global
Gas Turbine News
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ASME IGTI mechanical engineering magazine

In this issue

Register Today for ASME Turbo Expo 2011

The advance program, event registration, and housing reservations for Turbo Expo 2011 in Vancouver are now available online at www.turboexpo.org! ***Early registration discount ends May 9.***

Walter DiBartolomeo Roland Fischer Gary Mercer

KEYNOTE SPEAKERS ANNOUNCED

Three leaders from the aeroengine and power generation industry will highlight current development needs and trends by addressing the theme *"Clean & Efficient Turbomachinery Technologies for Future Low Carbon Economies"* at Turbo Expo in Vancouver.

Walter DiBartolomeo, Vice President Engineering, Pratt & Whitney Canada; **Roland Fischer**, CEO Business Unit Products, Fossil Power Generation, Siemens Energy Sector; and **Gary Mercer**, Senior General Manager in Engineering, GE Infrastructure Energy, will all speak at the opening keynote on Monday, June 6.

TURBO EXPO
Turbine Technical Conference & Exposition
Presented by ASME International Gas Turbine Institute

TECHNICAL CONFERENCE

Turbo Expo has a well-earned reputation for bringing together the best and brightest experts from around the world to share the latest in gas turbine technology, research and development, and application. Now, the IGTI community is enhancing its leadership role in turbomachinery as it broadens the program scope to include related topics from wind and steam turbine technology as well as fans and blowers and the Solar Brayton and Rankine Cycle. The 2011 Technical Conference proceedings, alone, are worth the price of admission, as the DVD will contain over 1,000 peer-reviewed publications!

EXPOSITION

Turbo Expo is known for its high-quality, 3-day exhibition of gas turbine products and services, supported by prestigious companies such as ANSYS, CD-adapco, GE, Pratt & Whitney, Sulzer Metco, and many more! Daily lunches plus afternoon networking receptions in the Expo Hall are included in the registration package for delegates and exhibitors.

DON'T MISS THESE TURBO EXPO EVENTS:

CAREER DEVELOPMENT COURSES

Taking place just before the conference begins, our Turbo Expo short courses provide focused, fundamental training. Choose from several courses to be held Saturday and Sunday, June 4-5, 2011. See page 54 for more details and visit www.turboexpo.org to register.

ANNUAL WOMEN'S DINNER

Women working in the turbomachinery industry who register for Turbo Expo are eligible to attend our women's networking reception and dinner. The dinner will be held during Turbo Expo on Tuesday evening, June 7, 2011. This year the dinner will feature speakers Susan Scofield, head of the Siemens Gas Turbine Future Frames Department and Lisa Burgarella, Director of Information Technology, Pratt & Whitney.

SPECIAL NETWORKING EVENT FOR YOUNG ENGINEERS

While attending Turbo Expo 2011, young engineers won't want to miss a ***special networking event on Wed., June 8, for rising engineers***. This special networking event will give young engineers the opportunity to meet a variety of representatives from the turbomachinery industry as well as members of IGTI's technical committees. Come and meet potential mentors and seek advice from industry experts during Turbo Expo in Vancouver! **Visit www.turbo.expo.org today for more details and to register.** Students qualify for discounted registration.

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View From The Chair

By Ron S. Bunker, Ph.D., Chairman of the IGTI Board

Ron is a Principal Engineer in the Energy & Propulsion Technology Labs of the GE Global Research Center in Niskayuna, New York. bunker@ge.com.

This issue of the *Global Gas Turbine News* (GGTN), the quarterly news and events letter of the ASME International Gas Turbine Institute, is my fourth and final View from the Chair coming just prior to Turbo Expo 2011 in Vancouver, British Columbia. It seems as though I started these articles just yesterday. In the last three Views, I have discussed the ASME Energy Challenge and its relationship to IGTI, Turbo Expo growth and diversity, paper quality, the new no-show author policy, the Institute Sector Board within ASME, and the current Institutes (IGTI and IPTI) as role models for ASME growth. In short, the focus has been on maintaining IGTI as the premier organization for the development and dissemination of gas turbine educational and technological information, and on the growth of IGTI to meet new challenges globally with our typical high quality. In this View, I will continue the discussion by addressing two more subjects in the same vein.

First, IGTI has an array of Technical Committees (TC) that individually and collectively represent the best minds and talent from around the world in their respective specialties. Many of these TC's could, if they desired, organize and conduct well-attended technical symposiums separate from Turbo Expo. Such symposiums would be of a more intimate nature with perhaps 200 to 300 persons and limited to either one or two parallel technical presentation sessions. Indeed, many of you will know of similar symposiums organized by other associations and international centers. I recently issued a proposal to the IGTI TC chairs and vice-chairs to take up the challenge of creating technical symposiums under the auspices of IGTI, and with the event planning support of the very experienced and talented IGTI staff. Several "key" IGTI technical committees, or perhaps two or three in concert, will take the lead in organizing a specialty symposium in their field, or some subset of their area. Attendees may participate in most or all presentations, so the available interactions amongst attendees can be far greater than, for example, at Turbo Expo. Given at least six "key" technical areas as already delineated by the largest TC's, the symposiums may be held on a rotating basis, though a strict schedule is not required. In other words, each key area would hold a symposium to update progress roughly once every six years, though some may be more frequent and others less so. Because of this rotating schedule, these events should not draw away too much from Turbo Expo, yet they can serve to provide more intimate focus meetings for our members. There is no minimum requirement to be a key committee or topical area, simply an identified set of volunteers willing to make an event successful, and a topic, general or specific, that addresses a need. So for example, the 2004 Aero Engine Life Management Symposium was an effort of several committees. IGTI staff and the IGTI Board will aid in identifying and communicating with potential symposium sponsors and supporting organizations, including industry and government. Means will be found to extract the archival manuscripts for inclusion in our supporting ASME journals, and perhaps even to form special issues of journals or electronic book publications. If this proposal strikes a chord with you, please take up the discussion within your TC's to get things rolling.

Second, in keeping with our commitment to excellence and quality, it gives me great pleasure to announce that our next IGTI Scholar will be Dr. Om Sharma of Pratt & Whitney Canada. Om has been a major contributor to the advancement of gas turbine technology for 40 years with expertise in turbines, compressors, fans, unsteady flows, heat transfer, transitional flows, experimental methods, and computational fluid dynamics. Om was responsible for developing loss and heat load prediction methods for P&W, contributed greatly to the design of high and low pressure turbines at P&W since 1977, introduced the use of 3-D airfoils for turbines and compressors within P&W, and initiated the use of unsteady flow calculation methods in the turbine design process. He highlighted the impact of airfoil clocking and hot streak migration in turbines, and developed technology to detect precursor to stall and active stall avoidance technology for aero engines. At Turbo Expo 2011 in Vancouver BC, Om will be presenting his scholar lecture "The Role of Physical and Numerical Experiments in the Development of High Performance Axial Flow Turbines". I hope many of you will be able to attend what is surely to be an educational and entertaining lecture. I will certainly not miss it. ✻

IGTI Welcomes New Board Members

The International Gas Turbine Institute is pleased to announce the appointment of two new Board members. Starting July 1, Dr. Howard Hodson will become Incoming Member and Dr. Allan Volponi will serve as Member-at-Large.

Dr. Howard Hodson

Hodson is Professor of Aerothermal Technology and Director of the Whittle Laboratory at the University of Cambridge. His current research is mainly concerned with the flow and heat transfer in turbomachines, and in particular with the measurement and prediction of unsteady flow and its effects on performance, tip leakage phenomena in shrouded and unshrouded machines and real geometry effects in axial compressors and turbines. Hodson has received the ASME Gas Turbine Award, the ASME Melville Medal, and Best Paper Awards from the Heat Transfer and Turbomachinery Committees of IGTI. He is a Fellow of the ASME, the Royal Academy of Engineering and the Royal Aeronautical Society. Hodson is also past chair of the IGTI Turbomachinery Committee and a member of the Heat Transfer Committee.

Volponi is Discipline Chief and Senior Fellow for Diagnostics, Prognostics and Health Management at Pratt & Whitney. His interests are in the area of propulsion health management, where he is active in the development of engine performance diagnostic systems. He is a key developer of both P&W's Advanced Diagnostics and Engine Management (ADEM) ground-based system and the enhanced Self Tuning On-board Real-time Model (eSTORM) diagnostic system. Volponi is the recipient of the 1992 Manly Memorial Medal by the SAE, the 2006 IGTI Aircraft Engine Technology Award, and the Silver Specialist and Sir Roy Fedden Awards from the Royal Aeronautical Society. He is past chair of the IGTI Controls, Diagnostics and Instrumentation Committee and an ASME Fellow. ✻

Dr. Allan Volponi

CALENDAR OF EVENTS

MAY 2011

Gas Turbine Courses at Cranfield University,
Bedfordshire, UK
http://www.cranfield.ac.uk/soe/shortcourses/gte/

May 9-13: Mechanical Integrity of Gas Turbines
May 16-20: Gas Turbine Performance
May 16-20: Gas Turbine Transient Performance:
May 16-27: Gas Turbine Component Technology

JUNE 4-5, 2011

ASME Turbo Expo Courses
Vancouver Convention & Exhibition Centre | Vancouver, BC, Canada

Saturday, June 4:	Gas Turbine Operation & Maintenance Technology & Applications of Turbine Coatings
Sat. & Sun., June 4 & 5:	Advances in Turbines Aero-Thermo-Mechanical Design & Analysis Gas Turbine Aerothermodynamics & Performance Calculations
Sunday, June 5:	Basic Gas Turbine Metallurgy & Repair Technology Introduction to Optimization Methods & Tools for Multi-Disciplinary Design in Turbomachinery

For more info and to register, visit www.turboexpo.org

JUNE 6-10, 2011

ASME Turbo Expo 2011
Vancouver Convention & Exhibition Centre | Vancouver, BC, Canada

IGTI's flagship event comprises a major turbine technical conference and exposition. Visit www.turboexpo.org for more details.

JUNE/JULY 2011

Gas Turbine Courses at Cranfield University,
Bedfordshire, UK
http://www.cranfield.ac.uk/soe/shortcourses/gte/

June 20-24: Combined Cycle Gas Turbines Course
June 27 – July 1: Gas Turbine Combustion

AUGUST 1-3, 2011

AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit
San Diego Convention Center | San Diego, CA
The objective for JPC 2011 is to identify and highlight how innovative aerospace propulsion technologies powering both new and evolving systems are being designed, tested, and flown. Visit www.aiaa.org for more details

SEPTEMBER 12-15, 2011

40th Turbomachinery Symposium
George R. Brown Convention Center | Houston, TX
The Symposium, which features technical sessions and an exposition, focuses on users concerned with maintenance, performance, troubleshooting, operation, and purchase of rotating equipment

OCTOBER 10-14, 2011

Combined Heat & Power Course
Cranfield University | Bedfordshire, UK
http://www.cranfield.ac.uk/soe/shortcourses/gte/

NOVEMBER 13-18, 2011

International Gas Turbine Congress 2011
Osaka, Japan
The IGTC'11 promises to continue the tradition of nine previous congresses held in Japan, bringing together people from academia, industry, and government to share in the latest information on developments in the field of gas turbines, turbochargers, steam turbines, and their applications. For more info, visit: http://www.gtsj.org/english/igtc/IGTC11/index.html

NOVEMBER 21-25, 2011

Gas Turbine Technology for Operations and Maintenance Engineers Course
Cranfield University | Bedfordshire, UK
http://www.cranfield.ac.uk/soe/shortcourses/gte/

JUNE 11-15, 2012

ASME Turbo Expo 2012
Bella Center | Copenhagen, Denmark
IGTI's flagship event comprises a major turbine technical conference and exposition.

JUNE 3-7, 2013

ASME Turbo Expo 2013
San Antonio Convention Center | San Antonio, TX, USA
IGTI's flagship event comprises a major turbine technical conference and exposition.

1888 WIND ENERGY TECHNOLOGY

Charles Brush's Windmill Generator 120 Years Ago!

By Derek King, BRUSH Turbogenerators Inc., www.brush.eu

Capturing the power of the wind is trumpeted around the world as a renewable energy source that can provide more and more of our electric power. Way back at the beginning of the electrical industry an engineering pioneer was already capturing the wind's energy.

Charles Francis Brush's "Colossal Windmill" was set with a 56 ft. diameter sail area and stood in the back yard of his Cleveland family mansion. As Mr. Brush was also working and patenting plate compounds which became the standard for storage batteries, the generator power was stored in 408 batteries in the house's basement.

After being started up in 1888, all of the Brush mansion's energy needs were taken care of including an extensive laboratory, 350 incandescent lights, 2 arc lamps, and 3 electric motors.

The main wheel was mounted on 20 ft. long, 6½ inch diameter shaft set in two 26 inch long self oiling bearing boxes at the top of the 60 ft. tall rectangular tower. Gear ratio from the 144 blade sail to dynamo was 1:50 with 32 inch wide belt/pulleys connecting the main shaft to the double ended dynamo. The Brush dynamo used to create the battery charging power was of the design already being supplied for lighting around the world.

What was probably the world's first "automatic voltage regulator", maintained the field controls to ensure the voltage never exceeded 90 volts. On start up dynamo output was automatically switched to charge the batteries above 75 volts plus or minus 5 volts, and limit no load voltage to below 90 volts. Generator power output was measured at 12 kW at 500 rpm and was fed to the mansion via underground conductors.

Scientific American wrote in December 1890, "The reader must not suppose that electric lighting by means of power supplied in this way is cheap, because wind costs nothing. On the contrary, the cost of the plant is so great as to more than offset the cheapness of the motive power. However, there is a great satisfaction in making use of one of nature's most unruly motive agents. . . . . It has been in continuous operation more than two years and has proved in every respect a complete success."

The windmill was improved in successive years but eventually more modern equipment became available, including the connection of the Brush property to the local electric utility. The windmill fell into disuse and was eventually dismantled around 1925.

Derek King – 10/11/2010

Post Script: This is the same Charles Brush (Born Ohio 1849: died 1929) who founded the Brush Electric Company (Cleveland) and Anglo American Brush Electric Company (London) in 1879. He also was a founder (1905) of the Linde Air Products Co. which became part of Union Carbide in 1917, and with his son Charles Brush II the Brush Laboratories in Cleveland which became Brush Wellman the specialized manufacturer of beryllium metal products. The Brush name also lives on in the Brush Electric companies (large motors, turbogenerators, switchgear & transformers and railway loco) based in Loughborough UK.

Natural Gas

By Dr. Rainer Kurz, Manager, Systems Analysis, Solar Turbines Incorporated, www.solarturbines.com

In a recent article in *Mechanical Engineering* (Vol. 133, No.1, Jan 2011), John Reilly and Allison Crimmins discuss the future of energy supply in the light of economic, political and technological reality. Primary energy use, closely related to income, may more than double by the end of the century. And, it has to be asked how much of that increase will be from alternative energies, and how much from fossil fuels. It is a common misunderstanding that we are running out of fossil fuel (and I remember learning that in high school in the 70's, with clearly defined dates for the end of oil reserves in the early 2000's), but that is not the case. A study by MIT concludes that, absent climate policies that would impact energy prices, 80% of primary energy in 2100 will be supplied by fossil fuels, despite a ten fold increase in renewable energy and a 8.5 fold increase in nuclear energy. And just recently, in the latest State of the Union address, President Obama mentioned the importance of natural gas for the future energy mix in the United States.

The authors also point out that renewable energy sources are not free of environmental risks, either:

Wind turbines, deployed on a scale to meet 10% of the energy demand, could result in the stagnation of surface air, with potential impact on local warming and large-scale precipitation patterns. Bio fuels may create large indirect emissions and have indirect effects on water use and food supply.

While advanced new technologies will be needed in later years, significant emissions reductions can be achieved now, with current technologies. Due to the composition of natural gas, as well as the very high efficiency of modern gas turbines, electricity from natural gas causes much lower greenhouse gas emissions, as well as other emissions, than electricity from coal or oil fired power plants. Natural gas is found in reservoirs in many parts of the world. Lately, huge additional gas reservoirs have been exploited in the United States and elsewhere in the world.

This article intends to highlight the importance of gas turbines, centrifugal compressors and pumps, and other turbomachines in processes that bring natural gas to the end users.

To be useful, the natural gas coming from a large number of small wells has to be gathered. This process requires compression of the gas in several stages, before it is processed in a gas plant, where contaminants and heavier hydrocarbons are stripped from the gas. From the gas plant, the gas is recompressed and fed into a pipeline. In all these compression processes, centrifugal gas compressors driven by industrial gas turbines or electric motors play an important role.

Natural gas is also produced as a by-product of oil production: so-called associated gas. Turbomachines are used in a variety of applications for the production of oil and associated gas. For example, gas turbine generator sets often provide electrical power for offshore platforms or remote oil and gas fields. Offshore platforms, or FPSO's, have a large electrical demand, often requiring multiple large gas turbine generator sets. The natural gas is separated from the oil and cleaned before being used as a fuel for these gas turbines. Gas turbines are also used to drive compressors that re-inject gas into the well or the reservoir to maximize oil recovery.

The remaining gas is pumped via gas turbine driven export compressors to an onshore gas plant. Since oil production is often conducted off shore, these export pipelines run sub-sea.

Centrifugal gas compressors, driven by gas turbines or by electric motors are the benchmark products to pump gas through pipelines, anywhere in the world. Many developing countries with booming economies, such as China, India and Brazil, invest heavily in the expansion of their gas pipeline infrastructure. The pipelines transport gas from the oil and gas fields to gas fired power plants, industrial and residential users, sometimes thousands of miles away from the gas reservoir. Gas is also transported to large LNG plants, where the gas is liquefied to be shipped on tankers around the world. Along the way, gas may be stored in large underground cavities to balance supply and demand – and for this duty we also find many opportunities for gas turbine or electric motor driven centrifugal compressors.

Innovation in this key application of industrial turbomachinery will further increase efficiency, safety and reliability in the operation, and reduce the environmental impact. Many of these developments, including the integration of turbomachinery in the users' process, are possible by close cooperation between manufacturers and users of these machines. ✲

ASME Turbo Expo 2011 . . . CONTINUED FROM PAGE 49

FACILITY TOURS

Turbo 2011 will offer a variety of facility tours on Friday, June 10:

National Research Council Institute for Fuel Cell Innovation Located in the heart of the Vancouver fuel cell technology cluster, the NRC Institute for Fuel Cell Innovation (NRC-IFCI) supports Canadian leadership in clean energy technology by addressing industry-defined R&D and commercialization priorities.

MTU – Turbine Engine Overhaul Facility The Vancouver facility holds all OEM licenses required to repair and overhaul GE CF6-50 and CFMI CFM56-3 engines. Apart from accessory repairs in its own shop, the company also offers LRU (Line Replaceable Units) management services, which play an increasing role in MTU's service offerings.

Terasen Gas Terasen Gas develops and delivers alternative energy solutions, including district energy and geoexchange. They deliver energy to 96 per cent of the province's natural gas customers.

For more detailed tour descriptions, visit www.turboexpo.org.

**Space is limited for all tours. All tours are conducted at the discretion of the host company and under the conditions the company establishes, including restrictions and pre-screening of participants. All tours are subject to cancellation.* ✲

DOE-Sponsored University Research Program Develops Technology and People for the Gas Turbine Industry

By William H. Day, Ph. D., Leonardo Technologies, Inc. (LTI), Contractor for the US Department of Energy / NETL

The US Department of Energy's University Turbine Systems Research (UTSR) Program provides funding to universities to develop key technologies for advanced gas turbines operating cleanly and efficiently using coal-derived synthetic gas, hydrogen fuels, and other fossil fuels. This research focuses on the areas of combustion, aerodynamics, heat transfer, and materials in support of the Advanced Turbine Program goals of DOE's Office of Fossil Energy. The research is done by an informal network of universities, the collaborating companies in the gas turbine industry, and DOE's Advanced Turbine Program.

The UTSR Program includes a Gas Turbine Industrial Fellowship, funded by sponsoring GT manufacturers. This fellowship of work assignments at the manufacturers' facilities helps facilitate the transition of the best students from academia to the GT industry, thereby helping to maintain U.S. leadership in this important technology area.

UTSR projects are established through an annual competitive solicitation open to all U.S. universities. The solicitation's R&D topics are established in response to overall program goals and given specific focus through communications with the GT industry. An annual UTSR workshop is held to facilitate technical communications between the GT industry, academia, and the DOE and to provide a critical peer review of UTSR projects.

UTSR Projects: Following are examples of the topic areas currently being worked on by the universities.

Aero-Heat Transfer Designing turbine endwalls for deposition resistance, endwall contouring and leading edge film cooling for improved aerodynamics, deposition and film cooling effects, trenched film cooling and contoured endwalls and cooling of vane leading edges.

Combustion Combustion stability, combustion flashback, validation of H2-CO-air combustion kinetics, turbulent flame speed measurements and modeling, experimental and numerical modeling of mixing processes, high pressure kinetics, multi nozzle combustor dynamics, flame speeds and NOX kinetics with contaminants and dilution.

Materials Degradation of thermal barrier coatings (TBC) by deposition, materials for oxy-fuel turbo machinery, effects of hafnia-based nanostructure on TBC, understanding protective oxide and TBC degradation, computational designed for new TBC.

UTSR Industry Committee: The GT industry provides leadership to define the thrust of the research program solicitation consistent with DOE goals and technical experts to evaluate the university research proposals. In many ways, the GT industry is the customer for this government-funded, university-performed research; this relationship drives R&D excellence. Industry involvement includes the following: recommend research topic areas, evaluate university proposals, review and collaborative support of ongoing university research, provide funding to the Fellowship Program, host UTSR Fellows, participate in the annual UTSR workshops. Industry committee members are as follows: Clean Energy Systems, Duke Energy, Electric Power Research Institute, General Electric Company, Ingersoll Rand Energy Systems, Parker Hannifin Corporation, Pratt & Whitney/United Technologies Research Center, Precision Combustion, Inc., Siemens Energy, Inc., Solar Turbines Inc., Southern Company Services, and Woodward FST.

Gas Turbine Industrial Fellowship The Gas Turbine Industrial Fellowship (GTIF) Program, implemented by Southwest Research Institute (SwRI), is a key part of the UTSR effort. GTIF provides undergraduate and graduate level science and engineering students with the opportunity to conduct research, engineering, and design projects with leading GT industry sponsors who are members of the UTSR industry committee. Under the guidance of industry experts, selected students complete a 10–12 week summer project in a variety of areas that include heat transfer, aerodynamics, combustion, thermodynamics, advanced materials and coatings, design, manufacturing, and test and evaluation. Students prepare a final report and presentation on their project for distribution to the industry sponsors and posting on the UTSR website. Historically, over 70% of the GTIF students have taken employment in the gas turbine industry following their graduation.

In sum, the close collaboration of government, industry and academia is providing an important contribution to the continued advancement of the state of the art in gas turbines.

For more details on the UTSR Program and the annual workshop please visit the following websites: http://www.netl.doe.gov/technologies/coalpower/turbines/projects.html and http://www.netl.doe.gov/events/index.html. ✻

ASME IGTI Professional & Member Development

By Shirley Barton, IGTI Professional & Member Development Manager

Professional Development:

- IGTI partnered with Southwest Research Institute to offer four hands-on training workshops in February at the SwRI facility in San Antonio and attendance continues to grow each year. Thirty percent of the attendees were Early Career Engineers!
- IGTI continues its successful partnership with the von Karman Institute (VKI) to offer two NEW workshops: ***Advances in Turbines Aero-thermo-mechanical Design and Analysis*** and ***Introduction to Optimization Methods and Tools for Multi-disciplinary Design*** June 4 & 5 prior to Turbo Expo 2011 in Vancouver, BC, Canada.
- Turbo Expo 2011 in Vancouver will also be the venue for four other workshops. Two are new this year, ***Gas Turbine Operation and Maintenance*** and ***Technology and Applications of Turbine Coatings***. Back by popular demand, IGTI will offer ***Gas Turbine Aerothermodynamics & Performance Calculations*** and ***Basic Gas Turbine Metallurgy and Repair Technology***.

If you have a topic you think will be of value to the turbine industry and would like to present it in a webinar format or a "face-to-face" format, please contact Shirley at bartons@asme.org.

For detailed information on upcoming training events and webinars for the turbomachinery industry, please visit the IGTI web site at http://igti.asme.org/

Member Development:

Please contact Shirley Barton (bartons@asme.org) regarding information on:

- Navigating the IGTI "Who's Who" directory
- Committee member updates
- Volunteer opportunities
- IGTI Awards and Scholarships

New! The International Gas Turbine Institute Student Scholarship:

IGTI will award **10 scholarships of $2,000 each**, to students who submit all the required documentation and meet the qualifications. ***Applications will be accepted through May 15, 2011.*** Applications will be reviewed in June/July and the award winners will be notified in September and receive their scholarship in October. For application and requirements, please visit the following web page: http://igti.asme.org/Honors/

2011 ASME International Gas Turbine Institute Award Winners!

Congratulations to the following ASME International Gas Turbine Institute Award Winners who will be recognized for their contributions to the industry at the 2011 Turbo Expo at the Vancouver Convention & Exhibition Centre in Vancouver, BC, Canada, the week of June 6-10.

- **ASME Gas Turbine Award** recipients are Eric M. Curtis, John D. Denton, John P. Longley, Budimir Rosic - Whittle Laboratory, Department of Engineering, Cambridge University for their paper presented at Turbo Expo 2009, *Controlling Tip Leakage Flow over a Shrouded Turbine Rotor using an Air-Curtain,* which presents the results of a systematic study on the use of an air-curtain seal to control leakage flow in shrouded turbine rotors.
- **The Industrial Gas Turbine Technology Award:** The 2011 recipient of this award is Donald Brandt, General Electric. This award recognizes sustained personal creative scientific or technological contributions unique to electric power or mechanical drive industrial gas turbine technology.
- **The John P. Davis Award:** The recipients are Ernst Schneider, Saba Demircioglu, Susana Franco, Dirk Therkorn ALSTOM (Switzerland) Ltd., for their paper presented at Turbo Expo 2009, *Analysis Of Compressor On-Line Washing To Optimize Gas Turbine Power Plant Performance.*
- **The R. Tom Sawyer Award:** The 2011 recipient of this award is Professor Dilip R. Ballal, University of Dayton, for pioneering combustion and fuels research that has advanced the design and development of gas turbine combustors and fuels; and for enthusiastic efforts in advancing and promoting the International Gas Turbine Institute.
- **IGTI Scholar:** The 2011 recipient of this honor is Dr. Om Sharma Ph.D., United Technologies Research Center. Dr. Sharma will give a lecture on, *"The Role of Physical and Numerical Experiments in the Development of High Performance Axial Flow Turbines"*. The focus of his lecture is to describe concepts and criteria developed to design high performance axial flow turbines over the last forty years. ✲

Make Plans Now to Attend!

TURBO EXPO

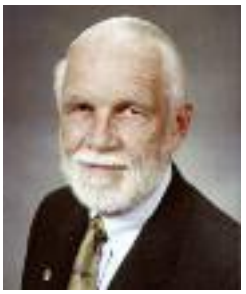
Turbine Technical Conference & Exposition

Presented by ASME International Gas Turbine Institute

JUNE 11-15, 2012 | COPENHAGEN, DENMARK

Featured Column: ***As the Turbine Turns...***

Jet Engines and Erupting Volcanoes



By Dr. Lee S. Langston, Professor Emeritus of Mechanical Engineering, University of Connecticut

It is one year ago when the largest European airspace shutdown since World War II occurred. On April 14, 2010 a volcano on the southern coast of Iceland erupted directly under the ice cap, Eyjafjallajökull, whose hard-to-pronounce name translates in English to "island mountain's ice cap". Although the eruption was not massive, water from the melted ice interacted with magma to throw clouds of fine volcanic ash as high as 30,000 feet into the atmosphere, and directly into the eastward flowing jet stream, on its way over the Atlantic and across Northern European airspace.

Clouds of volcanic ash pose real and substantial dangers for aircraft and their jet engines. The so-called ash is not the soft powdery form from a wood fire but is composed of bits of pulverized rock ranging typically from millimeter size (like sand) down to the micrometer range (like clay particles). Ingestion of this ash ablates jet engine blades and vanes and the ash can melt to a molten glassy state, causing blockages which can lead to compressor surge and possible flameout. Boeing reports that in the last 30 years more than 90 jet-powered commercial airplanes have encountered volcanic ash clouds leading to significant damage. So far there have been no fatalities reported – but plenty of close calls.

The Northern European airspace ash cloud shutdown lasted from April 15 to April 23, and then intermittently in different areas (e.g. Ireland and Scotland) until the middle of May. It is estimated that airlines collectively lost over $200M/day, with almost 100,000 flights and 8 million passengers affected. At the September 15-16, *2010 Atlantic Conference on Eyjafjallajökull and Aviation,* held at Keflavik Airport, Iceland, Stephen Perkins, an official of OECD (the European Organisation for Economic Cooperation and Development), gave an economic assessment of the shutdown cost. He estimated losses to all concerned as high as $5B. At the conference one Iceland volcanologist stated that this episode could be just a training exercise compared to the impact of a bigger eruption.

I can attest to some of the volcano costs to travelers. On April 15, 2010, my wife Liz and I, along with fellow passengers disembarked in Cape Town, South Africa upon completion of an Indian Ocean cruise. At the airport we learned that our flight back to the United States, via London's Heathrow Airport was cancelled due to the distant Eyjafjallajökull induced air space shutdown. We spent another night in Cape Town (at our expense) and fortunately managed to get a flight back to the US through Dakar, Senegal, far south of Iceland's eastward flowing volcanic ash clouds. Many of our fellow cruise passengers weren't as fortunate, becoming volcano refugees for many days in Cape Town at their expense, until able to secure alternate flights back to the northern hemisphere.

Fortunately the ash clouds cleared well before our IGTI June 14-18 TURBO EXPO '10 in Glasgow. When leaving the meeting and making connecting flights in Heathrow, I asked a taxi driver if the April shutdown had hurt his business. He said business was great – he and other drivers were charging stranded Heathrow passengers £2000 to drive them (via the Chunnel or ferry) to the European continent.

Given the huge worldwide costs and delays the shutdown incurred, one must ask just what danger does the ingestion of volcanic ash pose for aircraft gas turbines? Last year I wrote an article "Asking for Trouble"[1] in which I highlighted the 1980-1996 research on jet engine volcanic ash ingestion by Michael Dunn and his colleagues at Calspan. Mike, now a professor and director of the Gas Turbine Laboratory at Ohio State University is a past chair of IGTI's Heat Transfer Committee.

The experimental work of Mike Dunn and his associates showed that there are five dominant ash ingestion factors of immediate concern to a flight crew. These are ash material deposition occurring on the high turbine inlet guide vanes, blocking of turbine vane or blade cooling holes, erosion of the fan and compressor blades, degradation of the engine fuel control system, and deposition of carbon-like material in the fuel nozzles.

These revealing findings lead one to the consideration of research and development for ways to mitigate the effects of ash ingestion. One scheme that comes to my mind centers around the observation that ash particles can be electrically charged, as evidenced by displays of St. Elmo's fire in engine inlets. Might it be possible to apply a magnetic field at an engine inlet, to use the resulting Lorentz forces to divert the charged ash into the bypass air, where it would do less damage than passing through the engine's core gas path?

However, the most pressing concerns of volcanic ash ingestion flight dangers have to do with the actual measurement of atmospheric ash levels and the regulatory guidelines on acceptable ash levels in which jet powered aircraft can safely fly.

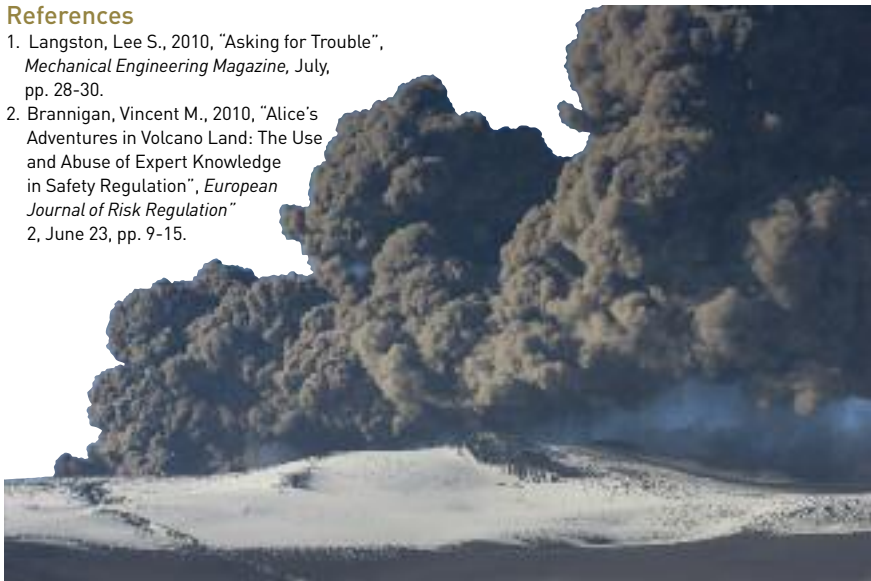
For instance, another Eyjafjallajökull volcano refugee, Vincent Brannigan, professor emeritus of jurisprudence in engineering at the University of Maryland has written the following[2] on regulatory aspects of the April 2010 airspace shutdown:

"European air traffic authorities, following well established and widely published safety protocols, began shutting down the air transport system due to the well known hazard of volcano ash. The shut-down lasted 6 days and soon became an unequal political contest between airline money and regulatory science. In a classic case of shooting the messenger the responsible airline parties tried to shift the blame for shutdown to the regulators, while nervous governments quailed before the bullying of the airline executives. Demands for compensation and accusations of regulatory incompetence filled the media."

If you want to learn more about jet engines and erupting volcanoes, I invite you to attend a panel session that Turbomachinery Committee past chair Aspi Wadia of GE Aviation and I will be co-chairing at TURBO EXPO '11 in Vancouver on June 7, 2011, for the Aircraft Engine Committee. We hope to see you there. ✻

References

1. Langston, Lee S., 2010, "Asking for Trouble", *Mechanical Engineering Magazine,* July, pp. 28-30.
2. Brannigan, Vincent M., 2010, "Alice's Adventures in Volcano Land: The Use and Abuse of Expert Knowledge in Safety Regulation", *European Journal of Risk Regulation"* 2, June 23, pp. 9-15.



IGTI: Serving Gas Turbine & Turbomachinery Professionals Worldwide for 57 Years!

Mission & Vision

IGTI is dedicated to supporting the international exchange and development of information to improve the design, application, manufacture, operation and maintenance, and environmental impact of all types of gas turbines, turbomachinery and related equipment. Our vision is to be the world's foremost vehicle for the development and dissemination of all gas turbine educational and technological information and to serve all professionals involved in the turbomachinery industry.

Operation, Membership & Governance

IGTI is one of two ASME Institutes and is governed by a ten-member international Board of ASME volunteers. Our volunteers represent a mix of academia, industry and government. We have 17 Technical Committees, 16 of which are organized according to individual fields of interest within turbomachinery technology. The 17th Committee, Wind Energy, represents our expanding scope.

Key Activities

Two of IGTI's key offerings to members are professional conferences and professional development.

Our flagship conference is Turbo Expo, which alternates between Europe and North America. See more details about Turbo Expo 2011 on page 49. And for a list of upcoming dates and locations for Turbo Expo, please check the calendar on page 51.

Our professional development department offers basic and intermediate training programs on a variety of platforms: Webinars, CDs, classroom training, and hands-on training. See page 54 for more information on our upcoming opportunities.

Awards and Scholarships

As mentioned in the last issue of the *GGTN,* IGTI offers a variety of awards of scholarships for those making outstanding contributions to the turbomachinery industry. Awards are presented annually at Turbo Expo. Scholarship applications are available each January.
Visit **http://igti.asme.org** for more details.

Publications and Networking

ASME publishes two journals related to the turbomachinery industry, *The Journal of Turbomachinery* and *The Journal of Engineering for Gas Turbines and Power.* If you are interested in submitting your work to either of these journals, please visit: **http://journaltool.asme.org**.

IGTI has an extensive library of technical papers and conference proceedings. If you are looking for a paper presented during a previous IGTI conference, please visit **http://igti.asme.org** to download an order form.

Be sure and keep in touch with IGTI throughout the year! In addition to our web site, regular IGTI updates are posted via Facebook, Twitter, and LinkedIn. Join our networks on these sites today! Also, IGTI committee members can contact each other via our Who's Who online member directory at: **http://igti.asme.org/Networking**.

Opportunities for YOU

IGTI appreciates our volunteers and is here to serve you! Here are some ways you can stay involved with IGTI:

- ASME Turbo Expo Exhibition and Sponsorship
- Publishing technical work in world-renowned forums and journals
- IGTI Sponsorship
- Honors, Awards, Scholarships and Travel Assistance
- Leadership within ASME and IGTI Structure
- Assistance with specialty conferences
- Continuing Education/Professional Development ✲

ASME TURBO EXPO 2012 SET FOR COPENHAGEN, DENMARK

Plan now to join 3,000 turbomachinery colleagues from around the world at TURBO EXPO, ASME's premier turbine technical conference and exposition, set for June 11-15, 2012, in Copenhagen, Denmark, at the Bella Center.

Turbo Expo 2012 highlights include:

- A FIVE-day Technical Conference that sets the world standard for turbomachinery technology events
- A three-day, premium exhibition of turbine products and services supported by leading companies in the industry
- A dynamic keynote session featuring prominent industry leaders
- A value-packed registration package that includes proceedings, access to all activities and abundant networking opportunities, including receptions and daily lunches
- In-depth workshops providing fundamental study on career development subjects

Leadership

Leading the organization of Turbo Expo 2012 are Executive Conference Chair Lennart Nilsson, Conference Chair Dr. Karen Thole and Technical Program Chair Dr. Jaroslaw Szwedowicz.

- Nilsson is CEO of Siemens Gas Turbine Systems in Sweden. Over the course of his career in power generation, he has also worked in Germany, the U.S., China, Japan and Poland.
- Dr. Thole is head of the Department of Mechanical and Nuclear Engineering at Pennsylvania State University. She is an ASME Fellow and also serves as the Associate Editor of the Journal of Turbomachinery. In 2008 she received the ASME Distinguished Service Award. In addition, she is a founder and integral leader of the IGTI Women's Networking Dinner, which is held annually during ASME Turbo Expo.
- Dr. Szwedowicz is Program Manager, Technology & Methods with Alstom, Switzerland. He chairs the ASME IGTI Structures and Dynamics Committee and previously served as committee vice chair, vanguard, and session organizer. Dr. Szwedowicz is an associate editor of the ASME *Journal of Engineering for Gas Turbines and Power.* He also serves as a board member of the Swiss Section of the ASME in Switzerland.

Technical Conference

The ASME Turbo Expo Technical Conference is globally recognized as the most important annual, international event for gas turbine technology. It is highly respected for presenting cutting edge, state of the art gas turbine technology from around the world, including contributions from academia and industry. The program scope has also been expanded to include related topics in solar, fans and blowers, and wind and steam turbine technology. To offer your work for publication in 2012, please note that abstracts are due by September 12, 2011 with drafts due November 14, 2011.

Exposition

When you exhibit at Turbo Expo, you will be among other key industry players. Turbo Expo brings together the top players in the turbomachinery industry and academia - attracting a key audience from aerospace, power generation and other prime mover-related industries. Exhibiting at Turbo Expo will maximize your ROI by placing your company in front of a focused target market, enabling you to generate high-quality leads to achieve your marketing objectives.

Exciting brand-enhancing sponsorship packages are also available! Packages are designed around your particular corporate goals and are an extremely effective way for your company to really stand out from the crowd - before, during and after the Show.

To insure your company's participation in the 2012 exposition, contact IGTI at +1-404-847-0072 x1646 or via e-mail at igtiexpo @asme.org. ✲