

# global Gas Turbine News

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ATLANTA, GEORGIA USA /// ASME INTERNATIONAL GAS TURBINE INSTITUTE



## Register Today for Turbo Expo 2012: Keynote Speakers Announced

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Al Brockett



Mark Pearson



Henrik Stiesdal

Event registration and housing reservations for Turbo Expo 2012 in Copenhagen are now available online at [www.turboexpo.org](http://www.turboexpo.org)!

### KEYNOTE SPEAKERS ANNOUNCED

Three leaders from the aeroengine and power generation industry will highlight current development needs and trends by addressing the theme *Reliable Gas Turbines Operating in Extreme Environments* at Turbo Expo in Copenhagen. **Al Brockett**, Vice President, Engineering - Module Centers, Pratt & Whitney; **Mark Pearson**, General Manager - Advanced Technology & Preliminary Design, GE Aviation; and **Henrik Stiesdal**, Chief Technology Officer, Wind Power Business Unit, Siemens, will all speak at the opening keynote on Monday, June 11.

The expanded use of gas turbines into new market segments, which includes extreme environments, requires the consideration of new and more comprehensive design and operational attributes. Innovative solutions for ensuring reliable energy extraction from turbines—even in extreme environments—are critical for power generation and propulsion. Meeting reliable energy needs through power generation must now account for intermittent operational requirements to off-set alternative energy sources such as wind and solar. Consideration of extreme environments for both power generation and propulsion, including the use of alternative fuels, is essential for existing turbine operations and components while still striving for efficiency improvements, reduction of weight, low cost, and environmental compatibility. Furthermore, safe and reliable propulsion and power generation are vital to meet the growing demands of global industrialization and urbanization.

By considering these aspects, gas turbine technology will not only continue to remain the mainstay, but also achieve greater market penetration and utilization for the power generation and propulsion industries.

**Al Brockett** has more than 33 years of engineering experience at Pratt & Whitney. During his tenure, he has held positions of increasing responsibility in systems and module center engineering. He was responsible for the development of the first production single stage high pressure turbine and was nominated for the UTC Mead Award in 1996. He has also held positions in operations, leading Cooled Turbine airfoil operations through restructuring in 2000. Brockett was recognized as the ASME Engineer of the Year in 2002.

**Mark Pearson** has almost 30 years of experience at GE, holding positions of increasing responsibility. He contributed to the GE36, GE90 and NASP Programs and led the Marine and Industrial Engine Systems Engineering Organization from 2001 to 2004 where he had technical oversight for all aeroderivative engines, including the world's first intercooled industrial gas turbine, the LMS100. In late 2004, Pearson took over the position of General Manager, Advanced Technology and Preliminary Design. He is currently responsible for the conceptual and preliminary design of the next generation commercial and military engines. His recent focus includes the LEAPX for

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

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# View From The Chair

By Klaus Brun, Ph.D., Chair, IGTI Board

Klaus Brun, Ph.D., is the Manager of the Machinery Section of Southwest Research Institute in San Antonio, Texas.

It is again my honor and pleasure to provide you with an update of the activities of the IGTI community in this, my third column, of the *Global Gas Turbine News*. By now many of you are all probably in full planning mode for the ASME Turbo Expo 2012 in Copenhagen. For the 2012 Turbo Expo Conference, we received nearly 2000 abstracts for technical papers, which will likely result in another new attendance and paper record for this event. Our many committee chairs, point contacts, session chairs, reviewers, and other volunteers are currently processing and reviewing the technical paper submissions so that we can continue with the highest quality publications at Turbo Expo. The local liaison committee for Turbo Expo Copenhagen has met and is currently garnering strong local support for the conference. For myself and on behalf of the entire IGTI board I would like to thank all sponsors, authors, organizers, and volunteers for your continued services to IGTI. I expect that Turbo Expo in Copenhagen will be another excellent exposition and technical conference highlighting IGTI's expanded focus of gas turbines, steam turbines, compressors, wind turbines, fans, blowers and other related energy machinery.

In October 2011 we also held a special three-day IGTI board and thought-leader meeting at Southwest Research Institute in San Antonio, Texas, to brainstorm ideas and to discuss creative new ways to make IGTI a better organization for its members. We had a good cross-section of the IGTI membership present and almost all technical committees had representatives attending the event. Many good ideas and suggestions were brought forward by the 40 attendees of this meeting, and we will further discuss some of these ideas during the upcoming committee meetings at Turbo Expo to get additional feedback. During the October meeting we also held a special awards presentation to honor two of our most long-serving and active IGTI members, Ron Natole and David Wisler, with



Distinguished ASME Service Awards. Throughout their many years of service to IGTI they have made many outstanding contributions to our community. They both certainly deserve this very special recognition.

This year IGTI held two specialty conferences: IGTI Gas Turbine Training USA, held at Southwest Research Institute in San Antonio, Texas, and IGTI Gas Turbine Training Week Europe, held at Helmut Schmidt University in Hamburg, Germany. Each of these events drew over 30 participants and feedback from attendees of the training sessions was very positive. IGTI intends to continue and grow these two Gas Turbine Training Weeks in the future and hopes that many of the IGTI volunteers will participate and benefit from this excellent educational opportunity. If you have new ideas for specialty conferences and training classes or if you are interested in helping to organize one of these specialties, please contact me or the IGTI staff.

Thank you very much again for all of your efforts in making IGTI a great organization. I am looking forward to seeing you in Copenhagen. \*

## CALENDAR OF EVENTS

### FEBRUARY 13-24, 2012

#### Gas Turbine Courses at Cranfield University Cranfield University | Bedfordshire, UK

<http://www.cranfield.ac.uk/soe/shortcourses/gas-turbine/>

**Feb. 13-15:** Introduction to Fatigue and Fracture Analysis

**Feb. 20-24:** Prime Movers for Oil, Gas Power & Process Industries

**Feb. 20-24:** Propulsion System Performance and Integration

### FEBRUARY 27- MARCH 2, 2012

#### IGTI & SwRI Gas Turbine Training Week (USA) Southwest Research Institute | San Antonio, TX USA

**Feb. 27-28:** Gas Turbines & Compressors

**Feb. 29:** Root Cause Failure Analysis

**Mar. 1:** Rotor and Blade Dynamics

**Mar. 2:** Field Factory Testing and Dynamics

For more details and to register, visit <http://igti.asme.org>.

### MARCH 5-9, 2012

#### Gas Turbine Appreciation

Cranfield University | Bedfordshire, UK

<http://www.cranfield.ac.uk/soe/shortcourses/gas-turbine/>

### APRIL 18-20, 2012

#### International Conference on Fan Noise, Technology and Numerical Methods

Congress Centre of CETIM | Senlis, France

More details: <http://www.fan2012.org/>

### APRIL 30- MAY 4, 2012

#### Mechanical Integrity of Gas Turbines

Cranfield University | Bedfordshire, UK

<http://www.cranfield.ac.uk/soe/shortcourses/gas-turbine/>

### JUNE 9-10, 2012

#### ASME International Gas Turbine Institute TE12 Turbo Expo Pre-conference Workshops Bella Center | Copenhagen, Denmark

**June 9:**

- Technology & Applications of Turbine Coatings
- *New!* Gas Turbine Rotor Life Management

**June 9 & 10:**

- *New!* Introduction to Optimization Methods and Tools for Multi-disciplinary Design in Turbomachinery
- Advances in Turbines Aero-thermo-mechanical Design & Analysis

**June 10:**

- *New!* A Primer on CHP Technologies
- Basic Gas Turbine Metallurgy and Repair Technology
- Gas Turbine Failure Analysis

### JUNE 11-15, 2012

#### ASME Turbo Expo 2012

Bella Center | Copenhagen, Denmark | [www.turboexpo.org](http://www.turboexpo.org)

IGTI's flagship event comprises a major gas turbine conference and exhibition.

### JULY 30 - AUGUST 1, 2012

#### 48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit and 10th International Energy Conversion Engineering Conference

Hyatt Regency | Atlanta, Georgia | [www.aiaa.org](http://www.aiaa.org)

The objective for JPC 2012 is to identify and highlight how innovative aerospace propulsion technologies powering both new and evolving systems are being designed, tested, and flown.

### OCTOBER 17-18, 2012

#### 6th International Gas Turbine Conference (IGTC-12)

Brussels, Belgium

<http://www.etn-gasturbine.eu/igtc.aspx>

The International Gas Turbine Conference is organized by the European Turbine Network. It takes place biennially, bringing together the whole value chain of gas turbine technology and research. Representatives from the European and international gas turbine community and policy-makers meet to discuss recent developments and future outlook on the market.

### JUNE 3-7, 2013

#### ASME Turbo Expo 2013

San Antonio Convention Center | San Antonio, Texas

IGTI's flagship event comprises a major gas turbine conference and exhibition.

# Announcing the Joint AIAA-IGTI Engine Design Competition for Undergraduate Teams

By Dr. Ian Halliwell, Chair - AIAA Gas Turbine Engines Technical Committee, Member - AIAA Air Breathing Propulsion Systems Integration Technical Committee, IGTI Education Committee & IGTI Aircraft Engines Committee  
e-mail: [ianhalliwell@earthlink.net](mailto:ianhalliwell@earthlink.net)

## The AIAA Foundation Engine Design Competition has been in existence for over twenty years.

It was set up originally to provide a medium for universities to satisfy ABET requirements via a senior capstone design course. However, participation has dwindled to three or four teams during the past several years and discussions within the AIAA propulsion community indicated that collaboration with IGTI was the best of a number of alternatives. This year a memorandum of understanding was drawn up between AIAA and IGTI, and the joint design competition was implemented.

The new joint engine design competition will be organized and administered by the Technical Committees for Gas Turbine Engines, High Speed Air Breathing Propulsion, and Air Breathing Propulsion Systems Integration within AIAA and Aircraft Engines and Education within IGTI. The combined resources of both organizations will enable value to be added to the event, initially through more extensive publicity. A much larger network of professional engineers will now be available to generate relevant contemporary topics, write high-quality RFPs, mentor student teams and populate

judging panels. Additional access to the relevant academic networks will encourage additional participation and provide further ideas for development and growth. Interest has been expressed for a division for graduate students, and this will be addressed once the new formula for the undergraduate event has been proven.

The broad objective is to engage engineering students worldwide in practical design activities on air-breathing engines that are reasonably representative of the real world. The immediate goal is to attract from 15 to 20 teams. The exercise will be challenging, but at a level that is not too daunting, with an emphasis on specific design issues that change year by year and are drawn from industry or government centers by the participating technical committee members. While “design/build” contests are currently very popular, our intent is to capture the excitement inherent in a mere “paper design” of an air-breathing engine for propulsion or power generation. After all, paper engine designs are what most of us in the business do most of the time and such an approach offers virtually limitless opportunity for scope and variety.

Special features of the new joint venture will be a four-person limit on team size and the invitation—with partial costs—of the best three teams based on the written proposals to appear at an international conference to present their designs to a judging panel from industry. The venue will alternate between the AIAA Joint Propulsion Conference (JPC) and ASME Turbo Expo. This year the competition will kick off at JPC in Atlanta.

The inaugural joint competition requests designs for *an engine to power an unmanned, half-scale model of a Joint Strike Fighter aircraft*. Design proposals are due by April 1, 2012. Complete details are available on the IGTI website at <http://igti.asme.org>. \*

## Turbo Expo 2012 Keynote Speakers . . . CONTINUED FROM PAGE 43

commercial narrow body applications and variable cycle technology for military applications.

**Henrik Stiesdal** is one of the pioneers of the modern wind industry and has worked with all aspects of wind turbine technology. He built his first small wind turbine in 1976 and in 1978 designed one of the first commercial wind turbines, licensed to Vestas in 1979. Stiesdal worked as consultant for Vestas until 1986, in parallel studying medicine, physics and biology at University of Southern Denmark. In 1987 Stiesdal joined Bonus Energy, later Siemens Wind Power, as a design engineer. A year later he was appointed Technical Manager and in 2000 Chief Technology Officer. In 2011 he was awarded the Poul la Cour prize, the European wind energy sector's most prestigious award.

### DON'T MISS THESE TURBO EXPO EVENTS:

#### 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, supercritical CO<sub>2</sub> power cycles and concentrating solar power plants. The 2012 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, three-day exhibition of gas turbine products and services, supported by prestigious companies such as ANSYS, CD-adapco, GE, Pratt & Whitney, and many more! Daily lunches plus afternoon networking receptions in the Expo Hall are included in the registration package for delegates and exhibitors.

#### Career Development Workshops

Taking place just before the conference begins, our Turbo Expo workshops provide focused, fundamental training. Choose from seven courses to be held Saturday and Sunday, June 9-10, 2012. Register for the conference and then take advantage of the opportunity to attend workshops while you are in Copenhagen! Course topics include gas turbine rotor life management, gas turbine failure analysis, basic metallurgy and repair, turbine coatings,

aero-thermo-mechanical design, CHP technologies, and optimization methods & tools for multi-disciplinary design in turbomachinery. Visit [www.turboexpo.org](http://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 12, 2012. Registered female delegates will receive an RSVP email from IGTI later this spring. Be sure to respond promptly! This year the dinner is generously sponsored by GE.

#### Special Networking Event for Young Engineers

The ASME International Gas Turbine Institute (IGTI) provides invaluable professional development benefits for early career engineers and students! Featuring the top experts and leading companies in the field of turbomachinery, there is no better place for young engineers to be than Turbo Expo! While attending Turbo Expo 2012, young engineers won't want to miss a *special networking event on Wed., June 13, 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 Copenhagen! **Visit [www.turbo.expo.org](http://www.turbo.expo.org) today for more details and to register.** Students qualify for discounted registration. \*

# Teaching an “Old Dog” New Tricks... A Naval Aviator’s Experience with Evolving Aircraft Engines

By Captain Mary Louise Griffin

**As a young college senior, contemplating “what I wanted to be when I grew up,” what I became was not even in the conversation: girls didn’t fly airplanes—at least not for a living!** And, there were two things I knew about what I didn’t want to be: I didn’t, with all due respect, want to be a school teacher like my mother; and, I didn’t want to be a stewardess for my daddy’s airline! And, my experience at the college career center taught me one thing about what I thought I wanted to be: I had already hit the glass ceiling for a woman with a business degree and no work experience (funny, I thought that first job was the “experience”). So, after a couple of interim jobs, I visited the Navy Recruiter who taught me two things about what I could be: being a newly commissioned Navy Ensign equaled middle management experience; and, oh, by the way, we are about to try a women aviator program. . .you interested? I said sure – why not!?

That is how I got here; now here is the story of what makes me the “old dog.” Since timing is everything (most of the time), I accepted the Navy’s interesting opportunity even though they had not resolved the legal issues that would allow the women to serve on the front line flying the “good stuff” from an aircraft carrier. We were assigned to fly the oldest stuff the Navy had! As I awaited my flight school start date I experimented with a few private lessons in a Cessna 150 just for fun and bummed a ride in the back seat of whatever was available around the base. Those experiences proved to me that I wanted to be a jet-girl even if they weren’t offering that at the moment. Flight training in T-28s and S-2s, powered by the R1820, was noisy, grimy and fun, but I kept working for that jet seat that I knew must come along sometime. On the day I passed my last check ride I got a surprise: “Would you like jets in San Diego?” Uh, yes! So there I was, a jet-girl, in the old but loveable A-4 Skyhawk, affectionately called the “Scooter,” and fully-equipped with one Pratt and Whitney J52-P-6/P-8 jet engine.

I learned early on that when you have only one engine, it is important to treat it right. Our maintenance was superb on those old aircraft, in part, because, if you cared to learn, the crusty Maintenance Chiefs would teach you how to “listen” to your aircraft, especially the engine, and they promised, with the right information, they could always fix it. I learned to lean my helmeted head against the canopy—not hard to do in a single seat cockpit—to feel and hear the engine.

In my 10 years flying the A-4, only one J-52 quit on me: one day, while feeling invincible with about 70 hours in type under my belt, the engine anti-ice system failed as I was executing a long approach through the San Diego sloppy winter overcast. There was no indicator light or gauge to tell me of the failure. I was on a perfect idle descent profile, so there was no indicated loss in RPM. I simply had no way of knowing there was no power available. When I pushed up the throttle slightly to slow the descent rate on final approach, nothing happened! I could feel a soft vibration and hear gentle humming, but there was no roar of advancing power. I was along-for-the-ride in my iced-up Scooter. Fortunately, things worked out well for me, and my Scooter, to make a pretty nice glider landing. As I rolled clear of the runway, out of the “slop” and in the warmer climes, the ice melted quickly and the power gradually spooled-up enough to taxi to the flight line. There was considerable debate over what had happened but finally all the clues came together: the Maintenance Chiefs figured out what to fix and that jet was back on the line.

My favorite “tough little P&W story” is not mine, but a fellow aviator with an adversary air combat maneuvering mission on a day that he was running a few minutes behind the rest of the flight. At takeoff, he pushed up the throttle of his A-4; his Pratt and Whitney responded quickly and fully; and off he went to engage his opponent (“win the fight,” he says), then return to the field about an hour later, without ever resetting the throttle from its “full military” takeoff power position (that is, until he entered the “break” for the visual traffic pattern at the field). He pulled the throttle to idle, and the engine began coughing. He pushed it back up and no cough—back to idle and cough—back and forth a couple of times as he also used “G” force of the pull to reduce to landing gear extension speed, and finally back to idle again for landing and taxi. When he got out of the aircraft on the flight line, the young plane captain attending to his

arrival pointed behind the aircraft and said “Sir, look!” The trail of engine blades extended the entire length of the taxiway and back on the runway, and there was not a blade to be seen up the tailpipe. That engine had held together, at full military power, long enough to get the mission done and return the pilot safely!

Following my Navy flying days, I got a new-old-aircraft courtesy of my airline. In spite of growing up within the airline industry, sitting on the floor watching Daddy install new things called simulators and that “room-sized-miniature-world-on-a-board-with-a-camera” called a visual system, I didn’t know anything about the aircraft. In my first years at American, they were hiring and training so fast that there was no “ready room time” to just talk to those who had flown our new-old-jet, Boeing 727. Move on through—next! A few months later I was back at the AA Flight Academy for First Officer (FO) School. The day I finished my FO check ride in the B727 simulator, the Check Airman, a former Marine with 20 years of A-4 experience, said to me, “Didn’t you fly the A-4?” “Yes,” I said. “OK then,” he said, “Don’t fight this Boeing so much; it is just a great big A-4. These are the same engines, just a different number stamped on the side, and, they will respond to you in the same way. And lucky you, now you have three of them!” Those were the best words anyone ever spoke to me in training. Why hadn’t anyone said that before? Who knows, but I had “broken the code” and was once again a happy jet-girl. Now I had a window seat again and could lean my head on the window and “feel” those engines: I don’t need “sync” indicators!

Just for the record, only one of these (by now pretty old), P&Ws quit on me: climbing out from Miami International, over Key West, warning bells and lights indicated an overheat and potential fire in the strut connecting pod engine to fuselage—not good! So, we shut that one down, rattled through all the procedures and returned that fully-loaded B727 to Miami on two engines without one bit of trouble.

My love affair with that old, but fast, aerodynamically clean, and just plain good looking, B727 lasted over 14 years, until the company sold them all. I was among the last “old dog” crews to finally make the switch to “modern technology.” Most of us had stayed on the B727 because we liked it, but now the B737-800, with new-fangled fan engines, was our ride. I knew that training would be a challenge. I was concerned with the glass cockpit, computer flight management system, highly advanced automation, and worst of all, only two of us to manage it all. I wasn’t so hot on the idea of losing my old round gages either (did someone say engine tapes!?). Fortunately, the engine instruments display on the flat screen looked just like a round dial – hooray! My next problem was that no one could tell me what a “CFM” engine was—who made it? I wasn’t supposed to care about that, but by this time I had been flying P&W “real-



**Captain Mary Louise Griffin and First Officer Bert Schnabel in the cockpit of an AA B737-800 on ramp at Grand Cayman**

jet engines” forever, and this thing was a “big, fat fan,” and no one seemed to know where it came from. I needed to know more. I heard the gripes from my fellow “loyalists” a few weeks ahead of me in training and was not happy. What’s worse, the engines were slung under the wings—and really close to the ground: who thought that was a good idea? I am no engineer but that spells huge drag and lots of potential yaw! This stretched-out version of the original B737, often called the “Guppy,” wallowed around like nothing I had ever experienced. Even with the new wing design (well, they said it was new), it was pretty slow. Let’s face facts: flying this thing was like flying a baby buggy—and then they put on winglets. Yikes, those things are eight feet tall! Think of it this way: it is like having three rudders but only one of them moves.

But, back to that weird engine—it does what? Selectable thrust!?! To use an overworked phrase—“yikes!” But, this was my job, so I needed to give that new bird a chance. After much gnashing of teeth and many questions, it started to get clearer how this all worked.

However, this “old dog” was in for some serious habit-pattern adjustments. The aerodynamic impact of the giant circumference engine was a curious aircraft handling challenge when compared to the sleek lines and blazing speed of the B727. (OK, maybe not so fast in the climb—one Captain I flew with said, at retirement, that his 27-year-all-B727-career had been “well balanced”: 9 years as FE; 9 years as FO; and 9 years in the climb). Now, in my new B737-800 jet, with big fat engines, I could get to altitude so fast that my ears hurt, but I was rowing a slow boat to destination! The “dial-a-thrust” settings were used by company dispatchers for more efficient cost of operation, but we were generally at odds with the reduced fuel plan.

This new-fangled fan engine was also supposed to be quieter, so we could get around some airport noise restrictions, but I still don’t want to be standing next to one at full power! Other things that required thought and aircraft management adjustments included: restrictions on selecting reduced power for takeoff during certain wind or contaminated runway conditions; crew resource management adaptations for the three-man crew folks; the tendency for new-generation pilots to rely on computer-generated data without knowing how it was derived or questioning it when it “just didn’t seem right”; the tendency for all of us “old dogs” to still want “all she’s got on every takeoff—just in case”; and, the uncomfortable feeling during the seemingly-forever-engine-spool-up-time when executing a missed approach. True, the big new fan engine did have really big power—if spooled up when you needed it—but, the really big drag and yaw could be a challenge, particularly in high crosswind or gusty conditions.

All in all, we learned to adapt and even kind of like the B737-800 jet, but today, conversations among peers of different backgrounds still engender the same jousting and debate: fan-jet or real-jet! It is all about setting expectations: not done well in training perhaps, but on the line, the new fan engines serve the industry well overall. Only once in my many years of aviation did anyone ask my opinion about designing the next generation aircraft for my mission—it was an interesting discussion. I would like to have more such discussions as newer technologies come from the drawing boards of the engineers. I don’t need to know how to build an engine and have never even thought about how to engineer one, but I do have some serious criteria for flying one: keep the blue-side-up! \*

*Captain Mary Louise Griffin, U. S. Navy, Retired, served 24 years of active and reserve service as a Naval Aviator where she accumulated 3,000 hours in the A-4 Skyhawk. She is also a retired American Airlines Captain, where she flew the Boeing 727, Series 100 and 200, and the new generation Boeing 737-800, accumulating over 10,000 hours, primarily serving the International Division throughout Latin America and the Caribbean. Currently, Mary Louise is an independent Aviation Safety Consultant.*

## ASME Gas Turbine Activities Gather Support in India

By Michael (Mike) Ireland, Managing Director,

ASME Engineering Research & Technology Development (Institutes, K&C, Meetings)

**In November, two important meetings regarding the Gas Turbine industry in India were held in Bangalore and Chennai, India.**

On November 5, 2011, 16 people gathered in Bangalore to discuss forming a gas turbine chapter of ASME and what key activities to undertake. The action plan included identifying gas turbine experts within the country and completing the Chapter petition by the end of the calendar year. There was also preliminary discussion on holding a small conference in 2012 on fuel flexibility and operability for gas turbines. Other suggested activities included connecting with ASME student chapters in India, increasing awareness of ASME codes and standards, sending a delegation to Turbo Expo in Copenhagen, and organizing workshops that integrate theory with practical training. Special thanks were given to Dr. Joseph Machnaim of GE Aviation, Bangalore for coordination, arrangement and conducting the meeting.

On November 21 at ITTM, Chennai, 22 participants from various Indian entities joined Madhukar Sharma of ASME (India) staff and me to continue discussion of creating locally relevant content in India. Dr. Bhaskar Roy, Professor, IIT Bombay, depicted the state of the industry in India. He highlighted the need for making research more visible and meaningful and stimulating excitement and engagement of students into the profession. Raju Navindgi from Gas Turbine Research Establishment (GTRE) shared thoughts on how ASME can be instrumental in fulfilling the knowledge-sharing needs of researchers, industry and end users—especially upcoming power sector users—and that the Indian government possessed a willingness and a mandate to support such initiatives. Murugesan Seerangan from GE Energy shared the need for experience exchange on various challenges related to gas turbines’ operational efficiency. I encouraged the Indian participants to continue their efforts in building a local gas turbine chapter and promised ASME support to add to locally relevant content. The group will continue to meet and explore opportunities for forums, symposiums and/or workshops with an eventual goal of bringing ASME Turbo Expo to India someday.

For more information on how to participate with the India Gas Turbine Chapter, please contact [SharmaM@asme.org](mailto:SharmaM@asme.org). \*



# ASME IGTI Professional & Member Development

By Shirley Barton, IGTI Professional & Member Development Manager

## Member Services

### Young Engineer Travel Award

IGTI offers several travel awards to students and young engineers employed in industry or government to attend ASME Turbo Expo to **present papers of which they are authors**. Please visit the IGTI web site at: <http://igti.asme.org/> for more detailed information.

### IGTI 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 from February 15, 2012 through April 15, 2012.** 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/>

### The ASME International Gas Turbine Institute Student Scholarship

One \$4,000 scholarship is awarded every year based on superior academic performance and demonstrated interest in the *gas turbine, propulsion, or turbomachinery industries* to an undergraduate or graduate student. Applicants must be ASME Student Members in good standing at the time of application. **Applications for each academic year are accepted from January 15, 2012 through March 1, 2012 after which the online application is closed.** Detailed instructions can be found by visiting the following web site: [http://www.asme.org/Education/College/FinancialAid/Details\\_Requirements.cfm](http://www.asme.org/Education/College/FinancialAid/Details_Requirements.cfm)

**Please contact Shirley Barton, [bartons@asme.org](mailto:bartons@asme.org), regarding information on:**

- Navigating IGTI's Technical Committee & Leadership Directory (Who's Who)
- Committee Member Updates
- Volunteer Opportunities
- IGTI Awards and Scholarships
- Training & Development



## IGTI Board Member Karen Thole Honored As "Champion of Change"

IGTI Board Member and 2012 Turbo Expo Conference Chair Karen Thole was recently welcomed to the White House as one of 12 "Champions of Change" who have worked to increase the participation of women and girls in science, technology, engineering, and math (STEM) fields.

Thole, Ph.D., P.E., professor of mechanical engineering and head of the Department of Mechanical and Nuclear Engineering at the Pennsylvania State University, was recognized as an outstanding community hero helping to build the ranks of women in the STEM workforce and ensure that America's science and engineering enterprise is fueled by the diverse talents of all of its citizens. At the White House event, she joined other educators, students, non-profit directors, corporate executives, and public sector employees in a moderated conversation around best practices for removing the roadblocks that too often discourage girls from pursuing STEM subjects or compel women to drop out of STEM fields.

Thole, along with colleagues, established an Engineering Ambassadors Program that empowers female students majoring in engineering with advanced communication skills; specifically, these students use the messages of the National Academy of Engineering's *Changing the Conversation* report to recruit high school girls into the discipline. In 2011, the Ambassadors spoke to more than 5,000 high school students, teachers and parents, and the program, which has partially been supported by the United Technologies Corporation since 2010, grew to include four universities that reach high school students throughout the Northeast.

Thole is an ASME Fellow and has been an ASME member for more than 15 years. She is also the pioneer of a successful "women in engineering" networking event that is held each year during ASME Turbo Expo. \*

## Professional Development

### European Training Week a Huge Success!

IGTI partnered with Helmut-Schmidt University in Hamburg, Germany to conduct a European Gas Turbine Training Week November 7-11, 2011. The highly successful week was sponsored by Helmut-Schmidt University, Southwest Research Institute and Solar Turbines Incorporated. IGTI would like to thank all of the following Instructors for sharing their knowledge, skills and time with all the engineers who attended these workshops!

- Dr. Klaus Brun, SwRI
- Dr. Franz Joos, Helmut-Schmidt University
- Dr. Rainer Kurz, Solar Turbines
- David Ransom, SwRI

### 2012 IGTI and SwRI Gas Turbine Training Week

IGTI is proud to be partnering for the fourth year with Southwest Research Institute the week of February 27-March 2, 2012 at the SwRI facility in San Antonio. See calendar on page 44 for course listings and registration details.

### 2012 Turbo Expo Workshops Announced!

Prior to Turbo Expo, IGTI is offering seven in-depth workshops on fundamental industry topics. See the calendar on page 44 for a complete list of workshops and visit <http://www.asmeconferences.org/TE2012/ShortCourses.cfm> for more details and to register.

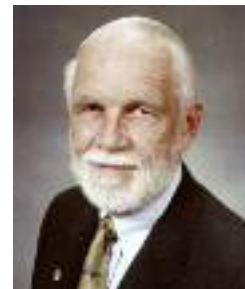
**If you have a topic you think will be of value to the turbine industry and would like to present it in a webinar format or a "face-to-face" format, please contact Shirley at [bartons@asme.org](mailto:bartons@asme.org).**

**For detailed information on upcoming training events for the gas turbine industry, please visit the IGTI web site at <http://igti.asme.org/>**

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

# Some IGTI History

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



**It has been said, if you would understand anything, observe its beginning and its development.** Let us look here at the origins of the International Gas Turbine Institute and its growth in supporting the technical development of the gas turbine industry.

The origins of IGTI go back some 68 years, and its development has been centered around our annual TURBO EXPO. I estimate since IGTI has held technical conferences, some 16,000 referenced papers have been presented and published in conference proceedings, involving on the order of 48,000 reviewers and 3,000 session organizers. About 25–35% of the papers are published in ASME archival journals.

The IGTI First Annual Gas Turbine Conference and Exhibit was held April 16–18, 1956 at the Hotel Statler in Washington, DC. This very first ASME all-gas turbine meeting had 25 exhibitors, six technical sessions, a total of 17 papers and an attendance of about 750. The conference fee was \$5 (with papers) and \$2 (without papers). By way of contrast, IGTI's 56th gas turbine conference, TURBO EXPO '11 in Vancouver, June 6–10, 2011 had 120 exhibitors, 285 technical sessions, a total of 977 papers and an attendance of 2366.

The IGTI gas turbine conference has been ASME's leading international technical meeting from its very beginning. The annual meeting is held in North America and in Europe on alternate years. Currently, more than half of the papers presented are from non-North American parts of the gas turbine community, most coming from Europe and Asia.

The gas turbine is the youngest of energy converters. The first jet engine-powered flight took place in Germany, and the first operation of a gas turbine to generate electrical power occurred in Switzerland, both in 1939. Within five years of this birth, the organization of IGTI—and of the gas turbine conference—commenced. Here are a few milestones, facts and dates that make up IGTI's history:

- On May 8–10, 1944, ASME's 17th National Oil and Gas Power Conference was held mid-continent (wartime) at the Mayo Hotel in Tulsa, OK. The technical program consisted of four sessions (a total of ten technical papers); three on diesel engine technology and one (two papers) on the newly emerging gas turbine. As *Mechanical Engineering Magazine*



R. Tom Sawyer  
June 20, 1901–  
January 19, 1986

The prime organizer  
and first chairman of  
the GTD of ASME, the  
precursor of IGTI.

reported: “Demonstrating the technical interest aroused by the gas turbine, the first new prime mover in 50 years, a capacity crowd of approximately 250 attended the first technical session which was devoted to that subject.” In anticipation of this intense interest in new gas turbine technology, on May 7, 1944, the Executive Committee of the Oil and Gas Power Division voted to form a ten member Gas Turbine Coordinating Committee (GTCC) to provide “...coordination and dissemination of new technical information on the gas turbine through periodic meetings and the presentation of technical papers.” This newly formed GTCC, with R. Tom Sawyer of the American Locomotive Company as its chairman, was the start of IGTI.

- By March 1947, GTCC had grown to 31 members and had sponsored an increasing number of gas turbine papers at ASME conferences. With its growing membership, the GTCC petitioned ASME for division status, and this was granted on August 14, 1947. Thus the Gas Turbine Power Division was formed, later to be called simply, the Gas Turbine Division (GTD). As the prime organizer (and by then author of the text, *The Modern Gas Turbine*), R. Tom Sawyer was the first chairman, serving for the remainder of 1947.
- The new GTD started in 1948 with three technical committees: Committee on Theory, Committee on Design, and Committee on Application. Over the last 57 years, these three grew into the 18 technical committees which form the backbone of IGTI today.
- As the international gas turbine community grew, the number of papers sponsored by the GTD increased to the point that it was obvious a separate meeting was needed. The first one was held in Washington, DC, in 1956 as mentioned above, with succeeding annual meetings taking place in other US cities. In 1966 Zürich was chosen as the first European site for the gas turbine conference. Not long after, the annual meeting developed into its present schedule of locating in North America and Europe in alternate years.
- As the GTD conference increased in size in the years after 1956, it became more and more apparent that a separate ASME staff was needed to take over the administration and operation of the Division. In 1978, Donald D. Hill became Director of Operations for the GTD and set up his office in Atlanta, with Sue Collins as his assistant. In 1982, additional staff was hired to take over direct management of the exposition.
- By 1986, the Gas Turbine Division outgrew its divisional status and was made an institute of ASME—the International Gas Turbine Institute—as we know it today. In 1988 the annual gas turbine conference was renamed TURBO EXPO. Projects and services developed, produced and financed by IGTI has increased, and the professional staff now numbers seven. The Atlanta area office is IGTI's headquarters and the hub of its international activity.

In the past, I have heard stories from early IGTI volunteers of members taking out loans on their homes to finance the upfront funding necessary to secure a conference site. Once the Atlanta office was formed, staff and volunteers worked closely together to make IGTI more financially sound. Thus in recent years we have been able to fund about \$1M in gas turbine scholarships, as well as providing the world's leading forum for gas turbine technology.

I hope that this short IGTI history helps to define the present and who we are. \*



# Future Fuel-efficient Gas Turbine Jet Engines Run Hotter, Make Component Testing More Critical

By Rob Murner, President, Test Devices

## Soaring fuel prices. Unrest in oil producing nations. Global demand to save the environment.

**Corporate demand to cut costs.** These are just some of the forces creating an urgent need for more fuel-efficient turbine engines. But while there is immense pressure on design engineers to develop these engines, the heat is on test engineers to create new ways to validate component parts that must survive the extreme temperatures (over 2000 °F) and high vibration of harsher turbine engine environments.

When an engine runs hotter and at higher pressures it extracts more energy from the fuel, making the engine more efficient; but extreme heat and higher running speeds increase stress on blades and rotors and are demanding new classes of materials. Engine components face stress and degradation through thermal interaction, creep, erosion, vibration, and hot corrosion. Testing options that simulate these conditions, such as spin testing, can validate the performance of critical components, especially when data for new materials is lacking.

Advanced spin testing can be used to evaluate blade resonance by simultaneously subjecting components to representative centrifugal, vibratory and thermal stresses of an operating engine. Bladed rotor components are tested fully assembled or with custom designed scaled rotors in a similar manner as they operate in the engine.

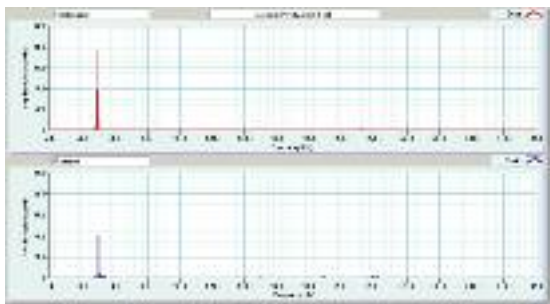


Figure 1: Damper design effectiveness at targeted modes.

Managing resonant vibration of compressor and turbine blades presents a technical challenge for jet engine and Industrial Gas Turbine (IGT) programs. Under certain conditions of operation, blades vibrate in response to pulsing flow from upstream stages. If common power settings coincide with blade resonant modes due to in-service damage or design issues, they can crack and fracture from high cycle fatigue in a very short amount of time.

Dynamic spin testing can replicate these high cycle fatigue (HCF) conditions. The test part is rotating at operational speed when excitation is introduced in a

controlled manner and measured with Non-Intrusive Stress Measurement Systems and/or strain gages. The test system is designed to dwell at specified resonant frequencies for 100 million cycles or more in order to perform Goodman Validations. By producing realistic resonant vibration, spin testing can accurately confirm expected modal frequencies. Speed control allows for very slow resonance crossings as well. This “Slow Sweep” capability helps to initially identify modes, distinguish between coupled modes, accurately measure amplification factors that take time to build, and determine damping (Q factors) thus allowing for very effective damping analysis and validation. (Figure 1) Finally the ability to hold resonance for long periods of time often results in broken blades, allowing for blade failure analysis, crack growth propagation, and validation of surface treatment and various repair methods.

There are many challenges which must be overcome to provide high temperature HCF conditions in a spin pit.

- Oil-based excitation methods are limited in temperature capability. They are not suitable for test conditions above 400 °F, so alternate excitation methods must be used for high temperature testing.
- Heated shaker table tests can produce the basic “bench data,” but do not include the effects of centrifugal loads (strain gradients, untwist, blade/rotor interaction etc), critical drivers of blade behavior.
- Validated tip-timing systems must be employed to record and analyze airfoil deformation in high temperature conditions where strain gages may not be feasible.
- The damping of integrally bladed disks is based in part on the interaction of the part while pumping air. Evacuated test conditions will produce significantly different responses for these parts. Testing in partial or full atmospheric conditions requires a powerful drive system to overcome the air drag.

Recently these techniques have been used to conduct successful proprietary test programs of both integrally bladed rotors and new airfoil designs at elevated temperature conditions. For high temperature testing, a customized sub-chamber is designed and constructed to enclose the test part within the rig. (Figure 2)

The test assembly is rotated to operational speeds; heating and excitation methods are introduced within the sub-chamber to create the required temperature and resonance conditions. \*

*Rob Murner holds an Aerospace Engineering Degree from the University of Michigan. Test Devices, [www.testdevices.com](http://www.testdevices.com), provides advanced technology spin testing services to customers in a wide variety of industries.*

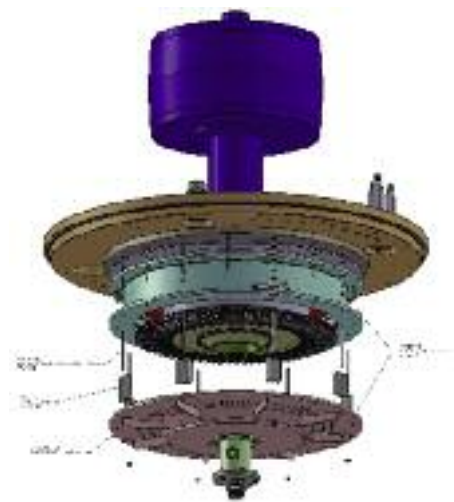


Figure 2 Test Devices' Aerodynamic Pulse Generation (APG) HCF excitation hardware.