ASME 2019 TURBO EXPO

ADVANCE PROGRAM

JUNE 17-21 IN PHOENIX, ARIZONA

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ANSYS®

You've already solved your easy problems

Only the toughest challenges remain. But even the hardest problems can be solved using ANSYS engineering simulation solutions. Design with the highest levels of efficiency, reliability and durability — and the lowest emissions and noise levels — while reducing development time and costs.

- **Turbine design and optimization**
- **Digital Twin**
- **Clean power and propulsion systems**
- **Additive manufacturing -** ***Register for the workshop, Design and Simulation for Turbomachinery Additive Manufacturing, Sunday, June 16.***

Booth #403

TABLE OF CONTENTS

CLICK ANY SECTION TITLE BELOW TO SKIP TO THE DESIRED PAGE.
CLICK THE HOUSE ON ANY PAGE TO COME BACK TO THIS PAGE.

Sponsors

SILVER

ANSYS®

BRONZE

NUMECA INTERNATIONAL

Attendee Bags

Solar® Turbines
A Caterpillar Company

Attendee Bags

ADDITIONAL SPONSORS

Women in Engineering

Concepts NREC
The Experts in Turbomachinery

Name Badge Insert

Altair

Lanyards

SUPPORTING PUBLICATIONS & PARTICIPATING ORGANIZATIONS

ETN Global

Diesel & Gas Turbine WORLDWIDE
engine systems technology for marine, stationary power, oil & gas and rail since 1969

mechanical engineering

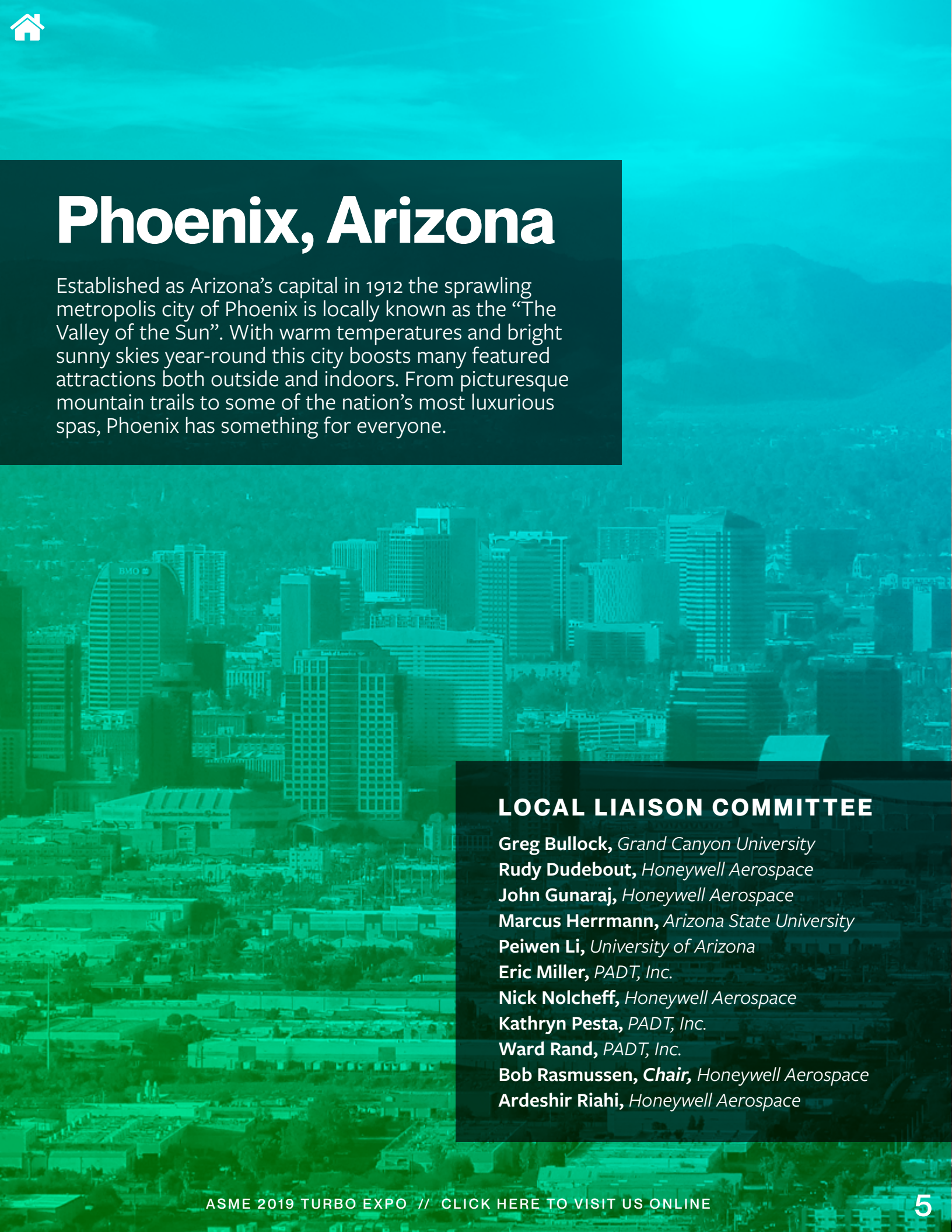
POWER

GTSJ

Turbomachinery INTERNATIONAL

Phoenix, Arizona

Established as Arizona's capital in 1912 the sprawling metropolis city of Phoenix is locally known as the "The Valley of the Sun". With warm temperatures and bright sunny skies year-round this city boosts many featured attractions both outside and indoors. From picturesque mountain trails to some of the nation's most luxurious spas, Phoenix has something for everyone.



LOCAL LIAISON COMMITTEE

Greg Bullock, *Grand Canyon University*
Rudy Dudebout, *Honeywell Aerospace*
John Gunaraj, *Honeywell Aerospace*
Marcus Herrmann, *Arizona State University*
Peiwen Li, *University of Arizona*
Eric Miller, *PADT, Inc.*
Nick Nolcheff, *Honeywell Aerospace*
Kathryn Pesta, *PADT, Inc.*
Ward Rand, *PADT, Inc.*
Bob Rasmussen, *Chair,* *Honeywell Aerospace*
Ardeshir Riahi, *Honeywell Aerospace*

FOR THE OUTDOOR ADVENTURISTS

Phoenix's Papago Park offers a hikeable trail to the Red Rock Buttes mountain range overlooking the city. For the summit seekers Camelback Mountains is an iconic landmark that offers endless panoramic views from a 1200 ft elevation peak known as the "Hump". Another "close to the city" outdoor getaway is South Mountain Park and Preserve, with its 50 miles of trails through 16,000 acres of the Sonoran Desert the night view of the skyline is known as the best Phoenix has to offer. Phoenix is also home to the nation's only Desert Botanical Garden accredited by the American Alliance of Museum, this oasis sits on 55-acres and comes alive at night with a mesmerizing light show.

FOR THE INDOOR EXPLORER

The city's museums offers a great way to fill your day. The Phoenix Art Museum is the Southwest's largest fine art museum featuring collections of both contemporary works and global masterpieces. Looking for a place to make a little noise? Then the Musical Instrument Museum might be for you the facility allows you to hear and play instruments from every corner of the world in what is boasted as a "One of a Kind Collection". While the Heard Museum offers a peek into the area's tradition. This museum is preserving the culture and history of 22 regional American Native tribes through an immersive experience that tells the colorful history of the native people of the southwest.

FOR THE RELAXER LOOKING TO UNWIND

Long revered for its healing properties, Phoenix is home to some of the most opulent spas in the country. Spas like the *Alvadora Spa* housed in the Royal Palms Resort, this facility is known for its signature treatments like their organic eucalyptus scrub. The *Well & Being Spa*, is another city favorite known for their Swiss shower, mineral rich clay facials from Africa and an indulging ginger and rosemary immune boosting bath. Phoenix spas are open and ready to put your mind and body at ease.

More about Phoenix

GETTING AROUND IN PHOENIX

Phoenix is a sprawling metropolis and really easy to navigate. It offers convenient public transportation, including buses and a light rail system.

OTHER HELPFUL INFORMATION

CURRENCY

The American currency is the United States Dollar (USD). 1 USD is divided into 100 (cents). Coins are circulated in the following denominations: 1 cent, 5 cents, 10 cents and 25 cents. The USD come in denominations of: $1, $5, $10, $20, $50, and $100.

TIPPING

In Phoenix AZ, tipping is not compulsory. It is, however, usual for Americans to leave a tip in restaurants and bars if they are happy about the service. A 10-20% tip is expected if the customer is satisfied. For Americans it's common to tip taxi-drivers or cleaning staff at hotels.

VISA REQUIREMENTS

All foreign nationals must have a valid passport to enter the United States of America. The USA is a sovereign country. A US visa is valid for a stay in all the 50 states of the union during the period for which the visa is valid.

ELECTRICAL OUTLET

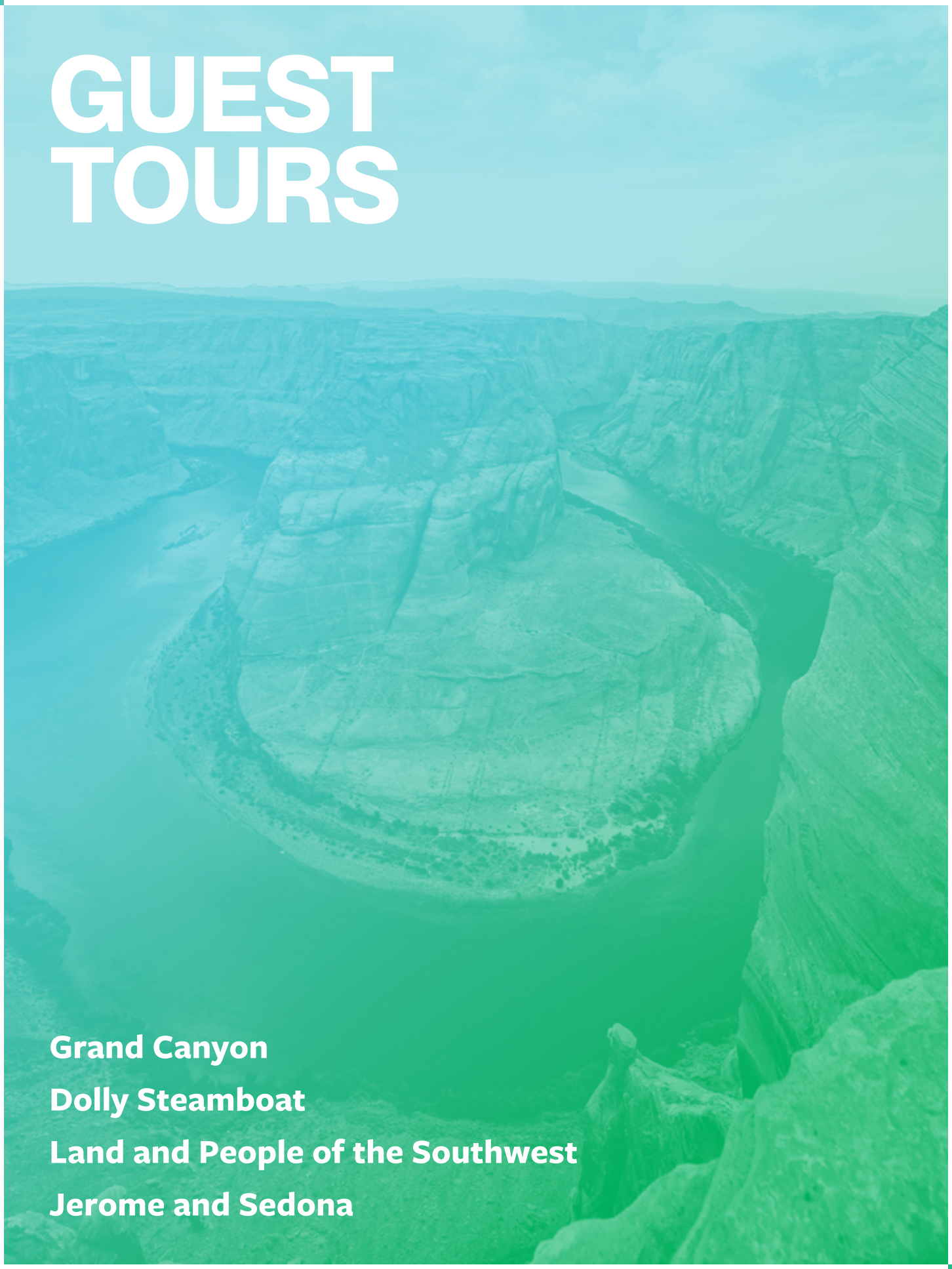
In the United States of America the power plugs and sockets are of type A and B. The standard voltage is 120 V and the standard frequency is 60 Hz.

TRAVEL DELTA

Delta Air Lines is pleased to offer **special discounts** for ASME Turbo Expo. You may also call Delta Meeting Network® at **1.800.328.1111**, Monday–Friday, 7:00 a.m. – 7:30 p.m. (CT) and refer to Meeting Event Code **NMSL4**.

Please note there is not a service fee for reservations booked and ticketed via our reservation 800 number.

GUEST TOURS



Grand Canyon

Dolly Steamboat

Land and People of the Southwest

Jerome and Sedona

Grand Canyon

The day begins with a fully narrated tour en route to the magnificent Grand Canyon. With several brief stops along the way, we will arrive just in time for lunch (on your own). After lunch at one of the restaurants at the Canyon, guests have time to explore the Grand Canyon Village and then will be taken on a guided tour with time to get out, take pictures and enjoy spectacular views along the rim drive.

A stop will be made at a Trading Post on the Navajo Reservation with the Painted Desert as a backdrop. There you may buy directly from the Navajo people and learn about their culture. Next it is back in the coach for the ride home with another stop in either Flagstaff or Camp Verde for a light dinner (on your own). The Grand Canyon is approximately a 4-hour trip (one way) from Phoenix. Restrooms are on the coach and stops will be made. Once at the Grand Canyon, several stops will be made along the rim where guests can get out and walk around; each guest can choose how much they want to walk. The average temperature at the Grand Canyon in June is 82 degrees Fahrenheit. Hats, sunglasses, and sunscreen are recommended.

Dolly Steamboat

Courtesy of The Dolly Steamboat

A Steamboat Cruise in the desert state of Arizona? What most people don't know is that in addition to our beautiful deserts and mountains we have an abundance of lakes.

After a scenic drive through part of the Apache Trail in the Tonto National Forest, away from the city, nestled at the base of the Superstition Mountains is spectacular Canyon Lake. As its name implies, the lake is defined by thousand-foot steep canyon walls. The Steamboat "Dolly" makes her rounds in this lake all year round.

On this 90-minute cruise enjoy the splendor of the canyons, wildlife, and unique desert plants in their natural habitat. See the breathtaking portions of the lake that can only be seen by boat.

This is a relaxing, entertaining, and educational experience that is for explorers of all ages. One of the most beautiful days in Arizona can be spent on Canyon Lake. Canyon Lake is approximately a 1.5 hour transfer from Phoenix. Dolly is part inside/outside. The lower inside area is Air Conditioned. Hats, sunglasses, and sunscreen are recommended.

- No beverages, food, alcohol, firearms (ccw holders ok) or weapons allowed. Unopened bottle water is ok.
- A snack bar is available on board with water, soda's, snacks and alcohol. Please keep in mind that it is cash or check only. No credit cards please.
- No glass containers are allowed at Canyon Lake.

Land and People of the Southwest

DESERT BOTANICAL GARDEN AND HEARD MUSEUM

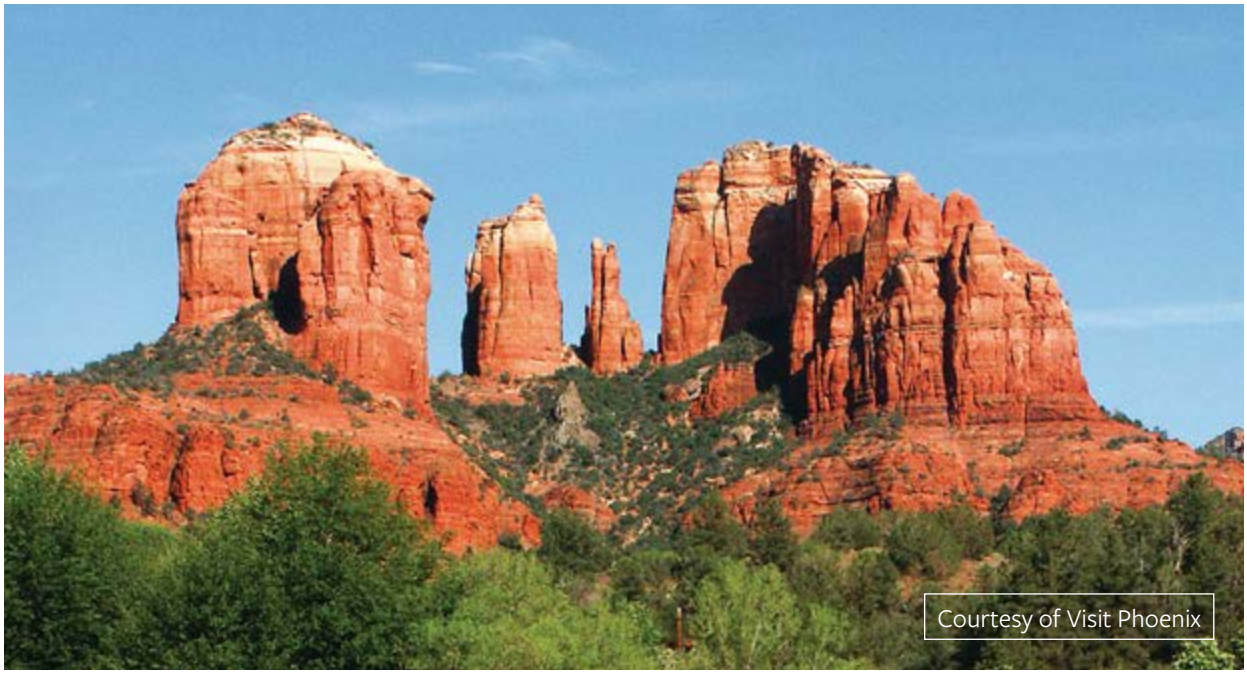
Two of the Southwest's most unique visitor attractions, The Heard Museum and the Desert Botanical Garden, have teamed up to present an unbeatable tour offer designed to acquaint visitors with the diversity of our region and the resourcefulness of its Native people. Includes self-guided visits to both attractions. A guide will accompany the group, on the bus, to both locations.

At the Desert Botanical Garden, discover more than 15,000 plants from the world's deserts in a spectacular outdoor setting. The Garden is a natural environment where you may see jackrabbits, squirrels, desert tortoises and other small animals that make their home here. For bird watchers, there are dozens of species of native and migratory birds, from jewel like hummingbirds to the desert hawks that circle gracefully overhead.

The Heard Museum, a museum of Native cultures and art, is internationally recognized for its collections of southwestern Native American artifacts and contemporary Native American fine art.

***Please Note:** the weather in June can be warm in Phoenix and the Desert Botanical Garden is all outside. This will be the first stop in the morning and you will spend approximately 1.5 hours there. Hats, sunglasses, and sunscreen are recommended.

Jerome and Sedona



You will leave the valley in comfortable coaches and north toward Jerome, high on Mingus Mountain, one of Arizona's most intriguing ghost towns. Neighboring town, historical Cottonwood, was the smelting town for the rich copper mine in Jerome. In its heyday 2000 workers lived in this area and Jerome was the largest town west of the Mississippi. The area boasted an opera house, Women's club and the largest swimming pool in the west. The geology of this area is very exciting, as at one time the whole area was the edge of Pangaea, so Arizona was once Ocean front property. The group will be given time to shop in the many unique shops of Jerome and will be able to eat at one of the popular restaurants in the town (lunch on own).

After lunch, guests will board the bus to Sedona, with its breath-taking monoliths. Settled in the late 1800's to farm and range, this little town has grown into a mecca for nature lovers, artists and tourists and enthusiasts for art, crafts, photography and sports. At 4300 ft elevation, Sedona visitors view majestic scenery and historical landmarks. The showiest place in town, TLAQUEPAQUE (pronounced t'lah-kay-pah-kay) is a recreated village reminiscent of a suburb of Guadalajara, Mexico. You will find tiled courtyards, fountains, bell towers, restaurants and a great variety of art galleries and craft shops.

While visiting beautiful Sedona, you can walk through the many art galleries and specialty shops, or just sit and revel in the tranquility of this place they call "Red Rock Country". The average temperature is in the 90's (Fahrenheit). Hats, sunglasses, and sunscreen are recommended. Jerome/Sedona is about 2-2.5 hours from Phoenix. Guests can choose how much they want to walk around.

Tour Registration

AVALON MEETINGS & ENTERTAINMENT

Please note that, while pick up times are firm, return times are approximate.

1. Registration and full payment for all activities must be received by: **May 17, 2019**
2. Any late registration for activities will be subject to available space.
3. Activity fees are nonrefundable unless tour is cancelled by Avalon.
4. Unless otherwise noted, gratuity is not included in tour prices and is at your discretion.
5. If minimum participant requirements are not met for activities, the activity may be cancelled. You will have the option of applying money to another activity or a full refund. Cancellation is at the discretion of Avalon.
6. Avalon acts only as agent for various owners and independent contractors providing means of transport and/or other services and acceptance thereof shall be deemed a consent to the further condition that neither Avalon nor any of its agents or employees shall be or become liable or responsible in any manner in connection with these services. **PLEASE NOTE THE TEMPERATURE IN PHOENIX IN JUNE AVERAGES 104 DEGREEs FAHRENHEIT**. The northern areas (Grand Canyon, Jerome, and Sedona) are cooler; see tour descriptions for more information.

QTY*	DATE	TOUR NAME	HOTEL PICK-UP	RETURN	COST *(Per Person)*
	Monday, June 17, 2019	**Grand Canyon**	7:00am	7 - 8:00pm	$115.00*
	Tuesday, June 18, 2019	**Dolly Steamboat**	10:00am	3:00pm	$85.00*
	Wednesday, June 19, 2019	**Land & People of the Southwest**	7:45am	11:45am	$95.00*
	Thursday, June 20, 2019	**Jerome and Sedona**	8:30am	5:30pm	$90.00*

** Please put the number of people registering in the **QTY** column.*

Name (Print): _____

Address: _____

Address (2): _____

Phone and Email: _____

By including your email address you are authorizing Avalon Meetings to contact you via this method.

MC/VISA # _____ Exp. date: _____

Security Code (last 3 digits on back or 4 on front for AMEX): _____

Signature: _____

Please check here if you have any special needs or disabilities concerns and we will contact you.

If you prefer to pay by check, please make checks payable to Avalon, and mail to 14415 N. 73rd Street, Suite 105, Scottsdale, AZ 85260. Make a copy of this form for your own records. If paying by credit card, you may fax this form to 480-860-2518 or email to alysiab@avalonme.com.

*** All tours will depart from the Phoenix Convention Center, Location #4 (see map); please arrive 15 minutes prior to departure!!!**

If you have any questions or need additional information, you may call Avalon at 480-860-2423. Avalon will notify every guest via mail or email with confirmation and/or cancellation letters. **The confirmation letters will also be your tickets for the tours.**

FACILITY TOURS

Honeywell Aerospace Phoenix Engines Facility

8:00 A.M. - 11:00 A.M. (INCLUDING TRAVEL TIME)

Honeywell's Engines assembly & test facility is located on an approximately 60-acre campus adjacent to Phoenix's Sky Harbor International Airport. At this location, Honeywell designs and manufactures propulsion engines and auxiliary power units for a variety of commercial and military applications. These include:

- Turbofan engines for business aviation and regional airline aircraft.
- Turboshaft engines for helicopter applications, with power ranging from 650 to 4500 shaft horsepower.
- Auxiliary Power Units (APUs) which supply from 40 up to 1400 equivalent shaft horsepower for all types of ground and airborne products.

Throughout its history, Honeywell's Power System's business has shipped over 125,000 propulsion systems and auxiliary power units to the market from this facility.

Transportation will be provided from the Phoenix Convention Center. The tour will include visits to an engine assembly area, a turbofan engine test cell, an additive manufacturing facility, and the Honeywell flight line.

Registration will be available soon on **https://event.asme.org/Turbo-Expo**

Additional Facility Tours will be added as they become available. Information will be promoted on **https://event.asme.org/Turbo-Expo**

GRAND OPENING & AWARDS INFORMATION

The 2019 Keynote Theme is Turbomachines for Clean Power and Propulsion Systems.

Keynote & Awards Program

TURBOMACHINES FOR CLEAN POWER AND PROPULSION SYSTEMS

TURBO EXPO KEYNOTE & ASME IGTI ANNUAL AWARDS

Monday June 17, 2019, 10:15 a.m. – 12:15 p.m.
Phoenix Convention Center

Advances in technology, regulatory changes, and market forces require that future power and propulsion systems undergo a major transformation. Emphasis on clean energy has led to increased use of renewables for power generation. Flexibility in operation is critical for energy utilities that incorporate wind turbines or solar panels with traditional gas turbines for efficient peak and levelload power management. This has driven innovative ideas for power plant integration, new cycles, and energy storage concepts that are in many ways reliant on turbomachinery. For aviation, marine, and other applications, there is a push to reduce the carbon footprint by moving to alternative or bio-fuels. Recently, the aviation industry is considering turbo-electric and hybrid-electric propulsion concepts in future aircraft for reduced emissions. These new propulsion systems require changes to the traditional turbomachinery architecture for seamless integration with the electrical components. Turbo Expo will bring together experts from power and propulsion areas to highlight the emerging trends and challenges associated with bringing clean energy technologies to fruition and new applications that will shape the turbomachines of the future.

It is the unique experience of the ASME Turbomachinery community combined with the conference theme *Turbomachines for Clean Power and Propulsion Systems* and the focus tracks *Turbomachines for Clean Power and Propulsion; Maintenance, Repair and Overhaul (MRO) for Turbomachinery*, that shall make the 2019 ASME Turbo Expo a must-attend event. Use this opportunity to network with the best and brightest experts from around the world in Phoenix, Arizona, USA, to open new chapters in turbomachinery.

Kicking off the Conference on Monday is the Keynote, a Panel focusing on Turbomachines for Clean Power and Propulsion Systems. On Tuesday and Wednesday, Plenary sessions will explore the keynote theme further by dedicated discussion on the aviation and power industry.

The Keynote is held in conjunction with the annual ASME IGTI Honors & Awards program honoring individuals who have made significant contributions to the advancement of the turbomachinery technology.

KEYNOTE MODERATORS

Atul Kohli, *Pratt & Whitney*
Ruben Del Rosario, *NASA*

KEYNOTE SPEAKERS

Andrew "John" Lammas
Vice President & CTO
Gas Power Systems, *General Electric*

As Vice President, Power Generation Technology for GE Power he leads the engineering teams responsible for heavy duty gas turbines, steam turbines, generators and associated accessory systems. His recent contributions include the design and validation of the next generation of Heavy Duty Gas Turbines the "HA's". John has been in this role since 2012.

Thomas Alley
Vice President of Generation
Electric Power Research Institute (EPRI)

As Vice President of Generation at EPRI, his team is responsible for research, development, and the application of technologies for both existing and future fossil generation fleet and large scale renewables such as hydro power, wind generation, and centralized solar. Since 2007 Alley has guided EPRI research that positively impacts a significant portion of America's non-nuclear central fleet. Alley has led the Generation sector by restructuring the portfolio to meet needs in facility flexibility, reliability, and efficiency. Tom Alley has 35 years of experience in the energy industry.

Janet L. Kavandi
Center Director, *NASA Glenn Research Center*

Dr. Kavandi serves as Director of the National Aeronautics and Space Administration's John H. Glenn Research Center in Cleveland, Ohio. In this position, she is responsible for planning, organizing, and directing the activities required in accomplishing the missions assigned to the center. Glenn is engaged in research, technology, and systems development in support of the nation's space propulsion, space power, space communications, aeronautical propulsion, microgravity sciences, and materials development programs. Prior to accepting the director's position, Dr. Kavandi served as Glenn's Deputy Director.

PLENARIES

Plenary: Aviation Focus
Tuesday, June 18 | 9:40 am – 11:10 am
Phoenix Convention Center

Plenary: Power Focus
Wednesday, June 19 | 9:40 am – 11:10 am
Phoenix Convention Center

Awards & Scholarships

YOUNG ENGINEER TURBO EXPO PARTICIPATION AWARD

The ASME Gas Turbine Segment Young Engineer Turbo Expo Participation Award (YETEP) is intended for young engineers at companies, in government service, or engineering undergraduate or graduate students in the gas turbine or related fields to obtain travel funding to attend ASME Turbo Expo to present a paper which they have authored or co-authored. The purpose is to provide a way for more to participate in the annual Turbo Expo.

The nominee must have obtained an academic degree (Bachelor, Master, PhD, or equivalent degrees) in an engineering discipline related to turbomachinery within five years from the year of the Turbo Expo that the applicant wishes to attend. The research results the applicant wishes to present at the conference can have been obtained either while pursuing an academic degree, or afterwards (students, professionals or young academics are eligible).

For 2019, ASME IGTI will provide YETEP Award winners with:

- One Complimentary ASME Turbo Expo Technical Conference Registration
- Complimentary hotel accommodations (Sunday to Friday)
- Up to $2,000 toward approved travel expenses

CONGRATULATIONS TO THE 2018 AWARD WINNERS:

- Alireza Ameli, Lappeenrants University of Technology
- Reid Berdanier, Penn State University
- Diogo Berta Pitz, University of Surrey
- Tania Sofia Cacao Ferreira, von Karman Institute/ Universite Catholique de Louvain
- Bogdan Cezar Cernat, von Karman institute for Fluid Dynamics
- Wyatt Culler, Penn State University
- Hanna Ek, Georgia Institute of Technology
- David Gonzalez Guadrado, Seoul National University
- Mohammad Arif Hossain, The Ohio State University
- Sunghwa Jeung, Ingersoll Rand
- R. Krishna Chaitanya Kalvakala, University of Illinois at Chicago
- Kathryn Kirsch, Pennsylvania State University
- Weihong Li, Tsinghua University
- Shyang Maw Lim, KTH Royal Institute of technology
- Xueliang Lu, Texas A&M University
- Jomar Mendoza, University of Southern California / UTRC
- Gladys C. Negtich, University of Oxford
- Jorge Saavedra, Purdue University Mechanical Engineering Graduate School
- Prashant Singh, North Carolina State University
- Charles Stuart, Queen's University Belfast
- Jonathan Tobias, University of Alabama
- Cori Watson, University of Virginia
- Yu Xia, Imperial College London UK

Nomination deadline for the Phoenix ASME Turbo Expo February 1, 2019:

https://www.asme.org/events/turbo-expo/program/students

ASME IGTI STUDENT SCHOLARSHIP PROGRAM

ASME IGTI has a long and proud history of providing scholarships to students who show promise for their future profession in the turbomachinery field. The aim is to attract young talent to the profession and reward their commitment, favoring their upcoming enrollment and active participation. The scholarship is to be used for tuition, books and other University expenses. The check will be made out to the University on the student's behalf.

Student application deadline is March 1, 2019 for the 2019-2020 Academic School Year. Scholarship winners will be notified between June 15 and July 15, 2019.

ELIGIBILITY OF THE APPLICANTS

ASME Scholarships are awarded annually to eligible ASME Student Members. You must be a current ASME student member in good standing (for login to the ASME online scholarship application). Click here to **Join ASME** or to **Renew your dues**.

Awards & Scholarships

To be eligible, you must be a community college, college, or university student who is enrolled full-time in Mechanical Engineering (ME), Mechanical Engineering Technology (MET), or closely related engineering studies.

For your major to be considered closely related to a Mechanical Engineering major, you must be taking at least 25% of your credits each semester in courses from the Mechanical Engineering Department.

For complete information on the scholarship program and application process, visit:

https://www.asme.org/career-education/scholarships-and-grants/scholarship/asme-scholarships-how-to-apply

NEW: When you complete the online application, you will be considered for all ASME scholarships for which you qualify, not just the ASME IGTI scholarship.

CONGRATULATIONS TO THE 2018-2019 STUDENT SCHOLARSHIP WINNERS:

- Parash Agarwal, Cranfield University
- Tuhin Bandopadhyay, Indian Institute of Technology, Kharagpur
- Samuel Barak, University of Central Florida
- Jeffrey Bennett, University of Virginia
- David Alejandro Block Novelo, Cranfield University
- Tânia Sofia Cação Ferreira, Université catholique de Louvain (UCL)
- Andrea Cassinelli, Imperial College London
- Bodgan Cezar Cernat, von Karman Institute/Universite catholique de Louvain
- Tapas Kumar Das, Indian Institute of Technology, Madras
- Xin Deng, University of Virginia
- Mohammad Arif Hossain, Ohio State University
- Seongpil Joo, Seoul National University
- Sandeep Kumar, University of Cincinnati
- Francesco Guido Ornano, University of Oxford
- Matthew Sirignano, Georgia Institute of Technology
- Xing Yang, Xi'an Jiaotong University

STUDENT ADVISORY COMMITTEE TRAVEL AWARD

The SAC is pleased to announce that 20 Student Advisory Committee Travel Awards (SACTA), worth up to $2,000 each, have been made available to cover or partially cover student travel expenses to Turbo Expo 2019, with priority given to students who both participate in the conference and actively contribute to the growth of the SAC. Applicants for these awards must be seeking a degree and must be or plan to be members of the SAC. The applicant must agree to participate in the SAC Annual Meeting at Turbo Expo 2019 and willing to help SAC leadership team to review and set-up student posters. Communication with the SAC leadership team may be requested prior to, during, and following Turbo Expo 2019. Students interested in this award must submit the application by March 1, 2019. All applicants will be notified of the decision on their application by March 29, 2019. Download the Student Advisory Committee Travel Award Application.

DEADLINES

Student Advisory Committee Travel Award (SACTA) Applications **Due March 1, 2019**

Technical Committee Student Liaison Subcommittee Applications **Due March 1, 2019**

Student Advisory Committee Executive Committee Position Applications **Due May 21, 2019**

NOTIFICATIONS

SACTA Awardees will be notified **March 15, 2019**

Technical Committee Student Liaison Positions will be notified **March 29, 2019**

Applications can be found online at: https://event.asme.org/Turbo-Expo/Program/Students

Awards & Scholarships

THE ASME R. TOM SAWYER AWARD

The R. Tom Sawyer Award is bestowed on an individual who has made important contributions to advance the purpose of the Gas Turbine Industry and to the International Gas Turbine Institute over a substantial period of time. The contribution may be in any area of institute activity but must be marked by sustained forthright efforts. The award was established in 1972 to honor R. Tom Sawyer who, for over four decades, toiled zealously to advance gas turbine technology in all of its aspects and includes a US $1000 honorarium and a plaque presented during ASME Turbo Expo.

The nomination must be complete and accompanied by three to five Letters of Recommendation from individuals who are well acquainted with the nominees' qualifications. Candidate nominations remain in effect for three years and are automatically carried over. The completed reference form from a minimum of 3 people will need to be sent in with the nomination package. It is up to the "Nominator" to submit all required information.

Your nomination package should be received at the ASME Office no later than August 15, 2019 to be considered.

Email completed nomination package to: **igtiawards@asme.org**

Congratulations to the 2018 ASME R. Tom Sawyer Award winner Dr. Aspi Wadia, GE Aviation

THE ASME GAS TURBINE AWARD

The Gas Turbine Award is given in recognition of an outstanding individual--or multiple--author contribution to the literature of combustion gas turbines or gas turbines thermally combined with nuclear or steam power plants. The paper may be devoted to design aspects or overall gas turbines or individual components and/or systems such as compressors, combustion systems, turbines, controls and accessories, bearings, regenerators, inlet air filters, silencers, etc. It may cover topics specifically related to gas turbines such as high temperature materials or fuel considerations, including erosion and corrosion complications. It can also be devoted to application or operational aspects of gas turbines for aircraft propulsion and ground power units, or automotive, electric utility, gas pipeline pumping, locomotive, marine, oil field pumping, petrochemical, space power, steel, and similar uses. This award was established in 1963 and includes a US $1000 honorarium and a plaque presented during ASME Turbo Expo.

Congratulations to the 2016 ASME Gas Turbine Award winners Dr. Svilen Svilenov Savov, TTP Plc, Dr. Nicholas Atkins, Whittle Laboratory, and Dr. Sumiu Uchida, Mitsubishi Heavy Industries

JOHN P. DAVIS AWARD

Awarded to a paper that focuses on new or continuing gas turbine applications, identifies planning, installation, operating and/or maintenance problems and their solutions, and exemplifies candid exposure of real-world problems and solutions.

Congratulations to the 2016 ASME Gas Turbine Award winners Dr. Parthiv N. Shah, ATA Engineering Inc., Gordon Pfeiffer,

ATA Engineering Inc, Dr. Rory R. Davis, ATA Engineering Inc., Thomas Hartley, Williams International, and Dr. Zoltan Spakovszky, Massachusetts Institute of Technology (Pictured with Jaroslaw Szwedowicz, Gas Turbine Segment Leader)

Awards & Scholarships

THE ASME IGTI AIRCRAFT ENGINE TECHNOLOGY AWARD

The Aircraft Engine Award recognizes sustained personal creative contributions to aircraft gas turbine engine technology. Eligible areas of accomplishment are aircraft engine design, and/or research and development performed in an industrial, academic or research laboratory environment in one or more of the following fields:

- Aircraft Engine Propulsion
- Airframe-Propulsion Integration
- Combustion & Fuels
- Controls
- Diagnostics
- Heat Transfer
- Manufacturing Materials & Metallurgy
- Operability
- Structures & Dynamics
- Turbomachinery

The Aircraft Engine Technology Award will include an optional opportunity to deliver a lecture or present an invited technical paper on the work for which the award is being bestowed, at ASME Turbo Expo. The recipient of the award will very desirably, but not necessarily, be a member of The American Society of Mechanical Engineers. The award will be made to a single individual.

Nominating and supporting letters for the Aircraft Engine Technology Award should be sent by **October 15, 2019** to: igtiawards@asme.org.

Nominating letters should contain all information on the nominee's relevant qualifications. The Award Committee will not solicit or consider materials other than those described below. The selection committee will hold nominations active for a period of three years.

A minimum of two supporting letters from individuals, other than the nominator, must accompany the nominating letter. Supporting letters should reflect peer recognition of the nominee's breadth of experience with various aspects of industrial gas turbine technology.

Congratulations to the 2018 Aircraft Engine Technology Award winner Dr. Charles J. Cross, Air Force Research Laboratory

THE ASME IGTI INDUSTRIAL GAS TURBINE TECHNOLOGY AWARD

The Industrial Gas Turbine Award recognizes sustained personal creative scientific or technological contributions unique to electric power or mechanical drive industrial gas turbine technology. Eligible areas of accomplishment are gas turbine design, application, operations/maintenance, and research/development/deployment, performed in an industrial, academic or research laboratory environment in one or more of the following fields:

- Combustion, Fuels, & Emissions Abatement
- Controls
- Diagnostics
- Electric Power Plant Integration
- Fluid Dynamics & Thermal Sciences
- Operation, Maintenance, & Life Cycle Cost
- Manufacturing, Materials, & Metallurgy
- Structures & Dynamics
- Thermodynamic Cycles
- Turbomachinery

The Industrial Gas Turbine Technology Award will include an optional opportunity to deliver a lecture or present an invited technical paper on the work for which the award is being bestowed, at ASME Turbo Expo. The recipient of the award will very desirably, but not necessarily, be a member of The American Society of Mechanical Engineers. The award will be made to a single individual.

Nominating and supporting letters for the Industrial Gas Turbine Technology Award should be sent by **October 15, 2019** to: igtiawards@asme.org.

Nominating letters should contain all information on the nominee's relevant qualifications. The Award Committee will not solicit or consider materials other than those described below. The selection committee will hold nominations active for a period of three years.

A minimum of two supporting letters from individuals, other than the nominator, must accompany the nominating letter. Supporting letters should reflect peer recognition of the nominee's breadth of experience with various aspects of industrial gas turbine technology.

Congratulations to the 2018 Industrial Gas Turbine Technology Award winner Leroy O. Tomlinson, Retired GE

Awards & Scholarships

ASME IGTI DILIP R. BALLAL EARLY CAREER AWARD

Early Career Awards are intended to honor individuals who have outstanding accomplishments during the beginning of their careers. Historically, there has been no such award to recognize early career engineers working in the area of turbomachinery.

An early career award is intended for those starting a professional career, which is typically after a relevant terminal degree: BS, MS, or PhD. A criterion of seven-years-from-degree will be used to define the nominee's eligibility. The nominee must receive the award prior to the completion of the seventh year beyond the terminal degree.

The recipient of the Dilip Ballal Early Career Award will be presented with the award at Turbo Expo. The award consists of a plaque, funds to support the travel and registration costs to Turbo Expo, free ASME membership registration for five years, and a US $2000 honorarium.

NOMINATION REQUIREMENTS

The nomination package should include the following:

a. A paragraph (less than 50 words) from the nominator highlighting nominee's contributions
b. Nomination letter
c. Two supporting letters
d. Current resume of the nominee

Nomination packets are due to ASME on or before **August 1, 2019**. Send complete nomination to: igtiawards@asme.org.

Congratulations to the 2018 Dilip R. Ballal Early Career Award winner Dr. Jacqueline O'Connor, Pennsylvania State University

ASME DEDICATED SERVICE AWARD

The ASME Dedicated Service Award honors unusual dedicated voluntary service to the Society marked by outstanding performance, demonstrated effective leadership, prolonged and committed service, devotion, enthusiasm and faithfulness.

Congratulations to the 2017 award winner Dr. Kenneth C. Hall, Duke University and the 2018 award winner Dr. Sy A. Ali, Clean Energy Consulting

For details on the 2019 award winners, please refer to the 2019 Awards Program. Programs will be available during the Turbo Expo Grand Opening: Keynote and Awards Program on Monday, June 17 in Phoenix, Arizona.

KEEP UP WITH IGTI ON SOCIAL MEDIA

facebook.com/asmeigti

twitter.com/IGTI

linkedin.com/company/asme-international-gas-turbine-institute

linkedin.com/groups/4058160

TECHNICAL SESSIONS

The Technical Conference has a well-earned reputation as the premier forum on all aspects of gas turbine and related turbine technology. The 2019 Program features technical sessions, focus tracks, panel discussions, tutorials, user-focused sessions and more.

Technical Sessions

AIRCRAFT ENGINE

Sessions within this track address issues of interest across a broad spectrum of aircraft engine technology subjects.

Presenters will cover a range of topics including:

- Operability
- Modeling, Simulation and Validation
- Inlets, Nacelles, Nozzles and Mixers
- Thermal Management Systems and Aero-Engine Oil Systems
- Whole Engine Performance and Novel Concepts
- Propellers and Open Rotors
- Engine Maintenance and On-wing Monitoring of Deterioration

Additionally, the following tutorial and panel sessions will be presented:

- Basics of Gas Turbine Engine (GTE) Core
- Basics of Gas Turbine Cycle Modelling
- Basics of Turboshaft Engine Cycle Design and Optimization
- Aero-Engine Powerplant Integration - An Airframers Point of View
- Developments in Hybrid-Electric Propulsion and Enabling Technologies

CERAMICS

Ceramics are important materials for consideration in the extreme environments found in the gas turbine engine hot sections due to their higher temperature mechanical as well as lower density than metals. The advantages of utilizing ceramic hot section components include weight reduction, improved thermal efficiency as well as enhanced power output and lower emissions. In order to realize the potential of rotating and static ceramic components, some unique technical challenges are being overcome by the engineering community. Specific areas of research and development include:

- CMC Components
- CMC Material Behavior: Fast Fracture
- CMC Material Behavior: Fatigue
- CMC Material Behavior: FOD, Erosion and CMAS
- CMC Ceramics Tutorials

COAL, BIOMASS & ALTERNATIVE FUELS

Sessions focus on high-interest topics in the area of alternative fuel systems for gas turbines, including Hydrogen fuel systems, steam turbines, and other turbomachinery technologies. Alternative and renewable fuels including gaseous and liquid hydrocarbon fuels, alcohols, and ethers; as well as pure hydrogen, or high hydrogen content fuels. Alternative liquid hydrocarbon fuels derived from coal or biomass feedstocks or other technologies. Technical, tutorial, and panel sessions will cover the fundamental physical and chemical properties of alternate and renewable fuels, important to their use in gas-turbine engines and other power systems, as well as their application in different power systems. Sessions will be of interest to researchers, technologists, computational methods involved in the generation and utilization of non-conventional fuels in gas-turbine-based energy systems, and for those wishing to start a new activity in this field.

- Hydrogen Fuel Delivery Systems
- Hydrogen and Hydrogen Content Fuels for Gas Turbine Applications
- Alternative Fuel Chemistry and Fundamentals
- Alternative Fuel Use in Gas-Turbine Engines
- Basics of Hydrogen and Alternative Fuels
- Liquid Fuel Atomization and Combustion
- Computational Methods for Hydrogen and other Alternate Fuels
- Basics of Combustion Computational Fluid Dynamics

COMBUSTION, FUELS & EMISSIONS

Aero and Industrial Gas Turbines with low specific fuel consumption and reduced CO_2 emissions require high combustor outlet temperatures with a continued emphasis on reducing emissions, without sacrificing operability or durability. In addition, Combustion systems are increasingly expected to operate with synthetic gaseous fuels or alternative liquid fuels. The Combustion, Fuels & Emissions sessions will highlight new technology and design approaches, using both experimental and computational techniques, employed to achieve improved combustor performance including ultra-low pollutant emissions and enhanced operability such as turndown and transient response. Broad trends for the 2019 conference include a continued focus on combustion dynamics for lean, staged

Technical Sessions

combustion systems, significant innovation in the development of combustion system such Dry Low NOx or novel rotary detonation, maturation of large eddy simulation analyses, as well as continued research of fundamental and applied topics in atomization, mixing, ignition, auto ignition, blowout and chemical kinetics. Technical sessions include:

- Ignition & Auto Ignition
- Atomization & Sprays
- Fundamental Combustion
- Novel Combustion Concepts
- Flashback & Blowout
- Pollutant Emissions Formation & Control: Combustor Performance
- Combustor Design & Development
- Chemical Kinetics
- Combustion Noise
- Pollutant Emissions: Modeling, Soot and Particulates
- Combustion Dynamics: Basic Mechanisms, Flame Response to Perturbations, Instability Analysis, Model Development, Nonlinearities and Damping & Control
- Combustion Modeling: Combustor Simulations and Large Eddy Simulations
- High Hydrogen Combustion
- Dry Low-NOx Combustor Development
- Micro Devices
- Combustor Flows
- Combustor Diagnostics
- Rotating Detonations

CONTROLS, DIAGNOSTICS & INSTRUMENTATION

The Controls, Diagnostics & Instrumentation Committee will host technical, panel, and tutorial sessions that will closely examine the global challenges associated with Gas Turbine Engine Technology. These will include the latest developments in gas turbine engine control, prognostics, diagnostics and health management, artificial intelligence, and instrumentation technology, and the impact these technologies have in enabling more efficient and reliable engines, lowering engine emissions, and reducing engine operating costs. More precisely, the exchange of information between experts from Government, Academia and Industry is promoted on the following topics:

- Control System Technology
- Optimal and Intelligent Controls
- Active Component Control
- Distributed Engine Control
- Engine Health Management
- Gas Path Performance Diagnostics
- Structural and Mechanical Component Health Management
- On-Board Engine Monitoring and Diagnostics
- Prognostics for Gas Turbine Engines
- Novel Sensors and Sensor Technologies
- Development of Standard and High Temperature Test Rigs and Probes
- Optical and Non-intrusive Measurement Techniques
- Flow, Temperature, Pressure and Acoustic Instrumentation
- Advanced Data Reduction Methods
- Integrated Controls and Diagnostics
- Modeling for Controls and Diagnostic Applications
- Life Usage Monitoring and Life Extending Control Algorithms and Sensors

CYCLE INNOVATIONS

The Cycle Innovations Committee is dedicated to the advancement of technology and innovation, with a particular focus on the thermodynamic cycle of gas turbine–based plants for power generation and propulsion. The Committee traditionally attracts paper submissions from a wide range of disciplines and scientific areas. Some of the thematic areas the Committee currently encompasses are listed below:

- Low or No Emissions Thermal Cycles and Advanced CO_2 Handling
- Supercritical CO_2 Cycles
- H_2 Production and Utilization
- Polygeneration Cycles and Process Integration (Power, Heat, Cooling, Fuels, Chemicals)
- Advanced Steam and Humid Air Cycles
- Steam and Water Injection Gas Turbine Cycles
- Closed Cycle Gas Turbine Technology
- Novel Aero Propulsion Systems for Aircraft and Rotorcraft
- Novel Marine Propulsion Systems
- Innovative Heat Recovery Steam Generators & Once

Technical Sessions

Through Steam Generators

- Renewable and Bio-Energy Concepts and Innovative Cycles
- Concentrated Solar Power Systems Incorporating Gas Turbine Technology
- Fuel Cell Driven Cycles and Hybrid Systems
- Externally Fired Gas Turbines and High Temperature Heat Exchangers
- New Cycles for Distributed Power Generation
- Thermo-Economic and Environmental Impact Analysis
- Cycle Simulation and Analysis for Performance and Health Assessment
- Low Temperature Heat Recovery Cycles
- Geothermal Cycles
- Compressed Air Energy Storage
- Innovative Control Systems for Power Plants
- Optimization of Traditional and Innovative Energy and Propulsion Systems
- Pressure Gain Combustion in Gas Turbines and Impact on Cycle Performance

EDUCATION

Sessions encompass gas turbine/turbomachinery education both in the university and in the industry. Specific teaching tools and techniques will be discussed, including web-based and large-scale remote education, along with industry opportunities for gas turbine engineers. Anyone interested in gas turbine/ turbomachinery engineering education is welcome, from students to academics and professionals. Academics will be exposed to ideas and best practices used at other institutions as well as innovative approaches for gas turbine/ turbomachinery education. Industry will have an opportunity to interact with educators to discuss relevant topic areas and to express their expectations with regard to changing needs. Discussions here have the potential to influence engineering education for a positive impact on future engineers. The sessions provide an active and constructive dialogue about gas turbine/turbomachinery education among practitioners from the industry, students, educators and researchers.

- Education Issues
- Professional Development Workshop for Mid and Late Career Engineers on Transition Coaching

ELECTRIC POWER

The Electric Power Committee (EPC) promotes the exchange of significant technical information on the application and operation of gas turbine power plant systems. The EPC organizes technical and tutorial sessions that deal with the current topics in the electric power industry related to the gas turbine as a major power plant component, its integration into the power plant, as well as digital solutions that prevent/reduce forced outages and machinery breakdowns, and improve operation efficiency. Presenters include owner/operators, original equipment manufacturers, industry independent service providers and other research institutions. The EPC also coordinates a panel session of the Original Equipment Manufacturers (Pathway Forward) and another of the Equipment Owner/Operators (Voice of the Customer), each intended to provide information and perspective on the current energy market. Furthermore, with respect to the economic and regulatory boundary conditions that provide commercial direction to gas turbine technology developers and their equipment's application, the EPC offers a panel session on these topics to provide a perspective on the challenges affecting our industry.

- 8-1 Gas Turbine Development
- 8-2 Gas Turbine and Combined Cycle Power Plant
- 8-3 Digital Solutions
- 8-5 Panel: Path Forward: Gas Turbine Technology
- 8-6 Panel: Voice of the Customer
- 8-7 Panel: Gas Turbine Industry Update
- Joint Tutorial and Panel (with Cycle Innovation): Overview of Grid-Scale Energy Storage Systems and Technologies

FANS & BLOWERS

Improvements in fans and blowers are means to address the global energy challenge, with manufacturers increasingly focusing on improvement in fan efficiency under legislative pressure and as a part of their response to global climate change. The academia-industry collaboration and the up-front use of Computational Fluid Dynamics (CFD) and Experimental Fluid Dynamics (EFD) are the key ingredients to facilitate the advancement from traditional empirical design methodologies. In response to these challenges, the ASMEIGTI Fans and Blowers Technical Committee consider all technical aspects associated with fans and blowers, with a special emphasis on:

- Fans and Blowers: Computational Fluid Dynamics
- Fans and Blowers: Experimental Methods
- Fans and Blowers: Optimization

Technical Sessions

HEAT TRANSFER

Heat transfer is a pacing technology in the development of advanced high-performance gas turbines for aircraft propulsion and power generation in both simple and combined cycle operations. The heat transfer sessions offered at Turbo Expo 2019 relate to every aspect of the state-of-the-art heat transfer, internal air system and seals design of turbomachinery and will include 180 technical papers with presentations and tutorials of basics in 42 sessions.

Heat transfer topics are subdivided into 13 tracks, one of which is sponsored jointly with Turbomachinery Committee and the second with Combustion, Fuels & Emissions Committee. The Conjugate Heat Transfer track with 3 sessions presents the latest methodology of performing conjugate heat transfer computations for the design of several critical gas turbine components, including validation with measurements. While the Numerical Internal Cooling track (4 sessions) primarily focuses on both CFD- and non-CFD-based computations, the Experimental Internal Cooling track (3 sessions) focuses on the advanced experimental methods and benchmark-quality measurements and empirical correlations. Both these tracks present all aspects of internal cooling technology for the design of turbine blades and vanes and adjacent hot components. Similarly, the Numerical Film Cooling track (7 sessions) and Experimental Film Cooling track (6 sessions) offer a wide range of information related to the development and recent research activities on film cooling that contribute significantly to heat transfer advancement in cooled turbomachinery components. Both these tracks include sessions detailing novel film cooling holes geometries, film cooling optimization, and recent advances in numerical and computational methods suitable for advanced film cooling design and performance. The General Computation Heat Transfer track (3 sessions) and General Experimental Heat track (4 sessions) cover a broad range of topics from fundamental heat transfer research to the development of advanced CFD and heat transfer methods and tools pertinent to gas turbine design and technology. Internal Air Systems & Seals track (6 sessions), offered jointly with the Turbomachinery Committee, represents the key area of gas turbine internal cooling and sealing technologies. Sessions in this track include papers on hot mainstream gas ingestion, pressure loss, free and forced convection heat transfer on rotating surfaces and in closed cavities, including innovative sealing systems and cooling air delivery concepts. The Combustors track (1 session) is held jointly with the Combustion, Fuels and Emissions Committee. This track presents numerical and experimental studies on optimal cooling of combustor liners and all aspects of combustor heat transfer.

Additional tracks include Additive Manufacturing (2 sessions), Multiphysics Modeling & Optimization (1 session), and Special Sessions (2 sessions), which features sessions one session on impingement heat transfer and one on tip clearance control, both of which currently do not fit in other tracks. The Tutorials track (1 session) presents basic tutorial on turbine cooling fundaments for the benefit of all interested conference attendees.

Conjugate Heat Transfer

- Conjugate Heat Transfer I
- Conjugate Heat Transfer II
- Conjugate Heat Transfer III

Numerical Internal Cooling

- Numerical Internal Cooling I
- Numerical Internal Cooling II
- Numerical Internal Cooling III
- Numerical Internal Cooling IV

Experimental Internal Cooling

- Experimental Internal Cooling I
- Experimental Internal Cooling II
- Experimental Internal Cooling III

Numerical Film Cooling

- Airfoil Leading Edge, Trailing Edge, and Blade Tip
- Endwall
- Advanced Turbulence Modeling/Simulation
- Hole Shape Studies I
- Hole Shape Studies II
- Miscellaneous I
- Miscellaneous II

Experimental Film Cooling

- Experimental Film Cooling I
- Experimental Film Cooling II
- Experimental Film Cooling III
- Experimental Film Cooling IV
- Experimental Film Cooling V
- Experimental Film Cooling VI

General Computational Heat Transfer

- General Computational Heat Transfer I
- General Computational Heat Transfer II

Technical Sessions

- General Computational Heat Transfer III

General Experimental Heat Transfer

- General Experimental Heat Transfer I
- General Experimental Heat Transfer II
- General Experimental Heat Transfer III
- General Experimental Heat Transfer IV

Internal Air Systems & Seals (with Turbomachinery)

- Hot Gas Ingestion: Ingress/Egress I
- Hot Gas Ingestion: Ingress/Egress II
- Rotor Cavity and Pre-Swirler
- Seals I
- Seals II
- Miscellaneous

Combustors (with Combustion, Fuels & Emissions)

- Combustor Liner Cooling

Additive Manufacturing

- Heat Transfer: Additive Manufacturing I
- Heat Transfer: Additive Manufacturing II

Multiphysics Modeling & Optimization

- Thermofluids and Thermomechanical Modeling and Optimization

Special Sessions

- Impingement Heat Transfer
- Tip Clearance Control

Tutorials

- Basic Tutorial I: Turbine Cooling Fundamentals

INDUSTRIAL & COGENERATION

Representing gas turbine applications within the cogeneration and process industries, technical sessions in this track cover a wide range of topics on cogeneration/ CHP (Combined Heat & power) systems, including but not limited to the following: thermo economic analysis, optimization and simulation methods, design, operation & maintenance aspects of Heat Recovery Steam Generators, operation & maintenance issues of cogeneration plants, gas turbine power augmentation technologies (inlet chilling, high pressure fogging, and wet compression or overspray, dry/ humid air inject, steam injection, etc.), compressor fouling, inlet air filtration systems, compressor washing, gas turbine upgrades and modifications, environmental and regulatory issues, and lessons learned from field experiences.

Other applications such as non-gas turbine based cogeneration/ CHP systems (steam turbine and reciprocating engine based systems, solar energy based systems, etc.), cogeneration and cold energy recovery in LNG plants, hybrid cogeneration systems (combined with fuel cells), and organic Rankine cycle based systems are also included.

Panel/Tutorial sessions cover topics on cogeneration technologies, compressor washing technologies, inlet air filtration systems, gas turbine power augmentation technologies, dynamic modeling of cogeneration/CHP systems, gas turbine combustion processes and emissions issues, fuel related issues, and Impact of Shale energy market.

- Gas Turbine Augmentation Technologies - Inlet Fogging, Wet Compression and Water Injections
- Waste Heat Recovery and Energy Storage Technologies
- Co-Generation Power Plant Performance, Operation and Maintenance
- Design and Evaluation of Co-Generation Power Systems
- Special Topics for Industrial and Co-Generation Systems
- Combustion & Emissions
- Energy storage

MANUFACTURING MATERIALS & METALLURGY

The field of materials and metallurgy associated with gas turbine manufacturing has traditionally been the source of numerous disruptive technologies such as the development of superalloys, precision single-crystal investment casting and ceramic coatings. These in turn have allowed an incredibly accelerated pace of innovation. Next generation materials and processes will allow even higher efficiency and reliability as well as greater flexibility operational mode. A major goal is to balance these with lower emissions and lower life-cycle cost of turbomachinery. Materials with higher strength, lighter weight and improved durability are required for these applications. The continuing development in metallurgy and materials science has resulted in newer materials, better surface protecting methods, and more reliable component life. Development in manufacturing technologies, including better process planning/optimization, advanced machining operations, additive manufacturing, newer coating and repair methods, helps to reduce the manufacturing cost and decrease overall operating cost of gas turbines. Condition assessment of parts after service

Technical Sessions

and advanced repairs are required to further reduce life cycle cost and impact to the environment.

The MMM committee is organized to disseminate the latest developments and research results in the areas of manufacturing, materials and metallurgy to gas and steam turbine designers, manufacturers, users, repair and service vendors, researchers and consultants. In addition to technical paper sessions, tutorial, lecture and panel sessions are planned where highly experienced panel members will discuss their latest experiences and knowledge in manufacturing methods, repair/coating processes and component inspections.

MARINE

Gas turbines are increasingly being used in both naval and commercial marine applications. Marine sessions showcase the latest developments and best practices for gas turbines and associated equipment in marine electrical power and propulsion systems. Paper subjects cover a variety of gas turbine related topics ranging among hot corrosion of advanced material, inlet filtration and protection, development and testing of hybrid electric propulsion, different innovative marine propulsion systems, and papers on clutch designs and comparisons for these marine propulsion systems.

Technical Paper Session Topics include:

- Design and Development
- Applications
- Auxiliaries and Support Systems
- Numerical Analysis and Performance Simulation

MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES

- Introduction to Gas Bearings for Oil-Free Turbomachinery (Tutorials of Basics)
- Microturbines: Component Design and Performance Analysis
- Microturbines: Compressors
- Micro Gas Turbine: Combustion and Fuels
- Microturbines for Distributed Power Generation and Hybrid Energy Grids
- Microturbines and Turbochargers: Emerging System and Application
- Microturbines and Turbochargers: Turbines
- Turbochargers: Performance Evaluation and Prediction
- Turbochargers: Bearing Systems
- Turbochargers: Compressors

OIL & GAS APPLICATIONS

The Oil & Gas industry is a large user of turbomachinery. The demand for oil and gas is consistently growing, and changing market conditions require innovative solutions. Operation and optimization of turbomachinery in a variety of Oil & Gas applications is therefore of great interest. Moreover, potentially extreme operation environments require the consideration of innovative design and operational attributes.

Sessions in the Oil & Gas Applications Track address both theoretical and practical Oil & Gas industry perspectives. The technical sessions provide the latest information on gas turbines and compressors in pipeline and compression stations. Particular emphasis is given to design, operation and maintenance, management, dynamic behavior, diagnostics and vibration and noise, as well as to all engineering issues in Oil & Gas applications. Wet gas compression and multi-phase pumping are also addressed, due to the increasing interest in many installations.

The Oil & Gas Applications Committee brings industry experts together in panel and tutorial sessions jointly held by both academic educators and industry professionals. Both basics of Oil & Gas installations and off-design operation issues will be covered, aimed to ensure improved efficiency and safe and reliable operation. The latest information about environmental impact, product upgrade, risk assessment, standards and legislation of gas turbines and compressors in Oil & Gas applications is also provided.

- LNG Applications
- Wet Gas Compression and Multiphase Flow
- Surge, Stall and Critical Conditions
- Systems, Components and Auxiliary Devices Analysis: I
- Systems, Components and Auxiliary Devices Analysis: II
- Performance Degradation
- Diagnostics, Maintenance, Operation
- Performance Analysis
- Power Cycles and Thermodynamics

Technical Sessions

ORGANIC RANKINE CYCLE POWER SYSTEMS

The use of an organic fluid in place of water (steam) in Rankine cycles is in general advantageous if the thermal energy source is at low/medium temperature, and/or the thermal power availability is small (few kW to few MW). In these cases the proper selection of the working fluid allows to obtain comparatively higher cycle efficiency, to solve several technological problems to obtain a more compact design of the expander and to limit the air leakage in the condenser. In the rather new framework of decentralized conversion of low temperature heat into electricity, the Organic Rankine Cycle (ORC) technology offers an interesting alternative, which is partly explained by its modular feature: a similar ORC system can be used, with little modifications, in conjunction with various heat sources such as waste heat, geothermal, biomass combustion or solar power. The technical sessions cover the latest research and operational experience in this field, with a special focus on working fluid, expansion machines, modeling and optimization issues.

- Organic Rankine Cycle Design and Exploitation

STEAM TURBINES

ASME Turbo Expo 2019 includes a track dedicated to Steam Turbines. While many of the analyses, computational methods, and experimental techniques are common for steam turbines and gas turbines, there are some unique features on steam turbines that warrant special consideration. Separate, co-located, steam turbine sessions at Turbo Expo provide a natural way of sharing many of the cutting edge technologies while giving the steam turbine community a dedicated forum for the unique technical challenges associated with wet steam, long last stage blades, industrial and co-generation steam turbines, erosion, stress corrosion-cracking (SCC) and more.

The following topics will be addressed:

- Steam Turbines Panel
- Steam Turbines Tutorial
- Last Stage Blades and Exhausts
- Wet Steam
- Valves & Seals
- Operational Aspects of Steam Turbines
- Mechanical Aspects of Steam Turbine
- HP/IP Aerodynamics
- General Design Aspects of Steam Turbines
- High Temperature Research in Mechanical Integrity

STRUCTURES & DYNAMICS

The expanded use of gas turbines in extreme environments introduces new demands on the structural integrity of aero and industrial gas turbine development and operation.

The program of seven Structures & Dynamics tracks, including (1) Emerging Methods in Design & Engineering, (2) Fatigue, Fracture & Life Prediction, (3) Probabilistic Methods, (4) Rotordynamics, (5) Bearing & Seal Dynamics, (6) Structural Mechanics, Vibration & Damping and (7) Aerodynamic Excitation & Damping, covers highly relevant issues concerning the mechanical integrity of gas turbine engines, compressors, steam and wind turbines as well as turbochargers.

Papers in the Structures and Dynamics Committee deal with best-in-class structural mechanics solutions by contributing fluid, acoustic, thermodynamic, and cooling interactions, which have an impact on the reliability and lifetime prediction or failure-free operation of mechanical components. Modeling and design methodologies based on analytical, numerical, probabilistic and experimental approaches are presented in more than 40 technical sessions organized by internationally recognized industry leaders and academic researchers.

International networking is arranged among all attended engineers, designers and researchers representing industry, academia and government from different countries. All participants benefit from scientific discussions and identification of cutting-edge technological news and trends in mechanical integrity for meeting today's and tomorrow's challenges in gas, steam and wind turbine industry for the best cross-product methodology synergy.

The diversity of subjects covered will boost attendees' knowledge and contribute to their professional career development.

The S&D panel and tutorial sessions, organized in collaboration with other Congress Committees, leverage engineer's knowledge for topics of the highest interest to the international mechanical engineering society.

Emerging Methods in Design & Engineering

- Emerging Methods on Advanced Designs
- Emerging Methods on Structural Design System

Fatigue, Fracture & Life Prediction

- Lifetime Prediction Methods

Technical Sessions

- Creep Modelling, Analysis and Testing
- Fatigue Crack Initiation
- Material Costitutive Modelling
- Fatigue Crack Growth Analysis

Probabilistic Methods

- Probabilistic Methods 1
- Probabilistic Methods 2

Rotordynamics

- Analysis I
- Analysis II
- Modeling improvements I
- Modeling improvements II
- Experiments and special investigations I
- Experiments and special investigations II
- Applications I
- Applications II
- Bearings and Seals I
- Bearings and Seals II
- Gas Turbine Rotordynamics - Practical Aspects
- Introduction to Torsional Rotordynamics
- Rotordynamics - Theory, Vibration Monitoring, and Case Studies
- How to Apply API Standards to Turbomachinery Rotordynamics - An Introduction

Bearing & Seal Dynamics

- Gas Bearings 1
- Gas Bearings 2
- Gas Bearings 3
- Gas Bearings 4
- Gas Bearings 5
- Tilting Pad Bearings
- Fluid Film Bearings 1
- Fluid Film Bearings 2
- Magnetic Bearings
- Squeeze Film Dampers
- Seals 1
- Seals 2
- Seals 3
- Seals 4
- Seals 5
- Seals 6
- Seals 7

Structural Mechanics, Vibration & Damping

- Mistuning I
- Mistuning II
- Mistuning III
- Mistuning IV
- Dynamics of bladed disks with nonlinearities
- Frictional Joints I
- Frictional Joints II
- Vibration and Damping of Bladed Disks
- Rotor-Stator Interaction
- Experimental Vibration Analysis I
- Experimental Vibration Analysis II
- Turbomachinery Aeromechanics

Aerodynamic Excitation & Damping

- Compressor Aerodynamic Forcing
- Aerodynamic Forcing in Different Turbomachinery Applications
- Compressor Aerodynamic Damping and Flutter
- Turbine Aerodynamic Damping and Flutter
- Methods for Aeroelastic Predictions
- Aerodynamic Excitation Reduction Mechanisms

SUPERCRITICAL CO_2 POWER CYCLES

Supercritical CO2 based power cycles provide significant efficiency and cost of electricity benefits to applications in waste heat, thermal solar, nuclear, and fossil fuel power generation. They also provide for separation, compression, transportation, and storage (geologic) of CO2 from fossil fuel power plants. The approach to supercritical geologic storage of CO2 benefits greatly from the existing technology and knowledge amassed around CO2 utilization and management in the oil & gas industry. While the

Technical Sessions

end goals of the CO_2 based power cycles and the CO_2 storage applications in the oil & gas industry are different, the properties of the working fluid, thermodynamics, technology and machinery used for these applications are very similar.

The confluence of interests related to the use and management of supercritical CO_2 has created an imperative to further the understanding of these applications. The Supercritical CO_2 Power Cycle committee organizes sessions that focus on the dissemination of machinery and cycle related technologies of sCO_2 power plant applications.

- Supercritical CO_2 Turbomachinery
- Supercritical CO_2 Compressors
- Supercritical CO_2 Heat Exchangers
- Supercritical CO_2 Testing
- Supercritical CO_2 Properties and Design Considerations
- Supercritical CO_2 Cycle Optimization
- Supercritical CO_2 Oxy-Combustion
- Supercritical CO_2 Cycle Concepts and Modeling

TURBOMACHINERY

The Turbomachinery Committee of ASME IGTI at Turbo Expo is the premier forum for the world's experts from academia, industry, and government to share advances in the state of the art in turbomachinery aero/thermodynamics technology. Technical paper sessions address aerodynamics topics on fans, compressors, turbines, and ducts in axial, radial and mixed flow configurations. The technical content covers not just a wide range of gas turbine applications for air and marine propulsion and power generation, but also other important sectors such as oil and gas, industrial gas compression, and expanders for waste heat recovery. Design concepts and processes, experimental results, and analytical approaches for modeling with CFD and simpler models are addressed. Design topics include such areas as optimization strategies, endwall profiling, leakage effects, tip clearance effects, quality effects, flow control, casing treatments, unsteady flows, and stall inception and control. Modeling topics include turbulence and transition modeling, LES and DNS, accelerated steady and unsteady formulations, and multi-stage steady CFD, as well as lower-order (non-CFD) models. The increasing emphasis on interaction effects between adjacent components and between multiple disciplines is reflected in specific sessions on these subjects. In addition, several sessions sponsored jointly with other committees focus on important areas of crossdisciplinary interest: with Heat Transfer, sessions on turbine cooling and secondary flow circuits; with Structures, on aeromechanics; and with Aircraft, on noise and acoustics. A new track was added this year to address all facets of deposition, erosion, fouling, and icing; sessions in this track are jointly sponsored by several other committees.

Turbomachinery: Axial Flow Fan & Compressor Aerodynamics

- Water Ingestion, Fogging, Pre-Cooling
- Transition & Roughness Effects
- Compressor Experiments
- Manufacturing & Deterioration Effects
- Transonic Compressor Design
- Tandem Aerofoils
- Tip-Clearance Flows
- Design Concepts
- End-Wall Flows & Passage Contouring
- Seal & Leakage Flows
- Flow Control - 1
- Flow Control - 2
- Flow Control - 3
- Casing Treatment - 1
- Casing Treatment - 2
- Stall
- Fan Design - 1
- Fan Design - 2
- Test Rig & Facility Design
- Compressor Design - 1
- Compressor Design – 2

Turbomachinery: Axial Flow Turbine Aerodynamics

- Endwall Profiling
- Tip leakage flows I
- Low Pressure Turbine Aerodynamics I
- Low Pressure Turbine Aerodynamics II
- Low Pressure Turbine Aerodynamics III
- Unsteady flows and transition
- Aerodynamic Studies I
- Aerodynamic Performances and Design
- Aerodynamic Losses

Technical Sessions

- Aerodynamic Studies II
- Aerodynamic Studies III

Turbomachinery: Design Methods & CFD Modeling for Turbomachinery

- LES and DNS Methods and Applications (1)
- LES and DNS Methods and Applications (2)
- Compressor Design Methods and Applications (1)
- Compressor Design Methods and Applications (2)
- Turbine Design Methods and Applications (1)
- Turbine Design Methods and Applications (2)
- Optimization Methods and Applications (1)
- Optimization Methods and Applications (2)
- Preliminary Design Methods (1)
- Preliminary Design Methods (2)
- Preliminary Design Methods (3)
- Radial Turbomachinery Design Methods and Applications (1)
- Cavity, Bearings and Seal Design Methods and Applications (1)
- Fan Design Methods and Applications
- Component Interaction and Multi-Physics Coupling (1)
- Novel Solver and Simulation Frameworks (1)
- LES and DNS Methods and Applications (3)
- Novel Solver and Simulation Frameworks (2)
- Cavity, Bearings and Seal Design Methods and Applications (2)
- Methods and Application for Hydrodynamics
- Application and Methods for Unsteady Flow (1)
- Component Interaction and Multi-Physics Coupling (2)
- Geometry Design and Meshing (1)
- Flow Separation, Loss and Boundary Layer Interaction Methods
- Novel Solver and Simulation Frameworks (3)
- Geometry Design and Meshing (2)
- Preliminary Design Methods (4)
- Radial Turbomachinery Design Methods and Applications (2)
- Novel Methods for CFD (1)
- Novel Methods for CFD (2)

Turbomachinery: Noise, Ducts and Interactions

- Compressor and Combustion Noise
- Fan and Engine Noise
- Gas Turbine Engine Intakes, Exhaust Diffusers, and Ejectors
- Gas Turbine Engine Transition Ducts and Flow Interactions

Turbomachinery: Radial Turbomachinery Aerodynamics

- Radial and Mixed Flow Turbines I
- Radial and Mixed Flow Turbines II
- Centrifugal Compressors 1
- Centrifugal Compressors 2
- Centrifugal Compressors 3
- Centrifugal Compressors 4
- Centrifugal Compressors 5
- Centrifugal Compressors 6
- Centrifugal Compressors 7

Turbomachinery: Unsteady Flows in Turbomachinery

- Unsteady Flows in Compressors I
- Unsteady Flows in Turbines I
- Unsteady Flows in Turbines II
- Unsteady Flows in Turbines III
- Unsteady Flows in Turbines IV
- Stall and Surge I
- Stall and Surge II
- Stall and Surge in Centrifugal Compressors
- Unsteady Flows in Centrifugal Compressors
- Analysis and Processing Techniques for Unsteady Flows
- Unsteady Flows in Compressors II

Turbomachinery: Multidisciplinary Design Approaches, Optimization & Uncertainty Quantification

- Parameterization Approaches
- Manufacturing Tolerances and Uncertainties
- Surrogate-Assisted Approaches, including Sampling and Data Mining
- Axial Compressors, Propellers and Fans

Technical Sessions

- Turbine Design and Cooling
- Preliminary Design Systems and Approaches
- Adjoint Methods
- Multidisciplinary Optimization and Sensitivity Analysis (fluid, structure)
- Sensitivity Analysis and Design for AM

Turbomachinery: Deposition, Erosion, Fouling, and Icing

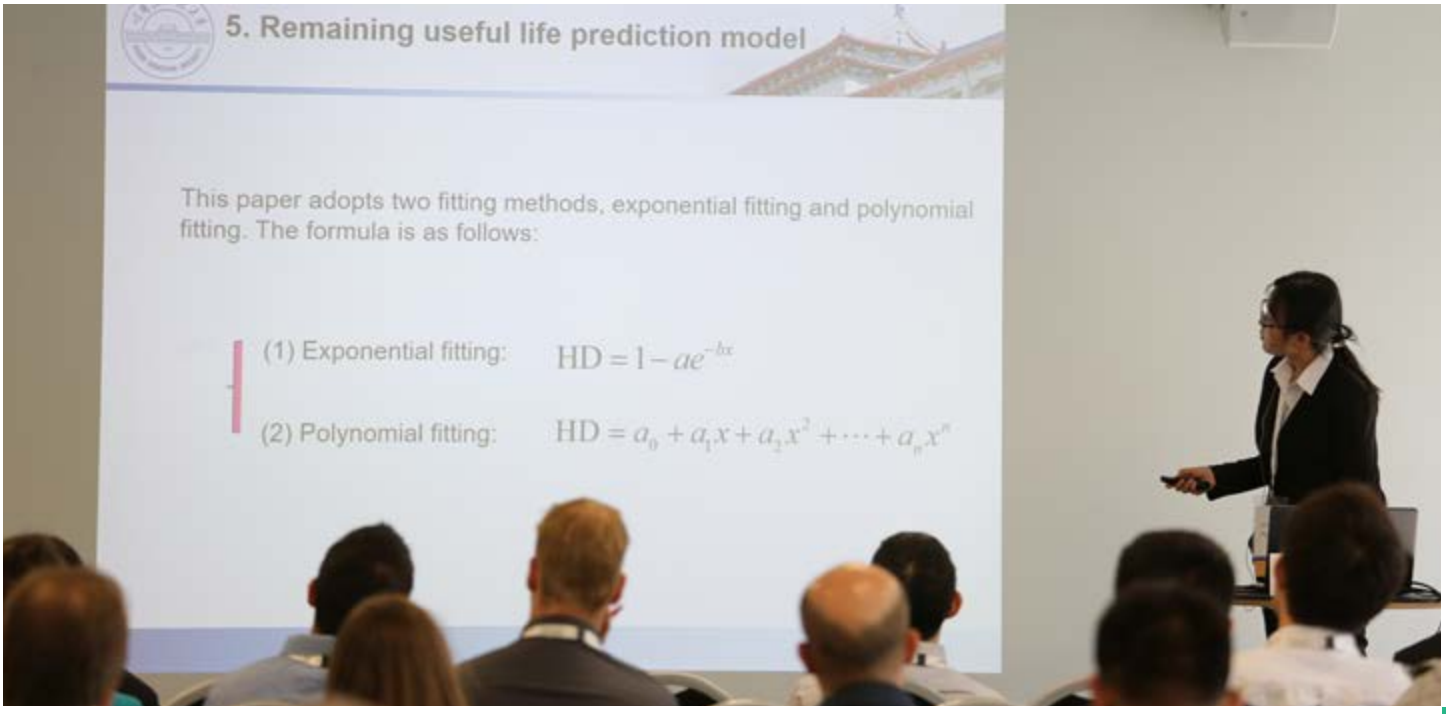
- Multi-phase (Water/Ice) Deposition in Gas Turbines
- Modeling Deposition in Turbine Cooling Passages
- Erosion in Turbines
- Deposition Modeling - I
- Deposition Modeling - II

WIND ENERGY

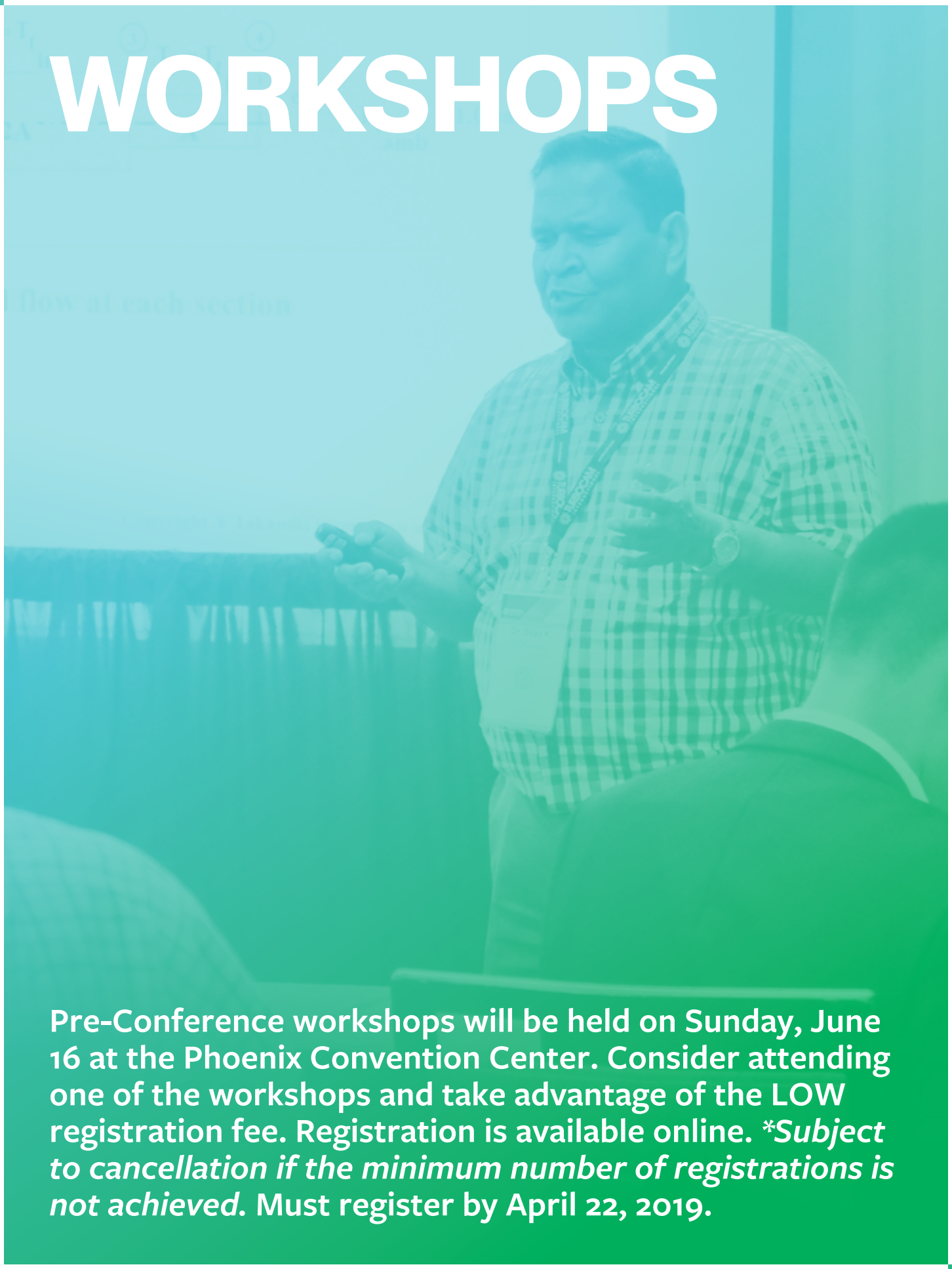
The rapid expansion of wind power and the steady decrease in the cost of wind-generated electricity has consolidated the position of wind power as an indispensable part of the global energy mix. Thus, the Wind Energy Technical Program will focus on innovations that are driving technological advances in the wind industry. The technical presentations cover aerodynamics, aeroelasticity, structures and condition monitoring aspects of wind turbines, as well as the interaction of wind turbines with other energy systems. These topics are addressed for small and large wind turbines, as well as vertical and horizontal axis wind turbines. Special panel sessions highlight the challenges that the industry is facing, as well as research being undertaken in universities and research laboratories. For experts and beginners, tutorial sessions and workshops will be presented to detail developments and tools that are employed in the rapidly growing wind industry.

The main topics addressed during the Turbo Expo 2019 conference are:

- Blade and Airfoil Aerodynamics: Experiments
- Blade and Airfoil Aerodynamics: Numerical Simulations
- Vertical Axis Wind Turbines
- Structural Loads, Aeroelasticity and Noise
- Condition Monitoring and Reliability
- Wind Turbine Simulation Methods and Applications
- Introduction to Wind Energy
- Latest Developments on Wind Turbine Design
- Flow Control and Smart Wind Turbines
- Tutorial: Machine Learning-based Power Curve Methods
- Academic Research Panel Session
- Industry Panel Session



WORKSHOPS



Pre-Conference workshops will be held on Sunday, June 16 at the Phoenix Convention Center. Consider attending one of the workshops and take advantage of the LOW registration fee. Registration is available online. **Subject to cancellation if the minimum number of registrations is not achieved.* Must register by April 22, 2019.

Workshops

WORKSHOP 1

PHYSICS-BASED MODELING OF GAS TURBINE SECONDARY AIR SYSTEMS

SUNDAY, JUNE 16
8:00 AM - 5:00 PM
COST: $300 PER PERSON

In gas turbines used for power generation and aircraft propulsion, the main flow paths of compressors and turbines are responsible for the direct energy conversion. To ensure acceptable life (durability) under creep, LCF, and HCF from operational transients causing high temperatures and their gradients in critical engine components, around 20% of the compressor air flow is used for cooling and sealing. This is analogous to blood, water, and air flow within a human body for its proper functioning. The main thrust of this workshop is to develop a clear understanding of the underlying flow and heat transfer physics and the mathematical modeling of various components of gas turbine secondary air systems (SAS). In addition to developing a clear understanding of the key concepts of thermofluids, the workshop will discuss vortex, windage and disk pumping in rotor/stator cavities, centrifugally-driven buoyant convection in compressor rotor cavities, pre-swirler systems, multiple reference frames, hot gas ingestion and rim sealing, and whole engine modeling (WEM) using nonlinear multisurface forced vortex convection links with windage in a layered approach. Additionally, the workshop will provide a design-friendly overview of rotating compressible flow network methodology along with robust solution techniques, physics-based post-processing of 3-D CFD results, and the generation of entropy map for design optimization. A number of design-relevant examples will also be presented in the workshop.

Five complimentary, autographed copies of Gas Turbines: Internal Flow Systems Modeling (Cambridge Aerospace Series) will be distributed among workshop attendees using a random draw.

LEARNING OBJECTIVES

- Develop a strong foundation in flow and heat transfer physics of various components of gas turbine secondary air systems
- Develop an intuitive understanding of 1-D compressible duct flows under the coupled effects of area change, friction, heat transfer, and rotation
- Gain knowledge in developing accurate physics-based and solution-robust secondary air flow network models
- Gain knowledge in detecting input and modeling errors in their flow network models
- Interpret results from their models for design applications.
- Develop skills to hand-calculate results to perform sanity-checks of predictions by design tools as well as to validate these tools during their development and continuous improvement
- Improve your engineering productivity with reduced design cycle time

OUTLINE

Module 1: An Overview of Secondary Air Systems

- Role of Secondary Air Systems (SAS) modeling in gas turbine design engineering
- The concept of physic-based modeling
- Key components of SAS
- Flow network modeling and robust solution techniques
- Role of 3-D CFD in SAS modeling
- Physics-based post-processing of CFD results
- Entropy map generation and application

Module 2: Special Concepts of Secondary Air Systems – Part I

- Free vortex
- Forced vortex
- Rankine vortex
- Windage
- Compressible flow functions
- Loss coefficient and discharge coefficient for an incompressible flow
- Loss coefficient and discharge coefficient for a compressible flow

Module 3: Special Concepts of Secondary Air Systems – Part II

- Euler's turbomachinery equation
- Rothalpy
- Multiple reference frames
- Pre-Swirler system
- Rotor disk pumping

Module 4: Physics-Based Modeling – Part I

- Stationary and rotating orifices and channels

Workshops

- Rotor-stator and rotor-rotor cavities
- Windage and swirl distribution
- Centrifugally-driven buoyant convection in compressor rotor cavity with and without bore flow

Module 5: Physics-Based Modeling – Part II

- Hot gas ingestion
- Turbine rim sealing
- Coupling with rotor-stator cavity purge flow and windage

Module 6: Physics-Based Modeling – Part III

- Whole engine modeling (WEM)
- Multisurface forced vortex convection link with windage
- Junction treatment in the network of convection links
- Layered flow network modeling methodology
- Key recommendations on SAS modeling

Earn 7 Professional Development Hours (PDH's) and receive a certificate of completion!

INSTRUCTOR

Dr. Bijay (BJ) K. Sultanian, *PhD, PE, MBA, ASME Life Fellow*

Dr. Bijay Sultanian is an international authority in gas turbine heat transfer, secondary air systems, and Computational Fluid Dynamics (CFD). Dr. Sultanian is Founder & Managing Member of Takaniki Communications, LLC, a provider of high-impact, web-based, and live technical training programs for corporate engineering teams. Dr. Sultanian is also an Adjunct Professor at the University of Central Florida, where he has been teaching graduate-level courses in Turbomachinery and Fluid Mechanics since 2006. During his 30+ years in the gas turbine industry, Dr. Sultanian has worked in and led technical teams at a number of organizations, including Allison Gas Turbines (now Rolls-Royce), GE Aircraft Engines (now GE Aviation), GE Power Generation (now GE Power & Water), and Siemens Energy (now Siemens Power & Gas). He has developed several physics-based improvements to legacy heat transfer and fluid systems design methods, including new tools to analyze critical high-temperature components with and without rotation.

During 1971-81, Dr. Sultanian made landmark contributions toward the design and development of India's first liquid rocket engine for a surface-to-air missile (Prithvi) and the first numerical heat transfer model of steel ingots for optimal operations of soaking pits in India's steel plants.

Dr. Sultanian is a Life Fellow of the American Society of Mechanical Engineers, a registered Professional Engineer in the State of Ohio, a GE-certified Six Sigma Green Belt, and an Emeritus Member of Sigma Xi, The Scientific Research Society. He is the author of three graduate-level textbooks: Fluid Mechanics: An Intermediate Approach, published in 2015; Gas Turbines: Internal Flow Systems Modeling (Cambridge Aerospace Series), published in 2018; and Logan's Turbomachinery: Flowpath Design and Performance Fundamentals, to be published in 2019.

For the ASME Turbo Expo 2019, he is the Heat Transfer Committee Point Contact, a role he also had for Turbo Expos 2013, 2016, 2017, and 2018.

Dr. Sultanian received his BTech and MS in Mechanical Engineering from Indian Institute of Technology, Kanpur and Indian Institute of Technology, Madras, respectively. He received his PhD in Mechanical Engineering from Arizona State University, Tempe and MBA from the Lally School of Management and Technology at Rensselaer Polytechnic Institute.

WORKSHOP 2

BASIC GAS TURBINE METALLURGY AND REPAIR TECHNOLOGY WORKSHOP

SUNDAY, JUNE 16
8:00 AM - 5:00 PM
COST: $300 PER PERSON

This workshop will explain superalloy metallurgy as it applies to gas turbine components. We will look at component damage experienced from gas turbine service exposure and the techniques used to analyze the remaining life of components removed from service. We will compare and contrast protective coatings, component repair technologies, and repair quality assurance techniques. The workshop includes many case study examples, and the last section is devoted to a workshop where attendees develop component repair solutions. Participants may submit questions in advance regarding repair issues faced in their jobs.

WHO SHOULD ATTEND

GT repair shop personnel, GT designers and technical staff, Operations and maintenance engineers and technicians responsible for gas turbine component repairs, and insurance companies.

Earn 7 Professional Development Hours (PDH's) and receive a certificate of completion!

Workshops

INSTRUCTORS

Douglas Nagy

Douglas Nagy is the manager of component repairs at Liburdi Turbine Services in Canada, where he manages industrial gas and steam turbine component repairs and provides guidance to research, metallurgy, and development engineering groups. He has 25 years of extensive experience in the analysis of industrial and aero gas turbine components, failure analysis, wear and friction research, high temperature gas turbine component inspection, condition assessment, superalloy metallurgy, and development of coatings and repair processes.

Doug lectures on superalloys and metallurgy at university and commercial levels. He is a part time instructor at McMaster University, supervising undergraduate and graduate student projects and theses. He has also served as expert witness on turbine component condition assessment, failure analysis, and metallurgy.

An experienced speaker, Doug has presented at numerous conferences and seminars such as the ASME/IGTI Turbo Expo, ASM Materials Solutions Conference, Various Gas Turbine User Meetings, Gas Turbine Users Symposium, and ASME International Gas Turbine & Aeroengine Technical Congress.

Doug is co-author of numerous technical papers on repairs of gas turbine components as well as coating design and application in publications such as Surface and Coatings Technology, Surface Engineering, Journal of Engineering for Gas Turbines and Power, and SAMPE Journal of Advanced Materials.

His professional affiliations include the Professional Engineers of Ontario (Canada), the American Society of Mechanical Engineers (ASME), and ASM International.

Dr. Warren Miglietti

Dr. Warren Miglietti is currently the President of Miglietti and Associates, based in Kansas City, Missouri. Prior to this he was Director of Repair Technology at ProEnergy based in Sedalia, Missouri. In addition he worked at the Reconditioning dept at PSM, (a wholly owned subsidiary of Alstom) initially as a Principal Engineer and later as a Technical Expert.

He worked at PSM for 7 years, after working 5 years at GE's Repair Development Center. Prior to this he worked 5 years for Sermatech International both as a component repair engineer and as a process repair engineer. His principal responsibility is the development of novel repair techniques and processes for components, operating in advanced land based gas turbine engines, such as the Frame 7/9FB, Frame 7/9FA+e, GT24/26 and W501F/M501F engines. He has 30 years of experience and expertise in the Arc Welding, Electron Beam Welding, Laser Beam Welding, Plasma Arc Welding, Narrow Gap Brazing, Wide Gap Diffusion Brazing, Fluoride Ion Cleaning (FIC), Acid Stripping and Heat Treatment of Nickel and Cobalt base superalloys, as well as Titanium, Aluminum and Stainless Steels.

Since University graduation (B.Sc and M.Sc from University of Natal- Durban, South Africa and Ph.D from University of Pretoria- South Africa) Warren's career has focused on developing repair techniques and processes for turbomachinery components for industrial, aircraft and aero- derivative components. In South Africa he focused on repair of aviation and military components; whereas in the USA, it has focused more on the IGT side of the business. Warren continues to support the industry as chairman of the Commission XVII – "Brazing and Diffusion Bonding" of the International Institute of Welding (IIW). He was past chairman of the Manufacturing, Materials and Metallurgy Committee of IGTI. Warren has supported this organization for over 25 consecutive years. He has also authored or co- authored the publication of 47 technical papers and has 12 repair technology patents granted and has 1 repair

technology patents pending. He was won numerous awards from the American Welding Society (AWS), German Welding Society (DVS), American Society of Mechanical Engineers/International Gas Turbine Institute (ASME/IGTI) and (International Institute of Welding (IIW), including a few Best Paper Awards.

WORKSHOP 3

GAS TURBINE AEROTHERMODYNAMICS AND PERFORMANCE CALCULATIONS

SUNDAY, JUNE 16
8:00 AM - 6:00 PM
COST: $300 PER PERSON

This interactive workshop introduces in 1 day carefully selected essential material on gas turbine aerothermodynamics and performance calculations. The pedagogical treatment with illustrative examples, flavored with practical considerations, will make the workshop comprehensible, interesting, and useful to both early career and experienced engineers. After completing the course the participants will have the knowledge to propel themselves in studying other gas turbine and turbomachinery topics.

- **Principle of thrust generation:** propulsive, thermal, core, transmission, and overall efficiencies; SFC to overall

Workshops

efficiency relationship; gross and net thrust. Calculated propulsive efficiencies of propeller, transport and military turbofans, and supersonic cruise vehicles. Practical considerations in selecting bypass ratio.

- **Essential aerothermodynamics applied to gas turbine engines:** Review of thermodynamic concepts including enthalpy, entropy, and variable specific heats toward understanding cycle analysis. Illustrative cycle analyses of both aircraft and industrial engines. Use of thermodynamic tables and turbine cooling flow accounting. Compressible flow review including conservation equations, nondimensional parameters including total to static relationships, mass flow function and impulse function. Concept of choking. Nozzle and diffuser analysis with illustrative examples in spreadsheet format including C/D nozzle.
- **Non-dimensional gas turbine and turbomachinery parameters.** Advantage of generalized presentation. Maps used in aircraft and industrial engine models.
- **Overview of turbomachinery aero design.** Energy transfer in a generalized turbomachine; Euler equation; illustrative example. Compressor stage velocity diagram showing the benefits from variable IGV and stators; conversion of velocity diagram parameters into thermodynamic parameters; radial equilibrium equation and its use in blading design; work coefficient, pressure coefficient, isentropic efficiency, polytropic efficiency, and degree of reaction; stage characteristics and development of overall map; illustrative examples of stage design; variable IGV/stators in constant speed industrial compressor; tip clearance effects, operability summary, and stall margin audit. Turbine stage velocity diagram analysis; work coefficient, pressure coefficient, isentropic efficiency, polytropic efficiency, and degree of reaction; Smith's turbine efficiency correlation and its adjustments for tip clearances and cooling flows; chargeable and non-chargeable cooling flows; illustrative examples including one showing blade twist in a free vortex design; Overall turbine maps
- **Overview of Combustor Characteristics:** Multidisciplinary design requirements; flow path through aviation and industrial combustors; emission reduction with premixing; pressure loss; combustion efficiency; stability, and pattern factor.
- **Component Matching and Integrated System Performance:** Requirement to satisfy conservation laws; Design point & off-design calculations; compressor/turbine matching; illustrative examples of turbojet and turbofan in a spreadsheet format showing key iterations
- **Multivariable solver:** Newton's 1-D method; multidimensional Newton-Raphson iteration; application to a mixed flow turbofan; model/data matching
- **Performance enhancement of subsonic turbofans:** High bypass ratio benefits; mixed flow turbofan; on-line control optimization; ejector/engine/nacelle integration for increased installed thrust.
- **Hybrid cycles used for power generation:** Flowpath schematics and cycle performance(SFC & Specific Power) of combined cycle, cycles with steam ingestion, aeroderivatives with regeneration and intercooling, cycles with reheat.

LEARNING OBJECTIVES

- Introduce participants with major topics in gas turbine performance of both aircraft engine and industrial gas turbines including review of relevant aerothermodynamics and cycle analysis with illustrative problems
- Analyze turbomachinery velocity diagrams and relate those to thermodynamic parameters; appreciate the usefulness of the degree of reaction and the radial equilibrium equation. Understanding facilitated with illustrative examples.
- Comprehend the discipline of operability and combustor characteristics
- Analyze cycle analysis problems on integrating the component performances to get the overall engine performance including compressor/turbine matching, design point and off-design calculations, and multivariable solver with capability to match model to test data. Understanding facilitated with illustrative examples.
- Present methods of performance enhancement of subsonic turbofans including analysis
- Hybrid gas turbine cycles used in power generation

WHO SHOULD ATTEND

Undergraduate & Graduate; Early Career and Experienced; Gas Turbine and turbomachinery design, performance, applications, and education.

ITEMS TO BRING

Laptop to be brought by each registrant would allow access to

the illustrative examples in excel spreadsheets provided with the course notes on a flash drive.

Earn 8 Professional Development Hours (PDH's) and receive a certificate of completion!

INSTRUCTOR

Syed Khalid, President, *Gas Turbine Systems Solutions, LLC*

The instructor received the MSME degree from Purdue University and the ME degree (Aerospace) from North Carolina State University. In addition to a strong analytical background, the instructor has extensive experience in performance, controls, operability, installation aerodynamics, and systems integration at Pratt & Whitney, GE, Rolls-Royce, and Lockheed Martin. He is a recipient of numerous industry and professional society awards. He is inventor/co-inventor of 20 issued patents and 3 pending patents. His publications include 15 technical papers and has made numerous oral presentations. The instructor has infused in the workshop public domain industrial considerations to increase the practical value.

WORKSHOP 4

PRIMER ON GAS TURBINE POWER AUGMENTATION TECHNOLOGIES

SUNDAY, JUNE 16
8:00 AM - 5:00 PM
COST: $300 PER PERSON

A comprehensive overview covering analytical, experimental, and practical aspects of the available gas turbine power augmentation technologies including a systematic approach of selecting a suitable power augmentation technology for a given application is provided. Importance of CFD analysis in case of specific technology is included. Case studies of actual implementation of discussed power augmentation technologies and lessons learned from these applications are included in the course. A significance of techno-economic evaluation and weather data analysis while selecting a suitable augmentation technology is discussed using a practical case.

Topics also include:

- Basics of available power augmentation technologies includes: wet-media evaporative cooling, high pressure fogging, overspray/wet compression, steam injection, refrigerated inlet cooling (vapor compression, absorption refrigeration, and thermal energy storage), dry air injection, humid air injection and hybrid power augmentation systems
- Importance of proper weather data collection and analysis and its impact on power augmentation technologies and power boost achievable
- Practical considerations in implementing discussed power augmentation technologies
- Advantages and limitations of discussed power augmentation technologies
- Operational and maintenance considerations

WHO SHOULD ATTEND

Engineers with EPC (Engineering, Procurement & Constructions) companies involved in power generation projects, power generation project developers, combined heat & power project developers, gas turbine users, gas turbine operators, consultants involved in gas turbine based power generation projects, and young engineers looking for careers in gas turbine based power generation and related technologies.

Earn 7 Professional Development Hours (PDH's) and receive a certificate of completion!

INSTRUCTORS

Dr. Rakesh Bhargava

Dr. Rakesh Bhargava is Founder & President of Innovative Turbomachinery Technologies Corp. His expertise includes applications of gas turbines and other rotating and reciprocating machines and packaged process equipment used in the off-shore, refinery, power generation, chemical, and pipeline industries. His more than 35 years of experience encompasses inspection and design reviews of process machinery and packaged equipment, evaluation and analysis of gas turbine power augmentation technologies, field problems resolution, failure analysis, inspection of turbomachinery component repairs, technical expertise in commercial disputes involving rotating machines and the global energy market analysis. He has given numerous invited lectures on gas turbine technologies and energy market around the world and provides customized training courses on rotating machinery and related topics. He is an active member of API Committee on Standards on Mechanical Equipment and has participated in upgrades of number of API specifications. He is a Fellow and Associate Fellow of ASME and AIAA, respectively and is past Chair

Workshops

of the ASME/IGTI Industrial & Cogeneration Committee and Oil & Gas Applications Committee. He is Associate Editor of the ASME Journal of Engineering for Gas Turbines and Power.

Dr. Mustapha Chaker

Dr. Mustapha Chaker is a leading authority in the area of gas turbine power augmentation having done pioneering work on the inlet fogging while being director of R&D at Mee Industries, one of the leading suppliers of power augmentation systems. He has conducted extensive analytical and experimental studies utilizing a wind tunnel and state of the art laser measurement system to evaluate the behavior of cooling systems. He has been also working on the thermodynamic modeling of gas turbines and the use of CFD methods for fogging and wet compression system design and optimization. In addition, he has over 25 years of experience in multidisciplinary skills including gas turbine power generation and mechanical drive, compression systems (centrifugal, axial, integrally geared, reciprocating, steam turbine...) and LNG application. He is currently working as Principal Turbomachinery engineer at McDermott. He is past chair of the Industrial and Cogeneration Committee. Dr Chaker has a Ph.D. in Engineering Sciences from the University of Nice – Sophia Antipolis in France. He is a fellow of the American Society of Mechanical Engineering.

WORKSHOP 5

INTRODUCTION TO PROBABILISTIC ANALYSIS AND UNCERTAINTY QUANTIFICATION

SUNDAY, JUNE 16
8:00 AM - 12:00 PM
COST: $200 PER PERSON

Uncertainty is an inescapable reality that can be found in nearly all types of engineering analyses. It arises from sources like measurement inaccuracies, material properties, boundary and initial conditions, and modeling approximations. Uncertainty Quantification (UQ) is a systematic process that puts error bands on the results by incorporating real world variability and probabilistic behavior into engineering and systems analysis. UQ answers the question: what is likely to happen when the system is subjected to uncertain and variable inputs. Answering this question facilitates significant risk reduction, robust design, and greater confidence in engineering decisions. Modern UQ techniques use powerful statistical models to map the input-output relationships of the system, significantly reducing the number of simulations or tests required to get accurate answers.

This four-hour workshop introduces probabilistic and Uncertainty Quantification methods, benefits, and tools and illustrates these concepts with case studies.

LEARNING OBJECTIVES

- Knowledge of common UQ and probabilistic methods
- How to apply UQ methods to an engineering system
- How to use UQ techniques to drastically save design time
- How to develop a robust and reliable design with UQ techniques
- Hot to interpret UQ results when making decisions

OUTLINE

- Introduction to UQ
- Motivation for using UQ
  - Commercial – Return on Investment
  - Regulatory – FAA and DoD
- Best Probability and Statistics
- UQ Methods
  - Design of Experiments
  - Gaussian Process
  - Polynomial Chaos Expansion
  - Model Calibration
  - Sensitivity Analysis
  - Uncertainty Propagation
- Benefits
- Case Studies
- Final Remarks

WHO SHOULD ATTEND

Engineers, program managers, and data scientists who are familiar with probabilistic analytics and want to further investigate how Uncertainty Quantification can maximize insight, improve design, and reduce time and resources.

Earn 4 Professional Development Hours (PDH's) and receive a certificate of completion!

Workshops

INSTRUCTORS

Dr. Mark Andrews

Dr. Mark Andrews, UQ Technology Steward, is responsible for advising SmartUQ on the industry's UQ needs and challenges and is the principal investigator for SmartUQ's project with Probabilistic Analysis Consortium for Engines (PACE) developed and managed by Ohio Aerospace Institute (OAI). He recently received the award for best training at 2018 the Conference on Advancing Analysis & Simulation in Engineering (CAASE). Dr. Andrews is a member of the Probabilistic Methods, a subcommittee of Structures & Dynamics committee for ASME Turbo Expo. Before SmartUQ, Dr. Andrews spent 15 years at Caterpillar.

Mr. Zachary Graves, UQ Applications Engineer

WORKSHOP 6

DESIGN AND SIMULATION FOR TURBOMACHINERY ADDITIVE MANUFACTURING

SUNDAY, JUNE 16
8:00 AM - 12:00 PM
COST: $200 PER PERSON

LEARNING OBJECTIVES

- Opportunities and Challenges Metal Additive Manufacturing presents for Turbomachinery.
- How to Design a component for additive manufacturing (including lightweighting)
- How to get the print for a component the first time

OUTLINE

- Introduction and Promise of Metal Additive manufacturing
- Design to Print workflow. Details of each step in the workflow
- Lightweighting- Topology Optimization, design validation
- Print Process Setup and Simulation

Earn 4 Professional Development Hours (PDH's) and receive a certificate of completion!

INSTRUCTORS

Jeff Bronson

Jeff Bronson is Senior Additive Manufacturing Expert and Sunil Patil is Industry Lead for Turbomachinery at ANSYS. Both of them have worked at Aircraft Engine Manufacturing OEMs before joining ANSYS where they supported various design and analysis aspects of modern and next generation jet engines. Jeff has extensive knowledge of whole metal Additive manufacturing workflow from Design to print to microstructure analysis and has been acting as advisor to Jet Engine, Gas Turbine OEMs and other organization in Turbomachinery field.

Sunil Patil, ANSYS Industry Lead - Turbomachinery

WORKSHOP 7

ADVANCEMENTS IN TURBOMACHINERY DEVELOPMENT FOR ELECTRIC PROPULSION

SUNDAY, JUNE 16
8:00 AM - 12:00 PM
COST: $200 PER PERSON

OBJECTIVE

The objective is to provide engineers with the understanding required to take on the next aerospace step toward electrification and optimization of turboelectric and hybrid propulsion systems. Design considerations given flight missions are undertaken before delving into off-design performance prediction.

OUTLINE

Basics of gas dynamics and fluid properties, Brayton cycles and/or electric propulsion combinations and architectures for aircraft engines, Specialized theoretical background and terminology, Review of electric propulsion architectures, Design requirements and constraints associated with electric

propulsion fans for different flight missions, Overview of axial and mixed flow fans and their practical application, Case studies, Fan noise estimation techniques, Optimization of fan under given constraints, Off-design assessments of designed fan

WHO SHOULD ATTEND

Engineers working on electrical propulsion and turbomachinery design, modifications, or upgrades. Engineers, Scientists, and

Workshops

Managers beginning or advancing in design and analysis of turbomachines. Program Managers who want to bring new design capabilities in-house. Engineering students looking to expand their knowledge and/or work in electric propulsion.

Earn 4 Professional Development Hours (PDH's) and receive a certificate of completion!

INSTRUCTORS

Clément Joly

Clément Joly is a Lead Engineer at SoftInWay and has been with the company since January 2013. He received his Master's Degree in Mechanical & Aerospace Engineering from Polytech Orleans in France while doing part of his education at Wichita State University in Kansas (USA). Mr. Joly specializes in steam and gas axial turbines, cycle design and analysis as well as waste heat recovery and supercritical CO_2 technologies. He teaches courses on fundamentals of turbomachines as well as design workshops using the AxSTREAM® platform.

Abdul Nassar, Managing Director, *SoftInWay*.

WORKSHOP 8

ROTOR DYNAMICS ANALYSIS AND BEARING DESIGN FOR HIGH SPEED TURBOCHARGERS/ GENERATORS

SUNDAY, JUNE 16
8:00 AM - 12:00 PM
COST: $200 PER PERSON

OUTLINE

This proposal concerns a workshop on rotordynamics and bearing design of high-speed turbochargers, turbines, generators, and other machines. The authors have extensive industrial and bearing design issues. The objective is for attendees with interest in such machines can view some advanced methodology and example rotor dynamics and high-level bearing design which may help them in their work.

For example, medium size turbochargers for diesel engines or reciprocating compressors normally employ radial and thrust fixed pad bearings to keep costs low. They often operate near or above the radial bearing linear stability threshold, in the 20,000 rpm to 50,000 rpm range, due to fixed pad bearing effects. It is useful to employ both linearized and nonlinear rotor bearing modeling to evaluate the optimum bearing configurations. Often, one of the best radial bearing options is the semi-floating bush bearing, consisting of an inner fixed pad bearing and squeeze film damper. The workshop will provide example turbocharger and similar machines evaluating radial bearing orbits, FFT spectrum analysis of the orbits, required oil flow, power loss evaluation of inner bearing plus squeeze film damper, temperature and other parameters. The effects of bearing parameters are evaluated and compared. Example results similar to turbochargers will be presented.

Another important factor is the thrust bearing to take the high loading associated with centrifugal impellers in turbochargers and similar high-speed machines. Again, fixed pad thrust bearings are employed. It is quite important to evaluate typical fixed pad thrust bearings for pressures, load capacity, oil viscosity, temperature, power loss and other effects at high speeds. The proper evaluation of the thrust bearing requires a 2-D Reynolds equation pressure solution with turbulent effects as well as a 3-D finite element thermal model of the oil film, thrust pads and thrust runner with proper heat flow matching across the fluid/solid boundaries. An important effect is the loss of oil film viscosity due to high oil film heating and the subsequent loss of load capacity. Example results similar to industrial turbochargers will be presented.

WHO SHOULD ATTEND

Design engineers, manufacturing engineers, engineers involved in high speed machinery, particularly medium sized turbochargers for diesel engine applications, generators, and turbines which often use fixed pad bearings for cost regions. Often they do not have extensive experience in rotor dynamics and design.

INSTRUCTORS

Paul Allaire, Chief Technology Officer,
Rotor Bearing Solutions International

Saeid Dousti, Senior Technical Fellow,
Rotor Bearing Solutions International

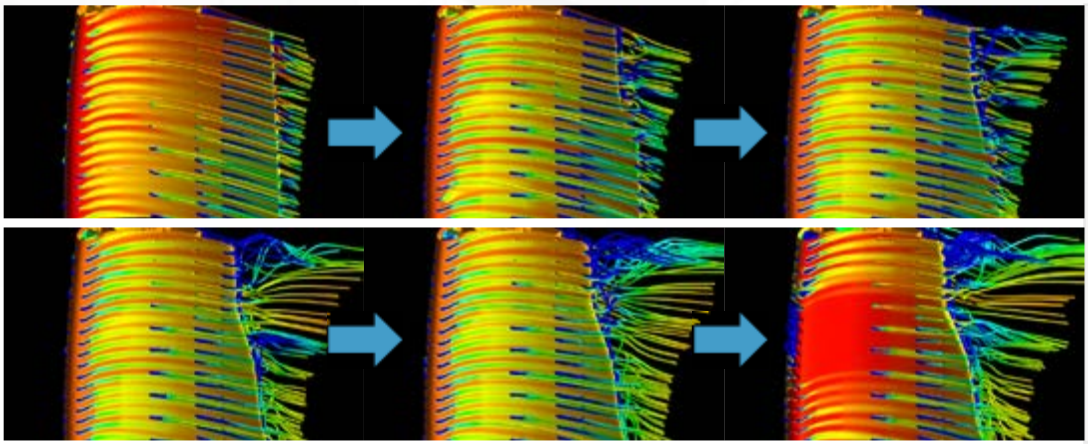
Jianming Cao, Vice President,
Rotor Bearing Solutions International

Timothy Dimond, President,
Rotor Bearing Solutions International

LAUNCHING a demo version during 2019

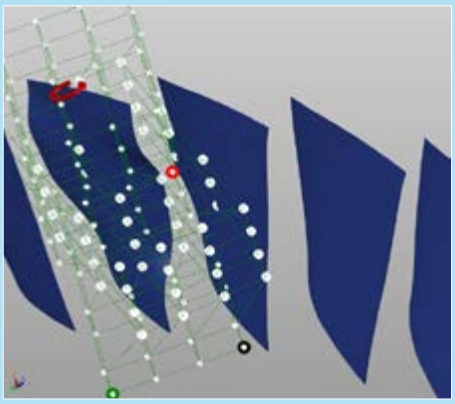
BOXERgeom

Interactively morph, deform, erode, transform and manipulate geometry



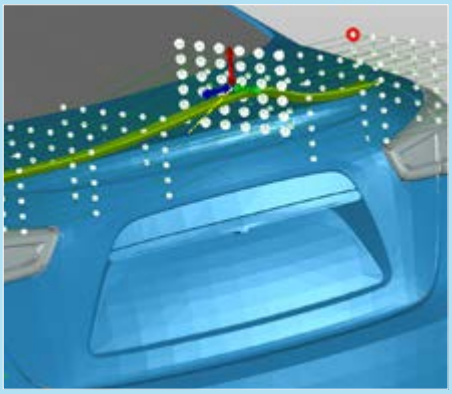
Geometry morphing technology models blade erosion based on simulated thermal loads.

Model and represent system performance degradation as seen in real in-services machines



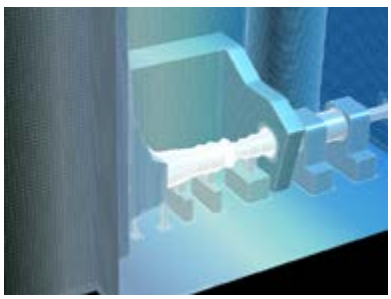
Interactively apply Free-Form twist to the mid span of an IP compressor blade

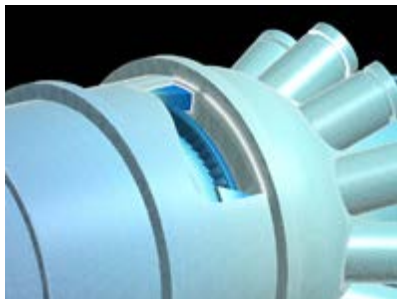
Interactively change the profile of a car rear spoiler

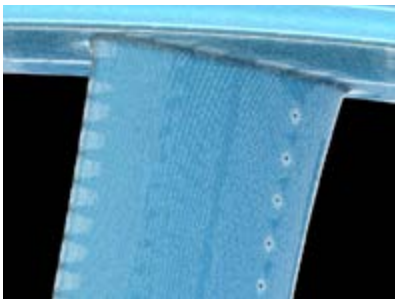


BOXERmesh

Scalable parallel mesh generation for large scale simulation







System Level Gas Turbine Power-Gen installation including turbomachinery assembles and blade cooling components

CAMBRIDGE FLOW SOLUTIONS
Proprietary and customised CFD

www.cambridgeflowsolutions.com

TUTORIALS

A **Tutorial of Basics** session covers a basic topic within the coverage area of a technical track. The goal of these sessions is for a typical Turbo Expo conference attendee to understand the basics in that particular area.

Tutorials of Basics

AIRCRAFT ENGINE

- Basics of Turboshaft Engine Cycle Design and Optimization
- Basics of Gas Turbine Cycle Modelling
- Propulsion System Integration: an Airframer View
- Basics of Gas Turbine Engine (GTE) Core

CERAMICS

- Ceramics Tutorials

COAL, BIOMASS, HYDROGEN & ALTERNATIVE FUELS

- Basics of Biomass
- Challenges of Combustion Computational Fluid Dynamics for Industrial Gas Turbine Engines

COMBUSTION, FUELS & EMISSIONS

- Combustion Fundamentals Tutorial
- Combustion Dynamics Tutorial
- Liquid Fuel Atomization and Combustion Tutorial

CONTROLS, DIAGNOSTICS & INSTRUMENTATION

- Transient Gas Turbine Engine Simulation and Controls Basics
- Machine Learning for Turbomachinery Design, PHM Analytics and MRO

CYCLE INNOVATIONS

- Simulation of Gas Turbine Dynamic Behavior at Design, Off-Design and Adverse Dynamic Operation Conditions
- Introduction to Dynamic Analysis and Hybridisation of Plant Systems
- Overview of Grid-Scale Energy Storage Systems and Technologies

EDUCATION

- Novel Approach to Teaching Principles of Turbomachinery Through Student Design Space Programming

ELECTRIC POWER

- Digital Solutions

HEAT TRANSFER: TUTORIALS

- Tutorial of Basics I: Turbine Cooling Fundamentals
- Conjugate Heat Transfer methodologies for GT Combustor Aerothermal Investigation

INDUSTRIAL & COGENERATION

- Fundamentals of Using Object-Oriented Programming to Model and Simulate Gas Turbines
- Compressing a Wet Gas: Perspectives and Experience across a Range of Applications
- Gas Turbine Components Design Using Aerothermodynamic Analysis
- Design and Evaluation Considerations of Waste Heat Recovery Technologies
- Combustion and Emissions

MANUFACTURING MATERIALS & METALLURGY

- Auto-Adaptive Additive Manufacturing
- Turbomachinery Manufacturing in a Digital Environment
- Narrow and Wide Gap Diffusion Braze Repair Technology including Applications

MARINE

- Gas Turbine Controls

MICROTURBINES, TURBOCHARGERS & SMALL TURBOMACHINES

- Introduction to Gas Bearings for Oil-Free Turbomachinery

OIL & GAS APPLICATIONS

- Industrial Gas Turbines- An Introduction
- Oil and Gas Applications
- Thrust Management 101: Analysis, Balance, and Monitoring
- Basics of Rotordynamics Instrumentation and Data Acquisition

Tutorials of Basics

- Dry Gas Seals and Panels: Design, Operation, and Maintenance Techniques for Improved Reliability

STEAM TURBINES

- Steam Turbines

STRUCTURES & DYNAMICS: PROBABILISTIC METHODS

- Industry Challenges in Uncertainty Quantification: Narrowing the Simulation – Test Gap with Statistical Calibration
- Introduction to Probabilistic Analysis and Uncertainty Quantification

STRUCTURES & DYNAMICS: ROTORDYNAMICS

- Gas Turbine Rotordynamics - Practical Aspects
- Introduction to Torsional Rotordynamics
- Rotordynamics - Theory, Vibration Monitoring, and Case Studies
- How to Apply API Standards to Turbomachinery Rotordynamics - An Introduction

STRUCTURES & DYNAMICS: STRUCTURAL MECHANICS, VIBRATION & DAMPING

- Turbomachinery Aeromechanics

SUPERCRITICAL CO2 POWER CYCLES

- Heat Exchangers for Supercritical CO_2 Power Cycle Applications
- Fundamentals of Direct-Fired Supercritical CO_2 Combustion
- Fundamentals of Supercritical CO_2 Power Cycles
- Supercritical CO_2 Power Cycle Modeling and Fluid Properties
- Turbomachinery Design for Supercritical CO_2 Applications
- Materials for Supercritical CO_2 Applications

TURBOMACHINERY: RADIAL TURBOMACHINERY AERODYNAMICS

- Centrifugal Compressors 3

TURBOMACHINERY: TUTORIALS

- Secondary Flow Systems Modeling
- CFD for Turbomachinery

WIND ENERGY

- Lifting-line Aerodynamics for Propellers, Propfans, and Airborne Wind Turbines

Professional Development Tutorial

TRANSITION COACHING FOR MID AND LATE CAREER ENGINEERS

FRIDAY, JUNE 21ST 10:15 - 12:45

Mid-career transitions including moving into a bigger role, juggling family situations and dealing with job performance issues can be some of life's most difficult.

Transitioning to life after a long career can also be extremely challenging. In every transition, individuals confront questions such as:

- What will my new identity be?
- How do I want my new life to look?
- What habits and skills do I need to fully maximize the next leg of my life journey?

This tutorial will explore the challenges of transitions and take the class participants through a series of exercises to:

- Assess current professional and personal situation
- Develop goals for the next phase of life
- Create an Action Plan for achieving those goals
- Evaluate existing and new identity
- Explore existing habits and how they will support or hinder the next phase of your life

Be prepared to think outside the box and develop some ideas and action plans that just may radically change your life!

ABOUT THE SPEAKER

Brian Forbes is a marketing consultant and executive coach with almost 30 years of leadership experience in the technology industry.

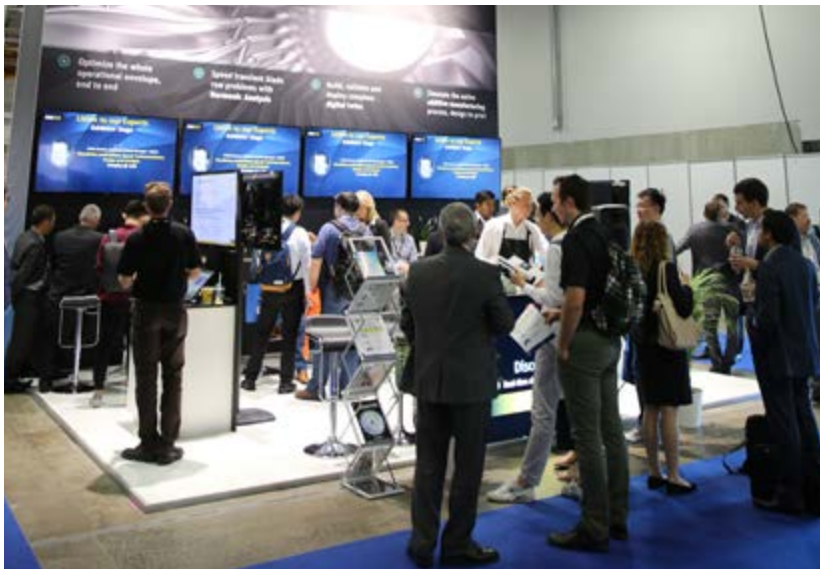
WHO MAY ATTEND?

This tutorial, funded by IGTI, is open to all who register and pay to attend the ASME 2019 Turbo Expo Conference.

WHY EXHIBIT

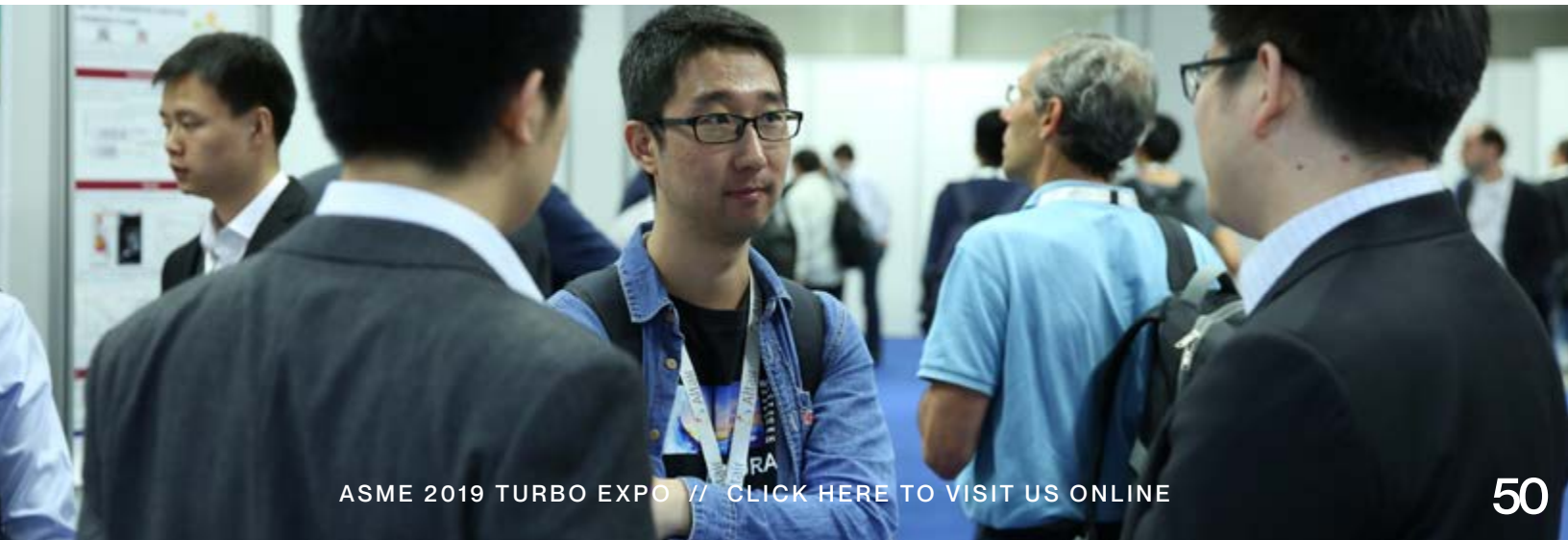
We understand that you need a return on investment for your sponsorship, exhibiting, and advertising dollars. An ASME Turbo Expo partnership gives you strategically focused access to an influential audience of commercial, governmental, and academic engineers in the field of turbomachinery. This alliance offers many Key Opportunities, including high visibility, hospitality, and networking.

Why Exhibit?



Raise Your Company Profile and Awareness

Gain access to professionals in the power generation and turbomachinery fields from industry, R&D, academia and government over three days while showcasing your products and services and building your customer base.



Why Exhibit?

To gain exposure to potential customers in the power generation and turbomachinery fields from industry, R&D, academia and government, over three days by showcasing your products and services.

The 3-day exposition will be on June 23-25 in London, England with some value-added activities to promote traffic! There are daily afternoon coffee breaks and open bar receptions in the Hall as well as daily lunch in the Hall for all registered attendees. Need a place to hold an interview or quick meeting – space will be available to exhibitors.

This is your chance to attract new clients, visit with current ones, learn more about the changing needs of the international turbomachinery industry - and ultimately, increase your sales.

ASME Turbo Expo brings together from around the world the top players in the turbomachinery industry and academia - attracting a key audience of over 2500 delegates from aerospace, power generation and other prime mover-related industries interested in sharing the latest in turbine technology, research, development, and application.

EXHIBITION INFORMATION

Secure your booth now for prime space availability and see how this event can generate bottom-line results for your marketing dollars. Visit the **online floor plan** and reserve your booth today. Click on the desired booth space and select RESERVE BOOTH. You will then be prompted to complete an application. Contact **igtiexpo@asme.org** if you have any questions or issues with space selection.

BOOTH SPACE PRICING:

Booth Space: $32.00 USD per square foot (For island or corner booths, add $2.00 USD per sq. ft)

ALL EXHIBITORS RECEIVE:

- Exhibit space with 8' black draped booth backdrop, 3' side dividers and booth sign
- 1 technical conference padge per 100sf of exhibit space including access to the technical conference papers
- 3 booth personnel badges per 100sf of exhibit space - each including the Monday evening Welcome Reception, Monday morning Keynote and Opening Luncheon and lunch in the Hall on Tuesday, Wednesday and Thursday
- Complimentary lead retrieval unit
- Complimentary exhibit hall passes to share with customers and prospects to drive awareness of your company's booth
- Significantly discounted Technical Conference registration for company employees
- 15-word company listing in the printed Conference Program
- Discounted advertising opportunities to increase the effectiveness of this opportunity
- Product category and company description in the online exhibitor directory with press releases, logo, brochure

Stay ahead of the competition and meet your customers face to face.

SPONSORSHIP INFORMATION

Take control of your company's exposure before, during and after the event. Featuring a variety of sponsorship opportunities designed to maximize your company's visibility, the ASME Turbo Expo sponsorship program provides even more ways to stand out from the crowd and make the most of your budget. Additional opportunities and descriptions can be found at:

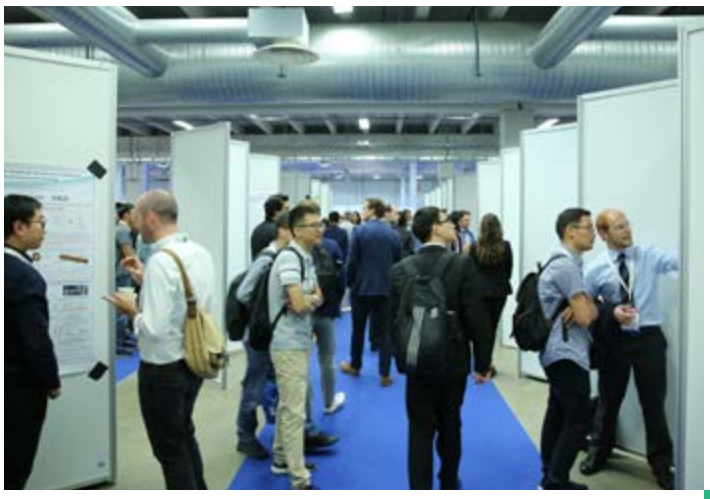
https://www.asme.org/events/turbo-expo/sponsor-exhibit.

PLATINUM CLUB: $20,000

GOLD CLUB: $15,000

SILVER CLUB: $10,000

BRONZE CLUB: $5,000



ASME 2019 Turbo Expo Exhibitors

4D Technology Corporation

ACTech North America, Inc.

Advanced Design Technology Ltd.

Aerodyn

Aeroprobe Corporation

Aikoku Alpha Corp.

Alta Solutions, Inc.

American Society of Mechanical Engineers (ASME)

AneCom AeroTest GmbH

ANSYS

APEX Turbine Testing Technologies

ASME Arizona Section

ASME Turbo Expo 2020

Bently Bearings

Calnetix Technologies

Calspan Systems Corporation

Cambridge Flow Solutions Ltd

Canadian Society for Mechanical Engineering

Capture 3D, Inc.

CEROBEAR GmbH

CFturbo Inc.

Cincinnati Control Dynamics, Inc

Cleveland Electric Labs

Combustion Science & Engineering

Concepts NREC

Creare LLC

datatel Telemetry

Diesel & Gas Turbine Worldwide

Dou Yee Technologies Pte Ltd

e+a

European Turbine Network

Flow Systems, Inc.

Flownex Simulation Environment

FOGALE nanotech

Franke Industrie AG

Fusion Inc.

Gas Turbine Society of Japan

GTI

Hansen Turbine Assemblies, Co.

Haynes International, Inc.

IfTA GmbH

Jasc-Controls

JETSEAL, Inc.

Kistler Instrument Corp

Kulite Semiconductor Products, Inc.

LG Tech-Link Global, LLC

Mechanical Engineering Magazine

Mee Industries Inc.

MMP Technology

MTU Aero Engines

National Aeronautics and Space Administration

National Research Council of Canada

Nord Lock Group

Notre Dame Turbomachinery Laboratory

NUMECA International

nVent Solutions UK Ltd

OROS

Oxford Flow

PADT, Inc.

Parker Hannifin Corporation

PCA Engineers Limited

PCB Piezotronics, Inc.

Pratt & Whitney

Präwest Präzisionswerkstätten GmbH & Co. KG.

Precision Filters, Inc.

Renishaw Inc

Sabalcore Computing Inc.

Scanivalve

Sensor Coating Systems Limited

Siemens PLM Software

SmartUQ

SoftInWay Inc.

Southwest Research Institute

TE Connectivity

TEES - Turbomachinery Laboratory

Torquemeters Ltd.

Turbocam International

Turbomachinery International

Turbostream Ltd

Tutco SureHeat

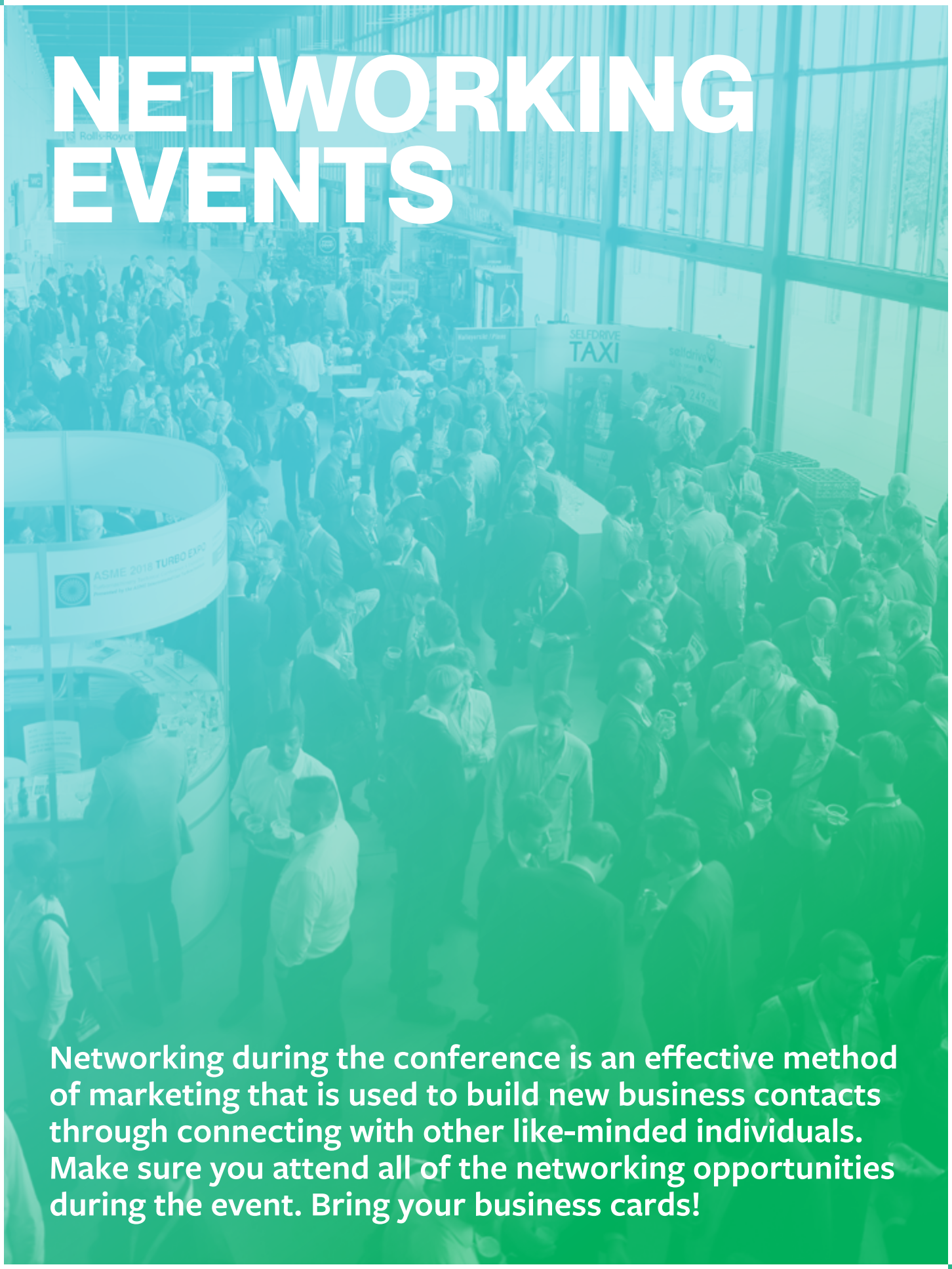
University of Stuttgart, ITSM

Vectoflow GmbH

Waukesha Bearings Corporation

Click here to view the current floor plan and exhibitor list.

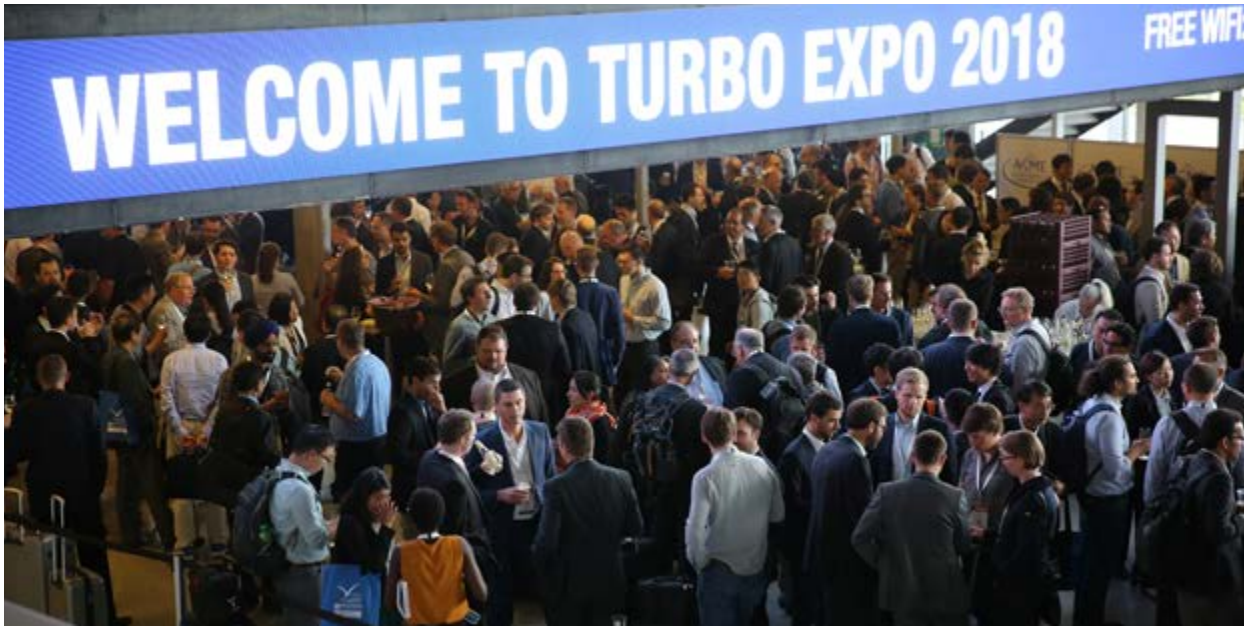
NETWORKING EVENTS



Networking during the conference is an effective method of marketing that is used to build new business contacts through connecting with other like-minded individuals. Make sure you attend all of the networking opportunities during the event. Bring your business cards!

Welcome Reception

All Conference registrants are invited to join their colleagues for complimentary light refreshments during the Monday evening event. In a casual atmosphere, greet friends and meet the thinkers from around the world who are shaping the future of turbomachinery.



Daily Lunches

All Technical Conference delegate badges as well as exhibit booth staff badges include a daily lunch. Additional lunches for guests can be purchased onsite during registration. Take the time during lunch to walk the exhibit floor and visit the many exhibitors from around the world showcasing their products and services.

Expo Hall Receptions

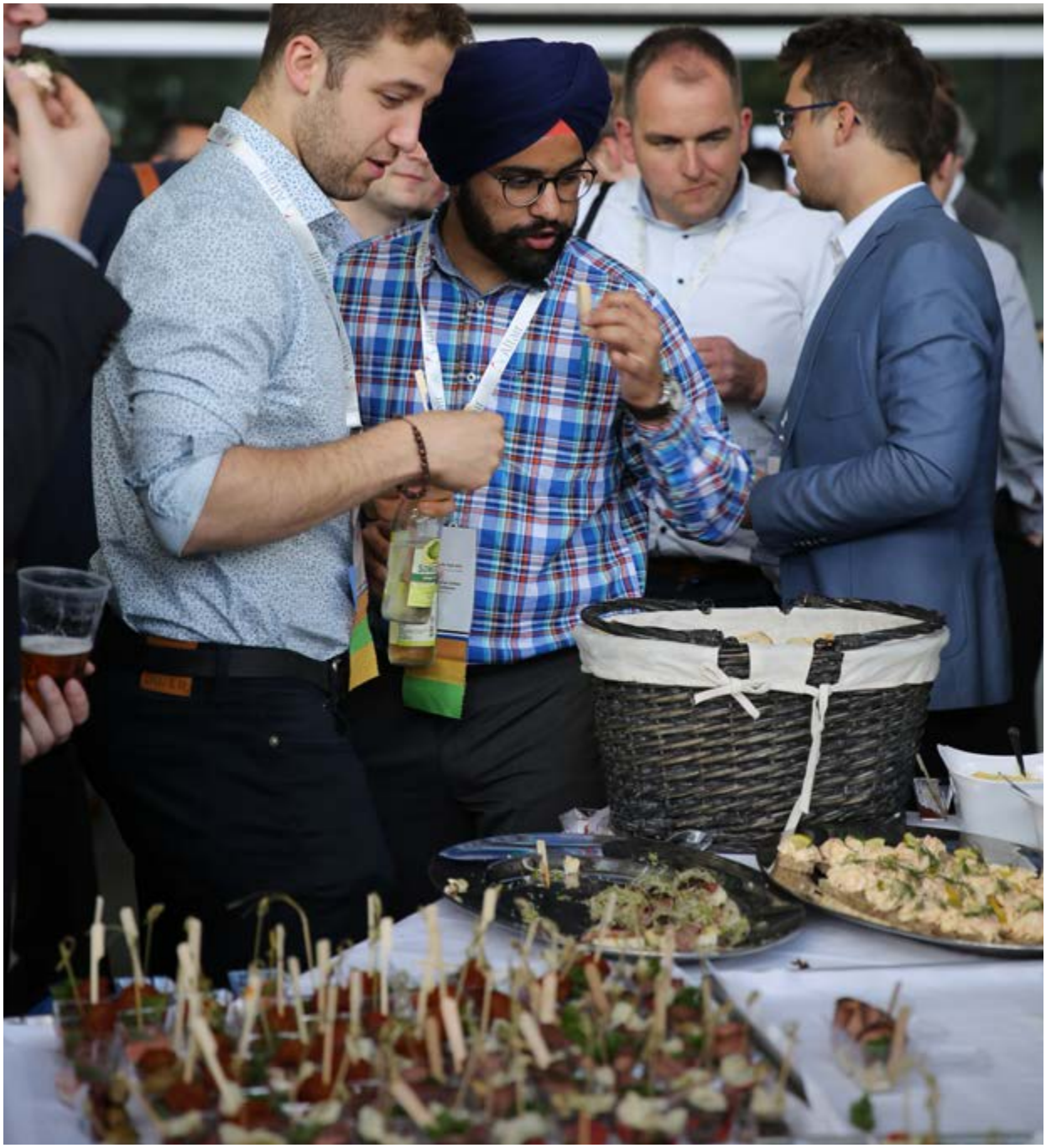
TUESDAY & WEDNESDAY, JUNE 18 & 19 | 5:00 - 6:30 PM

All registered delegates are invited to the Expo Hall for complimentary drinks and networking with industry colleagues, while viewing the exhibits of the industry's leading companies.

Young Engineer & Student Mixer

WEDNESDAY, JUNE 19 | 6:45 - 8:00 PM

Unwind after a full day of technical sessions and exhibits with fellow engineering students and early career engineers. This popular event allows students to make new friends and build their professional network in a casual evening atmosphere.



Women in Engineering Networking Event

TUESDAY, JUNE 18 | 7:45 PM - 9:00 PM | SPONSORED BY GE

Female registrants are invited to join their colleagues for a networking event that will feature a motivating talk by Katharina Kreitz of Vectoflow GmbH. Attendees will have the opportunity to network and learn about areas for success within the industry. Dinner will follow the talk and is included with your registration.

Katharina Kreitz earned her diploma from the Technical University of Munich in Mechanical Engineering, with a specialty in aviation and aerospace, and her MBA from the College des ingénieurs in Paris. While she was in school she had varied work experiences with NASA, Airbus Defense and Space, BMW, and Lufthansa Technik.

In 2014 Katharina co-founded Vectoflow, which designs and manufactures specialized probes for detailed flow measurements. Katharina is responsible for both Sales and Manufacturing.

Her personal interests include skiing, hiking, and sailing, and increasing women's participation in STEM careers and leadership positions.

Industry Participants

ASME Turbo Expo is proud to have over 2,100 Industry participants from all over the world. These individuals are active within the technical conference and participate as authors, panelists, reviewers, session organizers, session chairs, etc.

Hotel Information

Conference Headquarters Hotel

SHERATON GRAND PHOENIX
340 NORTH 3RD STREET
PHOENIX, AZ 85004

RATE — $159 USD
RESERVATION CUT-OFF DATE — MAY 24, 2019
MAKE YOUR RESERVATIONS TODAY ONLINE

Situated in the heart of downtown Phoenix, the hotel is within walking distance to the Phoenix Convention Center and approximately five miles from the Phoenix Sky Harbor International Airport.

REGISTRATION INFORMATION

Be sure to register for ASME Turbo Expo as soon as possible as rates will increase as the conference approaches. Continue reading to see full details on rates and benefits.

Registration ALL FEES ARE IN USD

TECHNICAL CONFERENCE REGISTRATION

- Access to every session in the Technical Conference
- Final Papers DVD comprised of all papers published for TURBO EXPO 2019
- Professional Development Hours (PDHs) Certificate
- Admission to the following networking events:
  - Grand Opening: Turbo Expo Keynote Panel & Awards Program (June 17)
  - Welcome Reception (June 17)
  - Tuesday Plenary Panel Aviation Focus (June 18)
  - Wednesday Plenary Panel Power Focus (June 19)
  - Daily Lunch (June 17 – 21)
- Exhibition (June 18 – 20)
- Exhibit Hall Reception (June 18 – 19)
- Opportunity to attend Facility Tours

REGISTRATION TYPE	*Register on or before* **APRIL 22, 2019**	*Register after* **APRIL 22, 2019**
ASME Member 5-Day	850	1000
ASME Member 3-Day	650	800
The following may register at the discounted Member rate(s): • ASME Members • Point Contacts, Vanguard Chairs • Session Chairs, Session Co-Chairs • Authors, Presenters, Speakers • ASME IGTI Committee Members • Active Military • Members of Reciprocating or Participating Organizations		
ASME Life Member 5-Day	375	525
Platinum Sponsor Employee 5-Day	625	775
Exhibiting Company Employee 5-Day	665	815
Non-Member 5-Day	1000	1150
Non-Member 3-Day	675	825
Student Member 5-Day	375	525
Student Non-Member 5-Day	425	575

For Group Registration (10+ or 20+) contact igtiprogram@asme.org.
Group Registrations must be paid in full by June 3, 2019.

Registration ALL FEES ARE IN USD

EXHIBITION PERSONNEL

- Admission to the following networking events:
  - Grand Opening: Turbo Expo Keynote Panel & Awards Program (June 17)
  - Welcome Reception (June 17)
  - Tuesday Plenary Panel (June 18)
  - Wednesday Plenary Panel (June 19)
  - Daily Lunch (June 17 – 21)
- Opportunity to attend Facility Tours

REGISTRATION TYPE	*Register on or before* **APRIL 22, 2019**	*Register after* **APRIL 22, 2019**
Booth Personnel	FREE	FREE
Three (3) free badges per 100 sf of booth space.		
Additional Booth Personnel	200	200
Booth purchase includes one technical conference badge per 9 sqm of booth space. Contact **igtiexpo@asme.org** for more information.		

WORKSHOPS

All pre-conference workshops will take place at the Phoenix Convention Center on Sunday, June 16th.

**Subject to cancellation if the minimum number of registrations is not achieved. Must register by April 22, 2019.

Workshop 1	8:00 am - 5:00 pm	Physics-Based Modeling of Gas Turbine Secondary Air Systems	$300
Workshop 2	8:00 am - 5:00 pm	Basic Gas Turbine Metallurgy and Repair Technology Workshop	$300
Workshop 3	8:00 am - 6:00 pm	Gas Turbine Aerothermodynamics and Performance Calculations	$300
Workshop 4	8:00 am - 5:00 pm	Primer on Gas Turbine Power Augmentation Technologies	$300
Workshop 5	8:00 am - 12:00 pm	Introduction to Probabilistic Analysis and Uncertainty Quantification	$200
Workshop 6	8:00 am - 12:00 pm	Design and Simulation for Turbomachinery Additive Manufacturing	$200
Workshop 7	8:00 am - 12:00 pm	Advancements in Turbomachinery Development for Electric Propulsion	$200
Workshop 8	8:00 am - 12:00 pm	Rotor Dynamics Analysis and Bearing Design for High Speed Turbochargers/Generators	$200

REGISTRATION TYPE	*Register on or before* **APRIL 22, 2019**	*Register after* **APRIL 22, 2019**
Visitor/Guest 3-Day	150	150
Additional Lunch	50	

Registration ALL FEES ARE IN USD

VISITOR/GUEST

- Admission to the following networking events:
  - Welcome Reception (June 17)
  - Exhibition and Exhibition Receptions (June 18 – 19)

REGISTRATION TYPE	*Register on or before* **APRIL 22, 2019**	*Register after* **APRIL 22, 2019**
Visitor/Guest 3-Day	150	150
Additional Lunch	50	

FREE ASME MEMBERSHIP

The following paid registrants will receive a free one-year ASME membership:

- Non-Member 5-Day/Non-Member 3-Day
- Student Non-Member 5-Day

ASME will contact eligible registrants and invite them to join within 90 days after the conference. For more information, visit ASME Membership.

CANCELLATION/REFUND POLICY

- Cancellations received on or before May 13, 2019 will receive a full refund, less a USD 200 administrative fee.
- No refunds will be granted after May 13, 2019. NO EXCEPTIONS. No-shows will not be eligible for refunds.

VISAS AND LETTERS OF INVITATION

You will be able to request your Conference Letter of Invitation during the Registration process.

REGISTRATION INQUIRIES

Contact us at **igtiprogram@asme.org**.

Schedule at a Glance

SUNDAY JUNE 16	MONDAY JUNE 17	TUESDAY JUNE 18	WEDNESDAY JUNE 19	THURSDAY JUNE 20	FRIDAY JUNE 21
	Registration 7:00 am - 5:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 6:30 pm	**Registration** 7:00 am - 5:30 pm	**Registration** 7:00 am - 3:00 pm
	Speaker Ready Room 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 5:30 pm	**Speaker Ready Room** 7:00 am - 3:30 pm
	Session Participant Networking Coffee 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am	**Session Participant Networking Coffee** 7:00 - 7:45 am
GT Workshops 8:00 am - 5:00 pm	**Conference Sessions** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 9:30 am	**Conference Sessions** 8:00 - 9:30 am	**Conference Sessions** 8:00 - 10:00 am	**Conference Sessions** 8:00 - 10:00 am
	Coffee Break 10:00 - 10:15 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 9:30 - 9:40 am	**Coffee Break** 10:00 - 10:15 am	**Coffee Break** 10:00 - 10:15 am
	Opening Session **Turbo Expo Keynote Panel: Turbomachines for Clean Power and Propulsion Systems** 10:15 am - 12:15 pm	**Plenary: Aviation Focus** 9:40 am - 11:10 am	**Plenary: Power Focus** 9:40 am - 11:10 am	**Conference Sessions** 10:15 am - 12:15 pm	**Conference Sessions** 10:15 am - 12:15 pm
		Conference Sessions 11:15 am - 12:45 pm	**Conference Sessions** 11:15 am - 12:45 pm		**Special Session: Planning for your Next Big Life Transition** 10:15 am - 12:45 pm
Registration 12:00 - 6:00 pm		**Expo Open** 12:30 – 6:30 pm	**Expo Open** 12:30 – 6:30 pm	**Expo Open** 11:30 am – 2:30 pm	
Speaker Ready Room 12:00 - 6:00 pm	**Opening Lunch** 12:30 – 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm **Poster Session** 12:15 - 2:00 pm	**Expo Lunch** 12:30 - 2:00 pm	**Expo Lunch** 12:15 - 2:00 pm **Closing Ceremony** 1:30 pm	**Closing Lunch** 12:30 - 2:00 pm
Gas Turbine Segment Meeting 1:00 - 5:00 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm	**Conference Sessions** 2:00 - 3:30 pm
	Coffee Break 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm	**Coffee Break** 3:30 - 4:00 pm
	Conference Sessions 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm	**Conference Sessions** 4:00 - 5:30 pm
	Scholar Lecture 5:45 - 7:00 pm	**Expo Hall Reception** 5:00 - 6:30 pm	**Expo Hall Reception** 5:00 - 6:30 pm		
Council of Chairs Meeting 6:00 - 7:30 pm	**Welcome Reception** 7:00 - 8:30 pm	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	**Committee Meetings** 6:00 - 7:30 pm	
		Women in Engineering Event/ Dinner 7:45 - 10:00 pm	**ECE/Student Mixer** 6:45 - 8:00 pm		

SCHEDULE SUBJECT TO CHANGE

FOCUS TRACKS

Focus Tracks

TURBOMACHINES FOR CLEAN POWER AND PROPULSION SYSTEMS

Recent regulatory changes and market forces require future power and propulsion systems to be "clean". This emphasis on clean energy has led to increased use of renewables for power generation requiring greater flexibility in operation. For aviation, there is a push to reduce emissions using bio-fuels and electric propulsion concepts that change traditional turbomachinery architecture. Emerging trends and challenges associated with bringing clean energy technologies to fruition will be highlighted at TE19 via keynote, plenary sessions, tutorials, panels, and technical papers. The Gas Turbine Segment and IGTI Leadership Team, as well as TE Committees, strongly believe that having a focus track on Turbomachines for Clean Power and Propulsion during TE19 will benefit the Turbo Expo community.

The TE19 technical paper abstracts submission deadline on various aspects of Turbomachines for Clean Power and Propulsion has passed. These topics are of great interest to the technical committees for a series of sessions, including joint sessions, on Turbomachines for Clean Power and Propulsion.

Turbomachines for Clean Power and Propulsion Systems is a single track (avoiding overlapping sessions if possible) that will address the various aspects of this emerging area. This topic, which is also the conference theme, will be highlighted at the keynote session. It will be followed by plenary and panel sessions with experts discussing the challenges and impact of this latest trend and technical sessions that will delve deeper into this subject. It is planned to supplement the Turbomachines for Clean Power and Propulsion track with exhibitors showing their latest capabilities and equipment. The goal is to generate and capture the basic and applied R&D and know- how for the Turbo Expo community.

TRACK, SESSION, PAPER NO., AND PAPER TITLE

Aircraft Engine

- *Whole Engine Performance and Novel Concepts*
  - **GT2019-90175** Impact of Engine Degradation on Optimum Aircraft Trajectories - Short Range
  - **GT2019-90788** Similarity Study of Lightly Loaded Shrouded Rotors for Distributed Propulsion
- *Modeling, Simulation and Validation*
  - **GT2019-92011** Integrated Turbine Design Using Evolutionary Strategies to Minimize Fuel Burn

Coal, Biomass, Hydrogen & Alternative Fuels

- *Micro Gas Turbine: Combustion and Fuels*
  - **GT2019-91483** A Biogas Fueled Micro Gas Turbine: Energetic Performance and Environmental Impact Analysis

Oil & Gas Applications

- *Performance Analysis*
  - **GT2019-90610** Optimized SGT-A35 (GT61) for Improved Emissions and Enhanced Efficiency Across the Load Range

Turbomachinery: Axial Flow Fan & Compressor Aerodynamics

- *Transonic Compressors*
  - **GT2019-91363** Flow mechanism and Design Methodology of Supersonic Aspirated Compressor Blading under Shockwave/Boundary Layer Interactions

Turbomachinery: Design Methods & CFD Modeling for Turbomachinery

- *Novel Solver and Simulation Framework (3)*
  - **GT2019-91314** Prediction of Film Thickness of an Aero-Engine Bearing Chamber using Coupled VOF and Thin Film Model

Focus Tracks

MAINTENANCE, REPAIR AND OVERHAUL (MRO) FOR TURBOMACHINERY IN THE LIGHT OF DIGITALIZATION

The latest trends in digitalization not only affect the way turbomachines are designed, but also have an impact on Maintenance, Repair and Overhaul (MRO). Today, turbomachines are monitored extensively using advanced sensor technology providing data that is processed in sophisticated models. The combination of digital replicas that account for a variety of physical phenomena along with pinpoint repair technology and customized manufacturing is revolutionizing the MRO sector. These aspects were introduced at TE18 in Oslo via plenary sessions, tutorials, panels, and technical papers. The Gas Turbine Segment and IGTI Leadership Team, as well as TE Committees, strongly believe that continued concentration on MRO/Digital during TE19 will benefit the Turbo Expo community.

Many of the TE Committees are interested in MRO/Digital. For TE19, abstracts for technical papers on the various aspects of MRO/Digital have been submitted. These topics are of high interest to the technical committees for a series of sessions, including joint sessions, on MRO/Digital.

MRO/Digital is a single track (avoiding overlapping sessions if possible) that will address the various aspects of MRO/Digital for turbomachinery. The focus track will have tutorial and panel sessions to build upon the momentum from 2018, and, along with technical papers discuss the impact of latest trends in digitalization and advanced repair technologies on the MRO sector. It is planned to supplement the MRO/Digital track with exhibitors showing their latest capabilities and equipment. The goal is to generate and capture the basic and applied R&D and know- how for the Turbo Expo community.

TRACK, SESSION, PAPER NO., AND PAPER TITLE

Controls, Diagnostics & Instrumentation

- *Topics in Diagnostics*
  - **GT2019-91150** Vibration Based Condition Monitoring of Helicopter Gearboxes Based on Cyclostationary Analysis
- *Data Analytics and Reasoning for Diagnostics*
  - **GT2019-91259** Turning Dynamic Sensor Measurements from Gas Turbines into Insights: A Big Data Approach

Industrial & Cogeneration

- *Co-Generation Power Plant Performance, Operation and Condition-Based Maintenance*
  - **GT2019-90686** Application of Adaptive GPA To an Industrial Gas Turbine Using Field Data

Manufacturing Materials & Metallurgy

- *Additive Manufacturing: Structures and Performance*
  - **GT2019-91419** A Novel Solid-State Additive Manufacturing Technology in Support of Turbomachinery Sustainment

Turbomachinery: Axial Flow Fan & Compressor Aerodynamics

- *Manufacturing, Deterioration, Damage Effects*
  - **GT2019-91310** Accuracy Assessment of Steady and Unsteady Multistage High-Pressure Compressor Simulations

Turbomachinery: Multidisciplinary Design Approaches, Optimization & Uncertainty Quantification

- *UQ, Manufacturing Uncertainties & FOD*
  - **GT2019-90378** A Novel Methodology for Detecting Foreign Object Damage on Compressor Blading

Wind Energy

- *Condition monitoring and reliability*
  - **GT2019-91136** Condition Monitoring of Wind Turbine Planetary Gearboxes Under Different Operating Conditions

ASME Gas Turbine Segment

Richard Dennis
Leader
DOE, National Energy Technology Laboratory

Nicole Key
Vice Leader, Sector Council Representative
Purdue University

Paul Garbett
Member
Siemens

Eisaku Ito
Member
MHI

Anestis Kalfas
Member
Aristotle University of Thessaloniki

James Maughan
Member, Treasurer
GE

Jaroslaw Swedowicz
Member
Siemens

Mark Zelesky
Member
Pratt & Whitney

Damian Vogt
Member, IGTI EC Chair, TEOC Liason
University of Stuttgart

Ruben Del Rosario
Special Advisor
NASA

Tim Lieuwen
Special Advisor, Clean Energy TAP Member
Georgia Institute of Technology

TURBO EXPO ORGANIZING COMMITTEE

Atul Kohli
Conference Chair
Pratt & Whitney

Ruben Del Rosario
Executive Conference Chair
NASA

Harald Schoenenborn
Technical Program Chair
MTU Aero Engines AG

Patricia Cargill
Review Team Advisor
GE Aviation

Dilip Prasad
Review Chair
Pratt & Whitney

Wing Ng
Vice Review Chair
Virginia Tech

Graham Pullan
Vice Review Chair
University of Cambridge

Ardeshir Riahi
Vice Review Chair
Honeywell Aerospace

Bob Rasmussen
Local Liaison Chair
Honeywell Aerospace

David G. Bogard
Tutorial Chair
The University of Texas

Damian Vogt
Gas Turbine Segment Liaison
University of Stuttgart

STUDENT NEWS

Student News

The Student Advisory Committee (SAC)is a group of students who work to foster student engagement in the IGTI community and improve the Turbo Expo conference every year. Towards this goal, the SAC organizes various sessions and events during the conference, provides opportunities for students to work behind the scenes with leaders in their technical area, and awards travel funds to eligible degree seeking individuals.

SAC COMMITTEE MEMBERS

Chair
Wisher Paudel, *Duke University*

Vice Chair
Shawn Siroka, *Penn State University*

Secretary
Samuel Barak, *University of Central Florida*

Past-Chair
Zhiping Mao, *Duke University*

SAC SESSIONS AT TURBO EXPO

The sessions organized by the SAC during the technical conference are focused on professional development and are open to all conference attendees. In previous years, the SAC has curated panel sessions led by community leaders on Turbomachinery Careers and Networking, as well as tutorial sessions titled "Effective Technical Presentations", and "The Art of the Peer Review Process".

POSTER SESSION

The Student Advisory Committee is once again sponsoring a student poster session at ASME Turbo Expo. Student posters will be on display on the main exposition floor on Tuesday, June 18th from 12:15 – 2:00 p.m. Be sure to stop by the poster session to see the results of their work and encourage them to become active in the ASME IGTI community.

CASH PRIZES FOR POSTER SESSION WINNERS

1st Place - $500

2nd Place - $250

People's Choice - $100

TECHNICAL COMMITTEE STUDENT LIASON APPLICATION

Applications are now being accepted to join the student liaison subcommittee designed to encourage interaction between the Student Advisory Committee (SAC) and the ASME IGTI technical committees. The student will be expected to serve as a link between the SAC and the leadership of the technical committee to which they are assigned. The potential outcomes of this relationship include, but are not limited to, collaboration for future tutorial sessions at IGTI Turbo Expo, communication of ideas and announcements between the SAC and the technical committee, and opportunities for professional development.

Applicants for these positions must be students who are or plan to be members of the SAC. The liaison will be expected to communicate directly with the leadership of the technical committee to which they are assigned. Further, the liaison should be in attendance at the ASME Turbo Expo 2019 Conference in Phoenix, AZ USA. Because attendance at Turbo Expo may not be guaranteed, applicants should apply with the intention to attend Turbo Expo 2019. Communication with the SAC leadership team may be requested prior to, during, and following Turbo Expo. The service period will extend from April 1, 2019 to March 31, 2020. Additional expectations may be outlined by the SAC leadership team, but not without input from the liaison.

To apply for a position as a liaison to the IGTI technical committees on behalf of SAC, please submit a resume or CV with the application to the SAC via email at sac.igti@gmail. com by March 1, 2019. If several applicants desire to represent the same technical committee, the SAC leadership team will choose representatives based on the contents of this application. You will be notified of the status of your application by March 29, 2019.

Download the Application

STUDENT/EARLY CAREER MIXER

Wednesday, June 19 6:45 – 8:00 p.m.

Unwind after a full day of technical sessions and exhibits with fellow engineering students and early career engineers. This popular event allows students to make new friends and build their professional network in a casual evening atmosphere. Complimentary refreshments will be provided.

ASME WANTS TO HELP YOU MAKE A DIFFERENCE IN MECHANICAL ENGINEERING BY PROVIDING UP TO

$350,000 in Scholarships

FOR ASME STUDENT MEMBERS

APPLICATION DEADLINE
MARCH 1, 2019

APPLY NOW

Is the financial burden of paying for education stressing you out? Are you working several jobs to pay for classes? Don't fret — ASME is here to help!

ASME has several scholarships available and we're looking for outstanding engineering students, like you, to take advantage of this opportunity and contribute to the turbomachinery community.

Here's what you need to know before applying:

- We have 60+ scholarships available--for both undergraduate, and graduate students.
- Scholarship money is paid to the recipient's academic institution.
- By completing a single electronic application you will be applying for any ASME Scholarships for which you may be eligible, including the ASME IGTI Student Scholarship for students focusing on the turbomachinery field.
- For ME/MET students enrolled full-time in a college or university during the 2018-2019 academic year.
- Students who demonstrate a high level of financial need--we want to help you graduate!
- Established college level GPA, minimum 2.5 out of 4.0

HOW IT WORKS:

1. **Step 1:** Become an ASME Student Member if you aren't already. Join **ASME online** or call ASME Customer Care at **(800) 843-2763**.
2. **Step 2:** Read the details about available ASME Scholarships and your eligibility by visiting the interactive **Scholarship Webpage**; then click on **How to Apply**. You will find the "APPLY" button on this page.
3. **Step 3:** Login to the online scholarship application using your ASME Member number and the email address on record with ASME. When prompted use the Program Key: **ASMEU**
4. **Step 4:** Ask a faculty member, professor or supervising engineer who knows your work to submit a recommendation letter through our online portal.
5. **FINISH:** Applications must be **fully** completed and submitted by the March 1st deadline.

Please note that these scholarships are only for full-time students who have declared ME or MET related majors and that have already established a college level GPA.

GET AHEAD OF THE GAME!

Submit early to be considered for all ASME Scholarships through one online application!

QUESTIONS

For questions regarding the scholarship program or applying **click here**, call toll free (U.S. applicants only) **(855) 276-3734**, or email us directly at **ASME.University@applyISTS.com**. Our offices are open Monday through Friday from 8:00 AM to 5:00 PM Central.

NUMECA INTERNATIONAL

Boost your performance in Design - Analysis - Optimization

OMNIS™ Platform - Integrated environment for multidisciplinary simulation and optimization

NEW: Lattice Boltzmann and **Navier Stokes** in one environment

Turbo-machinery

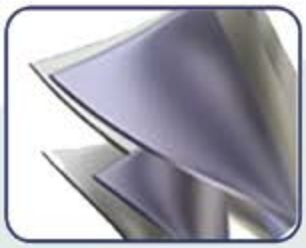
Multiphysics & External Aero

Meshing

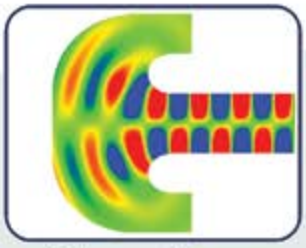
Marine

From preliminary, meanline design to detailed 3D steady & unsteady CFD

Full engine simulation with NLH



Robust Design Optimization with Uncertainty Quantification



Fully coupled aero-vibro-acoustics suite with wizard-based automation

Visit us at **booth #519**

FREE Lunch & Learn session Tuesday, June 18

NUMECA

Advanced developments for better products