is accomplished by funding university-based research projects that address scientific R&D and technical challenges in turbine-based systems and technology. This research focuses on the fundamental and applied issues associated with advancing the performance and efficiency of turbines in power generation beyond current state-of-the-art.

Technical areas of interest include hydrogen technology, supercritical CO₂ based power cycles, oxy-fuel combustion, materials, aerodynamics, heat transfer, and pressure gain combustion/rotating detonation engines.

The UTSR projects are typically three years in duration and focus on applied laboratory/bench scale R&D. Currently 13 universities and 19 projects are involved in the NETL-UTSR program. The innovations and scientific understanding generated under this program will then be transferred to industry manufacturers for incorporation into their next generation turbine technology products with the goal of producing reliable, affordable, clean, efficient, and cost-effective energy supplies.

One of the main purposes of this UTSR project review meeting is to facilitate peer-to-peer knowledge sharing and collaboration across boundaries to create a network of expertise and facilitate the acceleration of advancements in those fields.



Agenda-At-A-Glance

Tuesday, September 27, 2022

- 8:00 AM** **Registration/Continental Breakfast - Montezuma Hall**
- 9:00 AM** **General Session - Montezuma Hall**
- 9:00 AM** **Welcome and Introduction**
Eugene Olevsky, Dean of the College of Engineering and Gustaaf Jacobs, Director of the Center for Industrial Training and Engineering Research, San Diego State University
- 9:25 AM** **Opening Remarks**
Richard Dennis, Advanced Turbines & sCO₂ Technology Manager, National Energy Technology Laboratory
- 9:30 AM** **Keynote Speech: Hydrogen Use in Gas Turbines: Emissions, Operability, and Efficiency Impacts**
Tim Lieuwen, Regents' Professor, the David S. Lewis, Jr. Professor and the Executive Director of the Strategic Energy Institute, Georgia Institute of Technology
- 10:15 AM** **Keynote Speech: The Role of Gas Turbines in Decarbonization: The Challenges of Using Hydrogen**
John Mason, Director of Technology and Product Development in Turbomachinery Products, Solar Turbines
- 11:00 AM** **Break**
- 11:30 AM** **Panel Discussion: Utilization and Combustion of Carbon Free Fuels - Challenges and Opportunities**
- 12:15 PM** **Lunch - Montezuma Hall**
- 1:30 PM** **Keynote Speech**
Richard Dennis, Technology Manager for Advanced Turbines and Supercritical Carbon Dioxide Power Cycle Programs, U.S. Department of Energy's National Energy Technology Laboratory
- 1:45 PM** **Continue to Breakout Rooms**

Track A - Combustion and Carbon Free Fuels - Aztlan Room

Moderators: Matthew Adams and Richard Dalton

	Organization	Title	Presenter
2:00 PM	San Diego State University	Development of Design Practices for Additively Manufactured Micro-Mix Hydrogen Fueled Turbine Combustors with High-Fidelity Simulation Analysis, Reduced Modeling and Testing (FE0032080)	Gustaff Jacobs
2:40 PM	Purdue University	Investigation of Flame Structure for Hydrogen Gas Turbine Combustion (FE0032074)	Robert P. Lucht
3:20 PM - Break			
3:40 PM	Georgia Institute of Technology	Ignition, Turbulent Flame Speeds, and Emissions from High Hydrogen Blended Fuels (FE0032079)	Wenting Sun
4:20 PM	University of California – Irvine	Development and Application of Multipoint Array Injection Concepts for Operation of Gas Turbines on Hydrogen Containing Fuels (FE0032073)	Vincent McDonell
5:00 PM	Ohio State University and University of Michigan	Hydrogen Fuel Effects on Stability and Operation of Lean Premixed and Staged Gas Turbine Combustors (FE0032076)	Jeffrey Sutton and Venkat Raman

5:30 - 7:00 PM Poster Session

Track B - Supercritical CO₂ (Day 1 & 2) and Aero Transfer (Day 3) - Mata'yuum Room

Moderators: Seth Lawson and Drew O'Connell

	Organization	Title	Presenter
2:00 PM	GE Research	Low Leakage Seals for Utility-Scale sCO ₂ Turboexpanders (FE0024007)	Rahul Bidkar
2:40 PM	GE Research	High-Temp Seals for sCO ₂ Turbomachinery (FE0031924)	Rahul Bidkar
3:20 PM - Break			
3:40 PM	GE Research Center	Novel Modular Heat Engines with Supercritical Carbon Dioxide Bottoming Cycle Utilizing Advanced Oil-Free Turbomachinery (FE0031617)	Bugra Ertas
4:20 PM	Georgia Institute of Technology	Advanced Model Development for Large Eddy Simulation (LES) of Oxy-Combustion and Supercritical Carbon Dioxide Power Cycles (FE0031772)	Joseph C. Oefelein
5:00 PM	Parametric Solutions, Inc.	Supercritical Carbon Dioxide Oxy-Syngas Combustor Development and Testing (FE0031922)	David Cusano

5:30 - 7:00 PM Poster Session

Track C - Ceramic Matrix Composites & Additive Manufacturing (Day 1, 2, & 3) and Pressure Gain Combustion (Day 3) - Metztil Room

Moderators: Rin Burke and Don Ferguson

	Organization	Title	Presenter
2:00 PM	University of Texas at Austin and Pennsylvania State University	Integrated Turbine Component Cooling Designs Facilitated by Additive Manufacturing and Optimization (FE0031760)	David Bogard and Karen Thole
2:40 PM	University of Pittsburgh	Integrated Transpiration and Lattice Cooling Systems Developed by Additive Manufacturing with Oxide-Dispersion Strengthened Alloys (FE0031277)	Sarwesh Narayan Parbat
3:20 PM - Break			
3:40 PM	General Electric Power	High Temperature Additive Architectures for 65% CC Efficiency (FE0031611)	Richard M. DiCintio
4:20 PM	Siemens Corporation	Ensemble Manufacturing Techniques for Steam Turbine Components Across Length Scales (FE0031808)	Anand Kulkarni
5:00 PM	Pennsylvania State University	Development and Evaluation of a Novel Fuel Injector Design Method Using Hybrid-Additive Manufacturing (FE0031806)	Jacqueline O'Connor

5:30 - 7:00 PM Poster Session



Agenda-At-A-Glance

Wednesday, September 28, 2022

- | | |
|-----------------|---|
| 8:00 AM | Registration/Continental Breakfast - Montezuma Hall |
| 9:15 AM | General Session - Montezuma Hall |
| 9:15 AM | Keynote Speech: Overview of DOE Advanced Turbines Program
Robert Schrecengost, Advanced Turbines & sCO ₂ Program Manager,
U.S. Department of Energy |
| 10:00 AM | Break |
| 10:35 AM | Keynote Speech: Detonation Based Engines: Fundamentals, Opportunities and Challenges
Chiping Li, Program Officer of Energy and Combustion Science Portfolio, Air Force Office
of Scientific Research |
| 11:20 AM | Lunch - Montezuma Hall |
| 12:20 PM | Continue to Breakout Rooms |

Track A - Combustion and Carbon Free Fuels - Aztlan Room

Moderators: Matthew Adams and Richard Dalton

	Organization	Title	Presenter
12:30pm	University of Central Florida	Fundamental Experimental and Numerical Combustion Study of H ₂ Containing Fuels for Gas Turbines (FE0032072)	Subith Vasu
1:10 PM	Solar Turbines, Inc.	Development of a Retrofittable Dry Low Emissions Industrial Gas Turbine Combustion System for 100% Hydrogen and Natural Gas Blends (FE0032106)	Rajeshriben Patel
1:50 PM - Break			
2:10 PM	GE Research	Demonstration of a Gas Turbine-Scale Rotating Detonation Combustor (RDC) Integrated with Compressor and Turbine Components at 7FA Cycle Conditions (FE0032170)	Keith McManus
2:50 PM	National Energy Technology Laboratory - Research Innovation Center	Overview of Rotating Detonation Combustion Research at NETL	Don Ferguson

4:00 - 7:00 PM Lab Tour

Track B - Supercritical CO₂ (Day 1 & 2) and Aero Transfer (Day 3) - Mata'yuum Room

Moderators: Seth Lawson and Drew O'Connell

	Organization	Title	Presenter
12:30pm	Southwest Research Institute (SwRI)	High Inlet Temperature Combustor for Direct Fired Supercritical Oxy-Combustion (FE0024041)	Steve White
1:10 PM	Southwest Research Institute (SwRI)	Development of Coal Syngas Oxy-Combustion Turbine for use in Advanced Supercritical Carbon Dioxide (SCO ₂) Power Cycles (FE0031929)	Jeff Moore
1:50 PM - Break			
2:10 PM	GTI Energy	Step 10 MWe sCO ₂ Pilot Demonstration - 2022 Status Update (FE0028979)	William (Bill) Follett
2:50 PM	National Energy Technology Laboratory - Research Innovation Center	Design and Modeling of an 80 bar Oxy-Combustor for Direct Fired Supercritical CO ₂ Power Generation	Pete Strakey

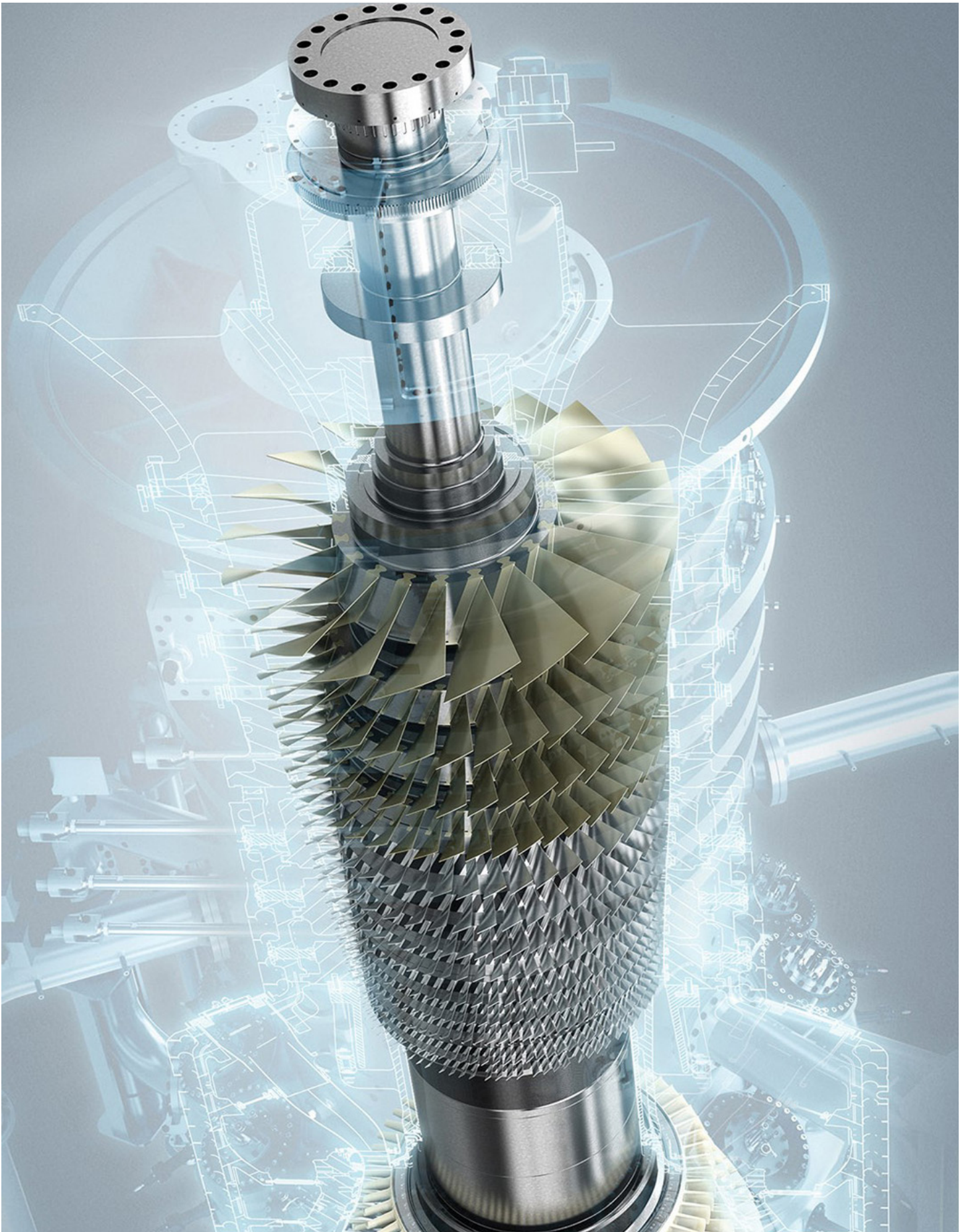
4:00 - 7:00 PM Lab Tour

Track C - Ceramic Matrix Composites & Additive Manufacturing (Day 1, 2, & 3) and Pressure Gain Combustion (Day 3) - Metztil Room

Moderators: Rin Burke and Don Ferguson

	Organization	Title	Presenter
12:30pm	Oak Ridge National Laboratory (ORNL)	Repair of Steam Compponnets Through Large Scale Metals AM (FWP-FEAA371)	Michael Kirka
1:10 PM	Pennsylvania State University	Development of Additive Manufacturing for Ceramic Matrix Composite Vanes (FE0031758)	Stephen Lynch
1:50 PM - Break			
2:10 PM	University of Pittsburgh and Georgia Tech	An Effective Quality Assurance Method for Additively Manufactured GasTurbine Metallic Components Via Machine Learning from In-Situ Monitoring, Part Scale Monitoring, and Ex-Situ Characterization Data (DE-FE0031774)	Xiayun Zhao, Albert To and Rick Neu
2:50 PM	Arizona State University and Raytheon Technologies Research Center	A Multiphysics Multiscale Simulation Platform for Damage, Environmental Degradation, and Life Prediction of Ceramic Matrix Composites (CMCS) in Extreme Environments (FE0031759)	Aditi Chattopadhyay and Luke Borkowski

4:00 - 7:00 PM Lab Tour



Agenda-At-A-Glance

Thursday, September 29, 2022

7:30 AM **Registration/Continental Breakfast - Montezuma Hall**

8:20 AM **Continue to Breakout Rooms**

Track A - Combustion and Carbon Free Fuels - Aztlan Room

Moderators: Matthew Adams and Richard Dalton

	Organization	Title	Presenter
8:30 AM	Raytheon Technologies Research Center	Low-NOx, Operable Ammonia Combustor Development for Zero-Carbon Power (LOAD-Z) (FE0032169)	Paul Papas and Lance L. Smith
9:10 AM	GTI Energy	Investigation of Ammonia Combustion for Turbines (IACT) (FE0032172)	John Vega
9:50 AM	Georgia Institute of Technology	High-Frequency Transverse Combustion Instabilities in Low-NOx Gas Turbines (FE0031285)	Timothy Lieuwen
	10:30 AM - Break		
10:50 AM	West Virginia University	Techno-Economic Optimization of Advanced Energy Plants with Integrated Thermal, Mechanical, and Electro-Chemical Storage (FE0031771)	Debangsu Bhattacharyya
11:30 AM	University of Central Florida	In-Situ Optical Monitoring of Operating Gas Turbine Blade Coatings Under Extreme Environments (FE0031282)	Quentin Fouliard
12:10 PM	Change Room		
12:20 PM	Open Discussion, Workshop Summary, Closing Comments and Wrap-Up - Richard Dennis, Advanced Turbines Technology Manager, NETL		
1:00 PM	Adjourn		

Track B - Supercritical CO₂ (Day 1 & 2) and Aero Transfer (Day 3) - Mata'yuum Room

Moderators: Seth Lawson and Drew O'Connell

	Organization	Title	Presenter
8:30 AM	Pennsylvania State University	Improving Turbine Efficiencies Through Heat Transfer and Aerodynamic Research in the Steady Thermal Aero Research Turbine (START) (FE0025011)	Karen A. Thole
9:10 AM	Ames Laboratory/Purdue University	Development of Hybrid LES-RANS Methods for Turbine Cooling Simulations (FWP-AL-20-450-022)	Tom I-P. Shih
9:50 AM	National Energy Technology Laboratory (NETL) - Research and Innovation Center (RIC)	Recent Studies of Internal and External Cooling Technologies at NETL	Doug Straub
	10:30 AM - Break		
10:50 AM	Pennsylvania State University	Discrete Element Roughness Modeling for Design Optimization of Additively and Conventionally Manufactured Internal Turbine Cooling Passages (FE0031280)	Xiang Yang
12:10 PM	Change Room		
12:20 PM	Open Discussion, Workshop Summary, Closing Comments and Wrap-Up - Richard Dennis, Advanced Turbines Technology Manager, NETL		
1:00 PM	Adjourn		

Track C - Ceramic Matrix Composites & Additive Manufacturing (Day 1, 2, & 3) and Pressure Gain Combustion (Day 3) - Metztil Room

Moderators: Rin Burke and Don Ferguson

	Organization	Title	Presenter
8:30 AM	Oak Ridge National Laboratory	Exploring EBC Temperature Limits for Industrial Gas Turbines (FWP-FEAA149)	Mackenzie Ridley
9:10 AM	Purdue University	Physics-Based Integration of H ₂ -Air Rotating Detonation into Gas Turbine Power Plant (HydrogenGT) (FE0032075)	Guillermo Paniagua
9:50 AM	University of Michigan	Pressure Gain, Stability, and Operability of Methane/Syngas Based RDEs Under Steady and Transient Conditions (FE0031773)	Mirko Gamba and Venkat Raman
	10:30 AM - Break		
10:50 AM	University of Alabama	A Robust Methodology to Integrate Rotating Detonation Combustor with Gas Turbines to Maximize Pressure Gain (FE0032077)	Ajay Agrawal
12:10 PM	Change Room		
12:20 PM	Open Discussion, Workshop Summary, Closing Comments and Wrap-Up - Richard Dennis, Advanced Turbines Technology Manager, NETL		
1:00 PM	Adjourn		

Keynote Speakers

John Mason – Solar – Director of Turbomachinery Technology and Product Development

John Mason is the Director of Technology and Product Development in Turbomachinery Products at Solar Turbines. His organization contributes to the development and execution of energy solution and product strategy including decarbonization, low-carbon fuels, and high-efficiency adaptations to new and existing gas turbines. John has more than 32-years of experience in the turbomachinery industry, 28-years with Solar, and holds BSME and MSME degrees from the University of California Irvine and University of Southern California.

Tim Lieuwen – Georgia Institute of Technology – Regents' Professor, the David S. Lewis, Jr. Professor and the Executive Director of the Strategic Energy Institute, Georgia Institute of Technology

Dr. Tim Lieuwen is a Regents' Professor, the David S. Lewis, Jr. Professor and the Executive Director of the Strategic Energy Institute at Georgia Tech. In this capacity, he manages Georgia Tech's overall strategy and external relations for its \$120M/year energy portfolio. He is also founder and CTO of TurbineLogic, an analytics firm working in the energy industry. Prof. Lieuwen is an international authority on clean energy and propulsion, and his work has contributed to numerous commercialized innovations in the energy and aerospace sectors. He has authored 4 books and over 400 other publications. Current and past board positions include governing/advisory boards for Oak Ridge National Lab, Pacific Northwest National Lab, National Renewable Energy Lab, Electric Power Research Institute, appointment by the DOE Secretary to the National Petroleum Counsel, and board member of the ASME International Gas Turbine Institute.

He is an elected member of the National Academy of Engineering, a fellow of ASME, APS, and AIAA, and foreign fellow of the Indian National Academy of Engineering. Major awards include the AIAA Lawrence Sperry Award, AIAA Pendray Award, and ASME's George Westinghouse Gold Medal.

Chiping Li – Air Force Office of Scientific Research – Program Officer of Energy and Combustion Science

Dr. Chiping Li is the Program Officer of Energy and Combustion Science portfolio at the Air Force Office of Scientific Research (AFOSR). The portfolio covers the Air Force's interests in energy conversion for aviation and space systems, including airplanes, rockets, and high-speed/hypersonic propulsion systems. Dr. Chiping Li is also the current chair the Multiagency Coordinating Committee for Combustion Research (MACCCR) which coordinates more than \$40M/yr of the nation's basic combustion research efforts funded by all federal agencies which have significant related interests. Dr. Chiping Li has been championing fundamental, relevant, and game-changing strategies for U.S. combustion research. Among other endeavors, he has strategically led and financially supported multiple key Air Force programs, working with other agencies, for the development of critical S/T elements to future propulsion system developments. These areas include but are not limited to advanced optical diagnostic techniques, pathway-centric combustion chemical kinetic mechanisms based on quantum chemistry computations/ advanced reaction measurements, and physics-based turbulent combustion models using state-of-the-art ultra-fast-laser experimental techniques, advanced mathematical approaches, and ultra-fast combusting detonation-based propulsion devices.

Dr. Chiping had broad experience, ranging from being a basic research scientist at the Naval Research Laboratory to the chief engineer of the robust scramjet program at Aerojet. He received his Ph.D. degree at the University of California, San Diego in engineering physics specializing in combustion science.

Bob Schrecengost – U.S. Department of Energy – Acting Director and a Senior Program Manager in the Hydrogen with Carbon Management Division

Mr. Schrecengost is the Acting Director and a Senior Program Manager in the Hydrogen with Carbon Management division of DOE's Office of Fossil Energy and Carbon Management (FECM). As program manager, Bob is responsible for the Advanced Turbines and Advanced Energy Materials programs, and for coordination of hydrogen initiatives in the Office of Carbon Management (FE-20).

Mr. Schrecengost joined DOE in January 2020. Before joining DOE, he spent 13 years as the Boiler R&D Program Manager for GE Steam Power and Alstom Power in Windsor, CT. Mr. Schrecengost has 37 years of experience in fossil power research and technology development. He holds a Bachelor of Science degree in chemical engineering from Carnegie-Mellon University and is a licensed Professional Engineer. Bob is the holder of 6 patents and has over 30 publications on fossil fuel emissions reduction technologies and power plant operations.

Rich Dennis – U.S. Department of Energy's National Energy Technology Laboratory (NETL) – Technology Manager for Advanced Turbines and Supercritical Carbon Dioxide Power Cycle Programs

Mr. Richard Dennis is currently the Technology Manager for Advanced Turbines and Supercritical Carbon Dioxide Power Cycle Programs at the U.S. Department of Energy's National Energy Technology Laboratory (NETL). These programs support US university, industry and U.S. national laboratory research, development, and demonstration projects. Rich has a Bachelor and Master of Science degrees in Mechanical Engineering from West Virginia University. From 1983 to 1992 Mr. Dennis worked in the on-site research group of NETL where he conducted research related to pressurized fluidized bed combustion, gasification and gas stream particulate cleanup for advanced coal-based power generation. From 1993 to 2000 Mr. Dennis managed contracted research for the DOE Office of Fossil Energy in advanced fossil fuel power generation including coal combustion, gasification, fuel cells, and gas turbines. In 2002 Richard was selected as a Technology Manager. Currently Richard is serving as the Technology Manager for Advanced Turbines, Supercritical Carbon Dioxide Power Cycles and Energy Storage programs at NETL. Richard is an ASME Fellow and recently received the ASME International Gas Turbine Institute Industrial Gas Turbine Award (2021).

Eugene Olevsky – San Diego State University - Dean of the College of Engineering

Dr. Olevsky received his B.S. degree in Mechanical Engineering from Kiev State University and M.S. degree in Applied Mathematics from Kiev Institute of Technology; his Ph.D. degree in Materials Engineering was granted in 1990 by the Ukraine National Academy of Sciences. In 1992, Dr. Olevsky joined Max-Planck Institute for Metal Research in Stuttgart, Germany as a Post-Doctoral Fellow, in 1994, he became a Research Fellow at the Catholic University of Leuven, Belgium; in 1995, he joined UC San Diego as a Visiting Scholar at the NSF Institute for Mechanics and Materials. In 1998, Dr. Olevsky became an Assistant Professor in the Mechanical Engineering Department at San Diego State University. In 2001, he was promoted to an Associate Professor, and in 2004, he became a Professor. In 2007, Dr. Olevsky was awarded the title of SDSU Distinguished Professor of Mechanical Engineering.

From 2018 to the present, Dr. Olevsky serves as the Dean of the SDSU College of Engineering. Dr. Olevsky is the author of over 500 scientific publications and conference presentations, and of more than 150 plenary, keynote, and invited presentations in the area of Materials Engineering. He has supervised more than 100 post-doctoral, graduate, undergraduate students, and research visitors. Dr. Olevsky is a scholar with broad international recognition. He was an invited visiting professor in Belgium, Denmark, France, Germany, Italy, Japan, South Korea, and Sweden. Dr. Olevsky's contributions to research and education have been recognized by multiple awards and honors. Dr. Olevsky is a Fellow of the American Ceramic Society, a Fellow of the American Society of Mechanical Engineers, Fellow of ASM (American Society of Metals) International, and Humboldt Fellow; he is a Fellow of the International Institute of Science of Sintering.

Gustaaf Jacobs - San Diego State University - Director of the Center for Industrial Training and Engineering Research

Professor Jacobs received a M.Sc. in Aerospace Engineering from the Delft University of Technology in 1998, where after graduation, he was appointed to a Research Associate. He received a Ph.D. in Mechanical Engineering from the University of Illinois at Chicago. Following graduation in 2003, he was appointed Visiting Assistant Professor in the Division of Applied Mathematics at Brown University. He later combined this position with a Postdoctoral Fellowship at the Department of Mechanical Engineering at the Massachusetts Institute of Technology. As of 2006 he was appointed Assistant Professor of Aerospace Engineering at San Diego State University and was promoted to Associate Professor in 2010 and Full Professor in 2014. . In 2002 he was awarded a University Fellowship at the University of Illinois. He received an AFOSR Young Investigator Award in 2009. He became an Associate Fellow of AIAA in 2013. He received the 2019 Distinguished Faculty Award at SDSU. He founded and directs the Center for Industrial Training and Engineering Research (CITER), which structures and enhances collaboration between industrial partners and SDSU. CITER's primary objective is to connect SDSU's Engineering departments, faculty members, undergraduate and graduate students with engineers and staff scientists of local industry. Through industry funded projects and scholarships, the students get first-hand training in an industry environment and are ready to join the workforce upon completion of their studies. The research interests of Professor Jacobs can broadly be defined in the area of computational multiphase, and multiscale flow physics using high-order methods for analysis of thermal-fluids in propulsion and energy systems.

Panelists

Subith Vasu – Professor affiliated with the Center for Advanced Turbomachinery and Energy Research (CATER) at the University of Central Florida

Dr. Subith S. Vasu is a Professor affiliated with the Center for Advanced Turbomachinery and Energy Research (CATER) at UCF. He received his B. Tech. in Aerospace Engineering from IIT Madras (2004) and earned his Ph.D. from Stanford University (2010) in Mechanical Engineering. He spent a year as a post-doc at the Combustion Research Facility (Sandia National Labs) before joining UCF in 2012 as an assistant professor in the Mechanical and Aerospace department. He is an expert in combustion, chemical kinetic modeling, spectroscopy, shock tube ignition, and species diagnostics. He has authored a plethora of journals (more than 115) and conference articles (more than 250)

on combustion-related topics and managed projects worth more than \$15M. Graduates from his group (11 postdocs, 17 PhDs, 15 M.S., and more than 100 undergrad students) hold key positions in academia, government, national labs, and industries (many in powergeneration). He is a recipient of the following prestigious national and international awards: DARPA Director's Fellowship 2020; DARPA Young Faculty Award - YFA 2018; DTRA Young Investigator (YIP) 2016; ACS Doctoral New Investigator (YIP equivalent) 2015; ASME IGTI Dilip Ballal Early Career Award 2017 (international award); and SAE Ralph R Teetor Educational Award 2018 (international). He also received the prestigious 2019 Microsoft Investigator Fellowship (1 out of 15 given in the country) to implement AI tools for his research and teaching endeavors. Dr. Vasu served as the Siemens Industrial Faculty fellow during 2012-2013, working as an industry person on the development of the hydrogen turbine program.

Luke Cowell – Group Manager for Combustion Technology Development and New Product Introduction at Solar Turbines

Luke Cowell is Group Manager for Combustion Technology Development and New Product Introduction at Solar Turbines. In this role he and his team have responsibility for the introduction of new combustion systems and increased operational flexibility for gas turbine products. Recent focus has been on combustion systems capable of using hydrogen while reducing pollutant emissions. In the past 35 years he has had a variety of engineering and leadership positions within the Engineering and Product Development groups designing and implementing gas turbine combustion systems at Solar. He has been a leading contributor to the introduction and product improvements to Solar's dry low emission SoLoNOx gas turbines expanding fuel flexibility while reducing pollutant emissions. He graduated from Penn State and earned a Masters from Purdue University.

Nate Weiland – Senior Fellow at the National Energy Technology Laboratory (NETL)

Dr. Nathan Weiland is a Senior Fellow at the National Energy Technology Laboratory (NETL), where he works to build and sustain a world-class competencies in energy conversion engineering and hydrogen production & utilization. From 2014 to 2020 he was a research engineer in NETL's Systems Engineering & Analysis group, where he performed systems studies of supercritical CO₂ power cycles and oxy-fuel magneto-hydrodynamics (MHD) power plants. Dr. Weiland's prior work with NETL as a postdoctoral student (2005-2008) and a West Virginia University research professor (2008-2014) included low-NOx hydrogen combustion, coal/biomass co-gasification, ash deposition processes in gasification systems, oxy-combustion plasmas for MHD power, and chemical looping combustion. He has received a B.S. (Purdue University), M.S., and Ph.D. (Georgia Tech) in Mechanical Engineering.

Keith McManus – Technology Manager for Combustion at GE Research

Dr. Keith McManus received his B.S. in Mechanical Engineering from Cornell University in 1982. While working as an Analytical Engineer in the Combustion Technology Group at Pratt and Whitney Aircraft (1982-1985), he earned an M.S.M.E. from Rensselaer Polytechnic Institute. He received his Ph.D. degree (1990) in Mechanical Engineering from Stanford University. His dissertation concerned active control of vortex formation for improving mixing and performance of combustion systems. Dr. McManus continued to work in active control of thermo-fluid systems and in the application of optical diagnostics to flow and combustion systems during a 2-year post-doc appointment at the C.N.R.S. combustion research laboratory in Paris and then while working at Physical Sciences Inc. (1992–1999). Since joining GE Research in 1999, he's held several technical positions and for the past 10 years has

been the Technical Manager for the Combustion Laboratory (1999-present). His primary focus at GE has been on technology development for low-emissions combustion systems for jet engines and power generation gas turbines.

Dr. McManus is a Fellow of the American Society of Mechanical Engineers and an Associate Fellow of the American Institute of Aeronautics and Astronautics.

Lab Tour

Solar Turbines will conduct a tour of its development and production facilities at its headquarters located on Harbor Drive in San Diego, CA.

A maximum of 50 visitors will be allowed. Anyone that is interested must send an email to David Voss (voss_david_w@solarturbines.com) with the subject line “UTSR Solar Turbines tour request” no later than September 19th.

All visitors will need to be pre-screened by Solar Turbines security and watch a safety orientation video prior to the day of the tour. Due to safety, the following clothing are not allowed: open-toed or high heeled shoes, skirts, shorts, or exposed legs. No photography will be allowed. This is a walking tour of a large facility. Tour visitors will need to be able to walk and stand for two hours. No photography is allowed in any of the facilities.

Organizing Committee

- | | |
|-------------------------|--|
| • Matthew Adams | U.S. Department of Energy, National Energy Technology Laboratory |
| • Richard Dennis | U.S. Department of Energy, National Energy Technology Laboratory |
| • Patcharin (Rin) Burke | U.S. Department of Energy, National Energy Technology Laboratory |
| • Erik Albenze | U.S. Department of Energy, National Energy Technology Laboratory |
| • Karen Lockhart | WE2 |
| • Katie Hart | WE2 |
| • Gustaaf Jacobs | San Diego State University |
| • Gary Jesionowski | KeyLogic Systems |

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