

# WESTERN TURBINEUsers

Long Beach  
March 2015

# W.T.U.!

1990



2015

## 25TH ANNIVERSARY

LONG BEACH, CA

# Commemorating 25 years of dedicated service to owners, operators of GE aeros

**LM2500 • LM5000 • LM6000 • LMS100**

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# PRESIDENTS



**John Tunks**  
1990-1992

**Jim Hinrichs**  
1992-2008



**Jon Kimble**  
2008-2013



**Chuck Casey**  
2013-

# WESTERN TURBINE Users

25th Annual Conference  
and Exhibition

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## PRESIDENT'S MESSAGE

On behalf of the Board of Directors, Officers and support staff, welcome to the 25th anniversary of the Western Turbine Users conference.

In the late 1980s, a handful of brave investors purchased some early model LM2500 and LM5000 gas turbines for service in California. Their operations and maintenance personnel quickly realized the common issues and advantages of the LM engine, gathering in small groups to compare experiences and provide solutions to present to the OEM.

Western Turbine Users was born. Incorporating in 1990, the small group of plant representatives grew to 50, doubled to 100, then 500, and now is over 1000 members strong. Be proud to associate with our organization's legacy, rich history, and worldwide influence as you collaborate with other industry professionals. Little did our predecessors imagine their forethought would result in something as meaningful, relevant, and influential as WTUI.

Join me in celebrating 25 years of the evolving General Electric aeroderivative gas turbine industry. Users like you have challenged equipment suppliers to improve their products, as we demand new uses and extend the lives of our gas turbines and all support equipment. As a WTUI member your conference contribution is the root to our success. You are a vital element of the volunteer organization as we move forward to the next 25 years.

Chuck Casey  
President, WTUI  
Utility Generation Manager  
Riverside Public Utilities



# Remembering Jim Hinrichs

Every engineer worth his salt wants to know how things work—and how to make them work better. For those whose job it is to keep a powerplant running and electricity flowing, it is critical that they know how to keep the turbine shaft turning. That's what Western Turbine Users Inc is all about, Jim Hinrichs told the editors in a recent interview. Jim knew. He was a founding member of WTUI and served as its president for 17 years.

"When the first LM2500 packages were installed," Hinrichs recalled, "the guys at the plants were facing similar problems, but there was no mechanism for sharing solutions or even determining if your problem was one-of-a-kind." At the time, the OEM wasn't providing all the guidance needed, so the LM2500 pioneers decided to do it themselves.

Hinrichs continued, "At first we'd meet at the plants and sit around a conference table with one goal—to brainstorm, troubleshoot, share issues, and solve problems. Although GE had a service organization, these machines were brand new in land-based service and the OEM was on a learning curve just as we were." In 1991,

the founders made the decision to incorporate with regular by-laws and membership procedures, and that decision set the tone for the future of the group. It started as an all-volunteer organization and still is.

Another turning point resulted from GE's temporary withdrawal of technical support for the conference, Hinrichs recalled. "That



hole in our program was promptly filled by the licensed depots. The depots tackled the job of preparing detailed technical presentations to the users, a task central to the annual conference," he said. "Witnessing competing depot engineers sitting side-by-side editing each other's notes and

PowerPoint slides is a phenomenal sight and a testament to the WTUI camaraderie," Hinrichs added.

Still, the heart and soul of WTUI is the dedicated users who understand that helping a fellow user is an investment in their own company and expertise because "what's Joe's problem today, could be mine tomorrow." Through the years, WTUI has grown beyond Hinrich's expectations, but it remains true to its focus: solve users' problems, period.

Some of the people who knew Hinrichs best share their thoughts here. Two, Wayne Kawamoto and Mike Raaker, also were founding members. Jon Kimble followed Hinrichs as WTUI president, Chuck Casey is the current president. Mark Axford and Sal DellaVilla, non-users, have been an integral part of the organization's activities since its first official meeting in 1991.

No one has done more to ensure my professional success than Jim Hinrichs. I was a plant I&E tech for only one year following learning experiences in the US Navy and GE, when Jim tapped me to manage PurEnergy LLC's Colton





Power project—eight GE10B1 peaking units at two four-unit sites in California. That experience was a springboard to what has been an extremely rewarding career. I look forward to passing on to my grandchildren what Jim taught me.



Chuck Casey, *Utility Generation Manager, Riverside Public Utilities; WTUI President*

I've known Jim since his appointment to fill WTUI's first president's vacancy back in 1992. Throughout his position as president until his retirement in 2008, I got to know Jim as a great fellow associate, husband, and personal friend. We all looked up to Jim because of his friendly nature, ability to communicate well, and his cheerful personality to enjoy life. Both he and Susan have been the cornerstone in the growth of the WTUI. We will all miss him at our conferences.



Wayne T Kawamoto, *Plant Manager, Corona Energy Partners Ltd; WTUI Treasurer*

Jim Hinrichs was the soul of WTUI. All of the great things that WTUI has accomplished are due in large part to Jim's passion and vision: To create and grow an independent forum for aeroderivative gas turbine professionals. Other GT user

groups have been set up to replicate WTUI but none have come close to reaching the platinum standard set by Jim Hinrichs.

Mark Axford, *Axford Turbine Consultants LLC*



There are a lot of titles that come to mind when I think of Jim Hinrichs: manager, leader, professional, teammate, mentor, friend. I imagine anyone who worked with Jim would agree. I particularly admired his ability to communicate, his sense of organization, his energy and real love for what he was doing. Jim once described work in the power industry as "fun" and you could feel that when you were around him. I was honored when Jim recruited me to work with him as a member of the WTUI Board of Directors. I recall being surprised—overwhelmed—later, when Jim asked me to consider succeeding him as the organization's president. Those of you who knew Jim know he was persuasive, his zeal was infectious; I accepted. I'll always be grateful for his nomination.



Jon Kimble, *WTUI President Emeritus*

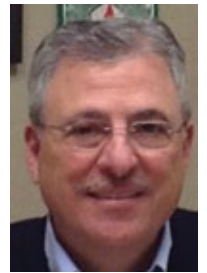
Everyone who knew Jim, knew him as a friend, and "oh by the way," he was president of WTUI. His sense of humor and inability to say anything negative about anyone, even me, made him a

special guy and the right person to lead the organization. Our discussions over the years evolved from engines, schedules, regulations, etc, to wives, families, dreams, and plans for the future. I am very proud to say I was Jim's friend and sidekick for the last 30 years. Charlene, Ida, and I will miss Jim and the times we spent with him and Susan, especially our "not so quiet" lunches and dinners. In case you didn't know, Jim had a very infectious laugh. We were always the loudest table.



Mike Raaker, *Raaker Services LLC; WTUI VP Emeritus*

I was devastated by the news of Jim Hinrichs's passing; he was a good friend. The mark of any man is how he has touched the lives of others. Jim touched so many others, and in so many ways, he will never be forgotten. He left his indelible imprint all over Western Turbine. Those of us who knew and worked with Jim know the measure of his contribution. Those who never had the opportunity to meet him, and today participate in WTUI, reap the benefit of his hard work. Rest in a well-deserved peace, Jim.



Salvatore A DellaVilla Jr, *CEO, Strategic Power Systems Inc*



# WESTERN TURBINE

## OFFICERS

### Chuck Casey

*President*

Chuck is Utility Generation Manager for Riverside Public Utilities (Calif), which serves over 105,000 electric residents and business customers with an LM2500 combined cycle, four LM6000 peakers, and four GE10B1 peakers. He has 28 years of generation experience—specializing in plant construction and commissioning, and regulatory compliance. Before joining Riverside in 2006, Chuck was a plant operator, I&E technician, and plant manager for Stewart & Stevenson, GE, and PurEnergy. He began his career as a nuclear electrician on US Navy fast attack submarines. Chuck was elected President of WTUI in 2013; during his 13 years with Western Turbine he has been LM6000 session chair, secretary, exhibit hall manager, and a member of the Board of Directors. He also serves as Chairman of the Southern California Public Power Authority Generation Group and participates in other industry user groups.



### Jim Bloomquist

*Vice President*

Jim served as a WTUI board member before being elected one of the organization's vice presidents. He has more than 38 years of experience with Chevron and is a subject-matter expert specializing in major electrical power systems and process and gas-turbine cogeneration facilities. Jim currently leads the Electrical Engineering Team for Chevron's California San Joaquin Valley Business Unit, an upstream oil producing company.



### Bill Lewis

*Vice President*

Bill is Plant Manager of a 700-MW combined-cycle facility in Lebanon, Pa. Previously, he was Plant Manager of PPL Generation LLC's Lower Mount Bethel Energy LLC. Before that assignment, he was responsible for the company's simple-cycle peaking gas turbines located in Connecticut,



Pennsylvania, and Illinois. Lewis served six years in the US Navy as a Gas Turbine Specialist, rising to the rank of Petty Officer First Class before taking a shore-side job.

### David Merritt

*Vice President*

David joined Kings River Conservation District in 2010 as the Deputy General Manager of Power Operations. KRCD owns and operates two LM6000PCs at the Malaga Peaking Plant as well as the 3 x 55-MW Pine Flat Hydroelectric Plant. Previously, he spent 19 years in the O&M groups of GWF Power Systems/GWF Energy LLC. There David managed three facilities, four LM6000 peakers, and a 23-MW solid-fueled combustor with steam turbine. Prior to GWF, he served in the US Navy.



### Wayne Kawamoto

*Treasurer*

Wayne is one of the founders of the Western Turbine Users and has served on the Board and as Treasurer since incorporation. He has a BS degree in Civil Engineering from the University of Hawaii and has held numerous positions in project management throughout his 39 years of professional employment. Wayne is the Plant Manager of Corona Energy Partners Ltd.



### Alvin Boyd

*Secretary*

Alvin is Manager of Power Plant O&M at Kings River Conservation District's Malaga Peaking Plant where he is responsible for two LM6000PC simple-cycle units. Before joining KRCD in 2011, he spent 24 years working for the City of Pasadena (Calif) Water & Power Dept as Power Production Superintendent managing the city's Broadway and Glenarm powerplants. He has over 30 years of power-industry experience. Alvin also spent nine years in the US Navy, mustering out as Machinist Mate First Class. He served on the WTUI Board of Directors from 2008 to 2013 and currently serves as co-manager of the exhibit hall.



## BOARD OF DIRECTORS

### Don Stahl

*Board Member*

Donald is Plant Manager for the Pueblo Generation Facilities in Colorado. He manages two powerplants totaling 380 MW of utility and non-regulated generation owned by Black Hills Energy—Colorado Electric and Black Hills Colorado IPP, respectively. Stahl came to the company in 2010 to manage installation and commissioning of the two LMS100s and four LM6000s at Pueblo.



### Ed Jackson

*Board Member*

Ed is Plant Manager of Missouri River Energy Services' Exira Generating Station in Brayton, Iowa. His gas-turbine experience includes Allison 501s, Solar Centaurs, LM2500s, and LM6000s. Previously he was a combined-cycle plant supervisor at Maui Electric Co and a field service and commissioning engineer for Stewart & Stevenson. Jackson spent eight years in the US Navy as a GT systems technician (electrical).



### Andrew Gundershaug

*Board Member*

Andrew is the Plant Manager for Calpine's Solano Peakers (five LM6000s), located in Northern California's Solano County. Previously he held various other positions at the company's aero generating assets in Northern California—including Operations Manager, Maintenance Manager, DCS Technician, and IC&E Technician. He has been with Calpine since entering the industry in 1998 as IC&E Technician at the Watsonville Cogeneration Plant following graduation from UC Santa Cruz. Andrew currently is serving his second year as the LM6000 Breakout Session chair; he served the previous three years as the LM5000 Breakout Session chair.



### Bryan Atkisson

*Board Member*

Bryan is a Plant Manager for Riverside



# LEADERSHIP TEAM

Public Utilities (Calif) with responsibility for four LM6000PCs and four GE10B1 peaking gas turbines. He has 14 years of experience operating and maintaining LM6000s and was involved in the construction and commissioning of the four Riverside units that he now manages. Bryan served eight years in the US Marine Corps, most of that time spent performing GT overhauls as a jet engine mechanic. He served WTUI as the LM6000 session chair for six years prior to joining the Board of Directors in 2013.



## Jermaine Woodall

*Board Member*

Jermaine is a Fleet O&M Manager for Exelon Generation. He has worked in various powerplant settings comprised of peaking units, frames, and renewables. Jermaine brings 14 years of industry experience to WTUI, gained in positions such as Instrumentation Controls & Electrical Technician. He also served in the US Navy for 10 years as an Aviation Electricians Mate. An alumnus of the University of Phoenix, his academic credentials include Master of Business Administration and Bachelors of Science in Management with a minor in Electronics.



## Devin Chapin

*Board Member*

Devin has over 20 years of experience in power generation. For the past 13, he has worked at Turlock Irrigation District (Calif), a municipal utility. Devin is Power Plant Supervisor, responsible for O&M management at TID's Almond Power Plant, which has four LM6000s. The oldest of these is a steam-injected LM6000PC Sprint, converted from an LM5000 STIG in 2003. The remaining three gas turbines represent GE's first production LM6000PGs, which are operated in simple-cycle mode and are valued for their rapid start capability. Devin has been involved with the LM6000PG project from the design phase through construction, commissioning, and commercial operation.



## BREAKOUT SESSION CHAIRS

### Bob Boozer

*New Users*

Now semi-retired, Bob remains active in the LM community by providing operator training for Reed Services LLC. His training began in the military where he instructed navy recruits, future commanding officers, engineering officers, and senior enlisted personnel in shipboard operations, emergency response, and plant management programs for diesel engine and gas-turbine platforms. After the military, Bob provided LM-series training in O&M for powerplants worldwide in the Stewart & Stevenson training group. Since then, he has held positions as Plant Manager at LS Power University Park, a 12-unit, 540-MW LM6000 peaking facility, as well as O&M Supervisor for TransAlta's Big Hanaford Project, a 4 x 1 LM6000PC-powered combined cycle with once-through steam generators.



### John Baker

*LM2500*

John is a Plant Manager for Riverside Public Utilities (Calif). Previously he was O&M Manager for Calpine Corp's Bethpage Energy Center in Hicksville, NY, where he was responsible for two LM2500s and two LM6000s. He started his gas-turbine career with Calpine at Watsonville, later working at the company's Agnews and Los Esteros facilities before moving to the East Coast. Prior to Calpine, John was in boiler operations at Foster Wheeler Energy Corp. This is John's eighth year as session chairman for the LM2500 group.



### Perry Leslie

*LM5000*

Perry has been a Plant Technician for Wellhead Electric Co at the Yuba City Cogeneration Plant since 2004. Responsibilities include I&C and mechanical maintenance, and operations. He also is the GT management team leader for Wellhead. Previously, Perry spent six years as a field service technician for GE in the Bakersfield area, working on LM1600,



LM2500, LM5000, and LM6000 engines. Earlier, he served in the US Navy for six years as a GT systems technician—electrical (GSE).

### Andrew Gundershaug

*LM6000*

Andrew is the Plant Manager for Calpine's Solano Peakers (five LM6000s), located in Northern California's Solano County. Previously he held various other positions at the company's aero generating assets in Northern California—including Operations Manager, Maintenance Manager, DCS Technician, and IC&E Technician. He has been with Calpine since entering the industry in 1998 as IC&E Technician at the Watsonville Cogeneration Plant following graduation from UC Santa Cruz. Andrew currently is serving his second year as the LM6000 Breakout Session chair; he served the previous three years as the LM5000 Breakout Session chair.

### Jason King

*LMS100*

Jason currently works for DGC Operations LLC as the O&M Manager for CPV Sentinel Energy LLC in North Palm Springs, Calif. He is responsible for the safe operation and maintenance of eight LMS100 peaking gas turbines. Prior to joining the Sentinel Project in 2012, Jason served as the Plant Manager for Wildflower Energy LP where he was responsible for the safe operation of five LM6000s. Jason has worked in the power generation business for over 14 years and has experience ranging from construction, commissioning, and operations of both LMS100 and LM6000 gas turbines. Prior to working in power generation, Jason served five years in the US Marines Corps as a helicopter gas-turbine mechanic.




## SUPPORTING STAFF

### Mike Raaker

*Historian/  
Ambassador*

What do diapers, toilet paper, jet engines, and WTUI have in common? Mike Raaker. He started his career at Procter & Gamble, assigned to install a cogeneration plant at the company's towel and tissue plant in Oxnard, Calif. The LM2500-powered facility would keep Mike





**TECHNICAL EXPERTISE**

Air New Zealand Gas Turbines is a world leading OEM approved gas turbine service provider, with an international reputation for quality overhaul and repair services on General Electric LM2500 and LM5000 gas turbines. As part of Air New Zealand's Engineering and Maintenance team, Air New Zealand Gas Turbines shares the operators' focus on cost-effective quality, reliability and engine availability. They provide up to Level 4 depot maintenance, and their dedicated field service team provide level 1 to 2 field service onsite.



busy for the next 30 years and would lead to his, and wife Charlene's, participation in WTUI.

**Charlene Raaker**

*Registration Coordinator*



As WTUI's Registration Coordinator (and Mike Raaker's better half), Charlene has been supporting the organization for almost as long as it has been in existence. Charlene's is the "voice on the other end of the line" whenever anyone calls the group.

**Wayne Feragen**

*Webmaster*



Wayne is Senior West Coast Plant Manager for Noresco, currently responsible for powerplants in Colton, Calif, and San Diego. Wayne has over 22 years of powerplant experience, starting as a Gas Turbine Electronics Technician First Class in the US Navy. After leaving the service, he went to Newark Pacific Paperboard and ran an LM2500. After that, he worked at two Sunlaw plants running LM2500s. Wayne has served as WTUI's Webmaster for the last seven years.

**Joella Hopkins**

**Jennifer Minzey**

*Conference Coordinators*



Mumtaz Marketing & Events has been assisting the WTUI Board in producing the conference for the past several years. Mumtaz has produced the past several Monday Night events, assisted with the registration process, coordinated the spouse tours, and has made the WTUI conference "Mumtaz!" As logistical mavens they thrive on the details. Their motto: Details make the big picture happen. Visit [www.MumtazMarketing.com](http://www.MumtazMarketing.com) for more information on the Mumtaz team, which looks forward to meeting attendees at the registration desk.

**HONOR ROLL**

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1990-2014**

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# TIMELINE

**Editor's note:** *Twenty-five years may not seem long, but a lot certainly can happen in that period of time, as this section attests. The timeline compiled from many contributors is not complete by any means, but it offers a perspective on how much the electric generation sector of the electric power industry has changed since owner/operators of GE aero gas turbines first started meeting informally in 1982.*

*This mosaic blends snippets of information on the users who have given freely of their time to create and grow the WTUI into the world-class organization it is today, the laws affecting gas-turbine design and operation, LM engine engineering, noteworthy plants in the fleet, highlights of involvement by the OEM, depots, and exhibitors. We think you'll find a quick read illuminating.*

**1939** The first utility gas turbine to generate electricity, rated 4 MW and developed by Brown Boveri & Cie of Switzerland, is commissioned in the town of Neuchâtel. The ASME Landmark is on display at the Alstom factory in Birr. Key to this engineering achievement was the successful demonstration of an efficient axial compressor. Its high power density made possible jet engines for aviation service—the forerunners of the GE LM engines supported by WTUI.

**1945** IHI, one of the four depots supporting WTUI technical sessions, develops Japan's first jet engine. Fast forward to today, the company has shipped more than 560 gas turbines—including LM machines.

**1967** IHI begins working in the areas of gas-turbine power generation equipment and cogeneration operations.

**1969** GE launches the LM2500 engine; marine propulsion is the first application.

**1971** First industrial use of an LM2500 is in the oil and gas industry.

**1972** Clean Water Act becomes law.

**1973** First oil embargo.

**1977** Important amendments to the Clean Air Act (1970) affecting powerplants are signed into law.

**1978** Natural Gas Policy Act initiates deregulation of the wellhead price of natural gas, allowing it to adjust with "market forces."

Second oil embargo.

Passage of the Public Utility Regulatory Policies Act (Purpa) opens the generation market to non-utility entities, providing

their facilities meet certain size, fuel, and efficiency criteria.

**1979** Fuel Use Act prohibits utilities from using natural gas, a response to the oil crises of 1973 and 1978 and the need to have natural gas for home and commercial/institutional heating and as an industrial raw material.

LM2500 is first used in power generation service.

The Three Mile Island nuclear accident occurs.

**1981** Batch Air Inc begins life as an engine repair facility. It is located at the Miami (Fla) airport and owned by George Batchelor.

Stewart & Stevenson receives its first LM2500 genset order from India, for an offshore platform.

**1982** A handful of users responsible for O&M at several West Coast LM2500 generating facilities and the first LM5000 cogen plant at Simpson Paper Co (Shasta mill) in Anderson, Calif, begin meeting every couple of months in break rooms to discuss problems/solutions, best practices, lessons learned. This is the beginning of what would become WTUI. The host plant was responsible for coffee and lunch.

GE engineering support for LM engines is headed by men such as Bill Baker, Horace Magley, and John Campbell.

IHI's first LM5000 begins operating in the US.

Stewart & Stevenson receives its first US LM2500 genset order for the Hawaiian Independent Refinery Inc (Fig 1). It begins operating the following year under the watchful eye of HIRI's 20-something lead engineer, Wayne Kawamoto. He later is elected WTUI's first treasurer, a job Kawamoto still has today.



**1. Wayne Kawamoto** needs shades to protect his eyes from the reflection off the first LM2500 engine installed by Stewart & Stevenson in the US. The year is 1983, the place was Hawaiian Independent Refinery. Mark Axford remembers



**2. GE's Jim McGlothlin** presents plaque to Andy Anderson and Brian Brown of Procter & Gamble recognizing the LM2500 at the company's Oxnard (Calif) facility for being the first Model PC to achieve 100,000 operating hours. Year was 2002. The engine eventually would break the 250,000-hr barrier before being replaced with a PE model

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**3. Mike Raaker (at right in left photo) and Wayne Kawamoto (right photo) prove their long-term involvement with LM aero engines with these 1980s Polaroids taken at the Batch Air repair facility in the shadows of the Miami airport**

The first West Coast LM2500PC installed by GE's Turbine Business Operations Div (TBO) is commissioned at Procter & Gamble's Oxnard (Calif) manufacturing plant as a Purpa-qualified cogeneration package (Fig 2). Mike Raaker, former WTUI VP and board member and current historian/ambassador, was the technical engineer assigned to that project by P&G management in Cincinnati. He was involved from the beginning of work.

**1983** Batch Air begins to overhaul LM engines for GE, to reduce the OEM's service backlog. Fig 3 is an "ancient" Polaroid of Mike Raaker (right) and Kevin Camfield in front of the Batch Air sign at the shop. Raaker was representing Procter & Gamble's Oxnard facility, Camfield P&G's Sacramento plant. As Raaker remembers, everyone visiting the plant was asked to sign in with a photo; that picture was circulated throughout the facility so everyone working on your engine could address you by name. How times change.

Hawaiian Independent Refinery starts

up the first LM2500 packaged by Stewart & Stevenson for US service (Fig 4).

Simpson Paper Co's (Shasta mill) commissions the first LM5000 installed in the US. Steve Johnson, one of WTUI's early proactive users, has responsibility for the engine and quickly becomes expert in operating and maintaining the problematic GT model. He remains at the mill for more than 12 years. At the time of installation, the Shasta unit was the third LM5000 operating worldwide—if you count the two engines in Bangladesh which reportedly were not running well, if at all.

**1985** The LM5000 at Simpson Paper Co (Shasta mill), which went commercial in May 1983, serves as the beta test site for the development of steam injection. Tests were successful and brisk sales of LM5000 STIG80 and STIG120 gas turbines followed.

**1986** Fuel Use Act is repealed. FERC Order 436 forces "open access," thereby allowing consumers (such as powerplants) to purchase gas at wellhead prices and

contract for pipeline delivery service.

**1987** Batch Air is sold to Greenwich Air Inc, owned by Eugene Conese.

**1988** GE buys Stewart & Stevenson.

Power Systems Engineering Inc builds the LM5000-powered Corona (Calif) Cogen Plant (Fig 5), today managed by WTUI Treasurer Wayne Kawamoto, and three LM2500-equipped generating facilities in Bakersfield, Calif. These projects are currently managed by CAMS Juniper CA LLC. The Corona plant supplied 35 MW to SCE and about 7 MW to Golden Cheese Co of California, the thermal host, until its closure in 2008.

The first significant Congressional hearing on global warming takes place.

TransCanada Turbines Ltd, perhaps best known as TCT, is established as a joint venture between Wood Group and TransCanada Corp.

Stewart & Stevenson provides Wheelabrator Technologies, Norwalk, Calif, its first LM2500 designed for high STIG injection. This technology is accepted and adopted by the South Coast Air Quality Management District in its NO<sub>x</sub> reduction retrofit rule.

**1989** FERC passes the Natural Gas Wellhead Control Act, essentially finishing what the Natural Gas Policy Act (1978) started.

Frank Oldread's focus on LM engines begins with his hiring by Power Systems Engineering Inc during construction of the LM5000-powered San Joaquin Cogeneration Facility in Lathrop, Calif. All of the LM5000 plants installed by PSE initially provided steam to an adjacent process plant (in this case, a glass factory). Some of the steam produced by the HRSGs installed in



**4. Stewart & Stevenson's first LM2500 package was installed at the Hawaiian Independent Refinery in 1983. Photo was taken years later**



**5. Wayne Kawamoto's plant in Corona, Calif, provided steam and electricity to an adjacent cheese manufacturing plant**

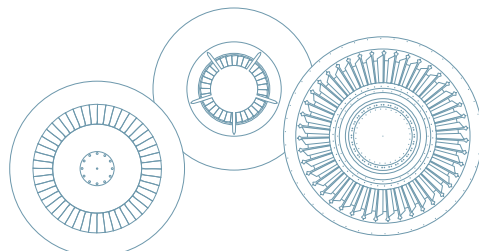


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all PSE LM5000 plants was injected into the gas turbine to reduce NO<sub>x</sub> emissions. San Joaquin's thermal host has since gone out of business, but steam still is injected into the GT.

Power Systems Engineering Inc is purchased by Dow Chemical Co and the business is renamed Destec Energy Inc, which builds five more LM5000-powered generating facilities in Bakersfield, Calif.

A prototype exhaust-flow wedge for Stewart & Stevenson gas-turbine packages is installed at the Wheelabrator plant in Norwalk, Calif. The wedge eliminated turbulence problems and streamlined exhaust-gas flow, reducing backpressure.

**1990** Amendments to the Clean Air Act place new emphasis on SO<sub>2</sub> and NO<sub>x</sub> emissions, air toxics, and interstate transport of air pollutants.

WTUI incorporates in the fall. Bylaws are developed. The directors elected after incorporation and their officer positions: John Tunks, president, until 1992; Wayne Kawamoto, assistant secretary, until 1994, and treasurer (he continues in this position); Bob Fields, secretary, until 1993; Ernie Soczka, chairman of the board, until 1993; Bill Caldwell, VP, until 1992; Leon Ballard, VP, until 1992.

**1991** Strategic Power Systems Inc (SPS) begins collecting O&M data for GE, sharing this information with WTUI. The company also releases its first ORAP® report to participating aero users and GE summarizing operating data from 24 plants equipped with 19 LM2500s and 14 LM5000s. SPS has worked collaboratively with the WTUI leadership since incorporation.

The first LM6000PA, designed for NO<sub>x</sub> control by use of water or steam injection, goes into service.

Treasurer Wayne Kawamoto files his financial report for the first Western Turbine conference following incorporation. Kawamoto could not have imagined at the time that he would still be doing this 25 years later. Expenses for the Sacramento meeting, which hosted 130 total attendees, were less than \$20,000, a small fraction of what this year's event will cost. The organization's reserve, as stated in the 1991 financial statement, was less than \$1000.

**1992** Brent Newton and Steve Johnson are elected WTUI directors and VPs; they hold those positions until 1995.

Congress passes the National Energy

The first LM6000PB, equipped with a dry low emissions combustion system (DLE), begins operation. It produces less than 25 ppm NO<sub>x</sub>.



**6. Jack Dow (center) and Mike Raaker (right) are recognized in this 1997 photo for their service as WTUI directors. Jim Hinrichs, president of the organization at that time, presents the awards**

**1995** Simpson Paper Co's LM5000/STIG80 in Anderson, Calif, reaches 100,000 operating hours under the maintenance contract offered by Energy Services Inc. Simpson owned three LM5000s; the other machines were in Pomona and Ripon, Calif. The Shasta mill went into bankruptcy and closed its doors in August 2001; however, the cogeneration plant continued to operate until May 2013.

Steve Johnson and Todd Emery are elected to three-year terms as WTUI directors.

**1996** California begins its first experiment in retail electricity competition.

John Fintland, owner and founder, Advanced Filtration Concepts Inc participates in his first WTUI meeting and hasn't missed exhibiting since.

Ken Gestel and Marc Kodis are elected WTUI directors. Gestel serves his three-year term; Kodis resigns in 1997. Joel Lepoutre is appointed to complete Kodis' term.

Larry Flood is appointed WTUI's first webmaster. He remains in that position until Wayne Feragen relieves him in 2006.

Orders 888 and 889 establish open access to electric transmission lines.

The first LM2500+ rolls off the production line.

TVS Filter's Industry Manager Fran Redisi first participates in a WTUI meeting as an exhibitor.

**1997** Bob McCaffrey and Dave Hermandson are elected WTUI directors for three-year terms. McCaffrey also serves as the organization's secretary for one year.

The first Model PC and PD engines leave the GE factory.

Frank Oldread becomes Destec Energy's turbine maintenance manager; he remains in Bakersfield.

Greenwich Air Inc is sold to GE, which closes the facility's doors in the early 2000s.

Jack Dow and Mike Raaker retire from the WTUI Board of Directors (Fig 6). Dow was elected secretary in 1998, a position he held until 2008. Raaker was elected

Policy Act, allowing access to utility transmission lines by independent power producers. This complemented Purpa (1978), which opened up the generation segment of the electricity value chain to non-utilities.

John Tunks resigns as president of WTUI and Jim Hinrichs is elected to succeed him. Hinrichs serves in that position until 2008.

First annual WTUI golf tournament is held in Monterey, Calif. Ronnie McCray is the tournament organizer. He continued as tournament chairperson until completing his term on the board of directors in 2003.

**1993** Air New Zealand Gas Turbines' John Callesen attends his first WTUI meeting, returning every year since.

An Eastern Turbine Group is formed and holds its first meeting to reduce cost and time of travel for owner/operators in the East. But the allure of California is too great and the group cannot be sustained.

Brian Hulse and Don Driskill are elected to the WTUI board for three years; Driskill also is elected secretary.

Frank Oldread leaves San Joaquin Cogen for greener pastures as a plant manager for Destec Energy in Bakersfield.

Gae Dow is hired as WTUI conference director, serving in that capacity until 2008.

**1994** Jack Dow and Mike Raaker are elected to three-year terms as WTUI directors.



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**7. Frank Oldread's collection of badges** don't reflect his first 10 years or so of LM involvement but are sufficient to explain by glance how dramatically the aero generation sector has changed in WTUI's 25 years. Note the different employers—not because Oldread switched, but because his employer was purchased by his next employer. Also reflected are Oldread's changing roles over the years—from plant operations to engine service; and his different functions within WTUI

VP in 2002 and remained in that position until retiring in 2010. He currently serves as the gas-turbine organization's ambassador and historian.

Kyoto Protocol is adopted, committing participants to reducing greenhouse gas emissions.

NGC Corp acquires Destec Energy and its plants in Bakersfield, San Joaquin, and Corona, Calif.

The first LM6000PC (SAC) and PD (DLE) models, more powerful than the earlier PAs and PBs, achieve commercial operation.

**1998** Jim Amarel and Norm Duperon are elected WTUI directors for three-year terms.

LM6000 highlights include a variable-speed mechanical-drive option, commercial operation of the first dual-fuel DLE combustor, and first commercial operation of the Model PC Sprint™ (Spray Intercooled Turbine) system.

Stewart & Stevenson sells its gas-turbine business to GE.

**1999** Joel Lepoutre and Frank Oldread are elected WTUI directors for three-year terms. Oldread offers a montage of WTUI name badges in Fig 7 that reflects the ongoing and dramatic changes in the aero sector of the power-generation business over the years.

NGC Corp is rebranded Dynegy Inc.



**2000** More than 200 LM6000s have entered commercial operation since the model was introduced in 1991. The high-time engine had logged more the 50,000 operating hours by this time; fleet operating hours were in excess of 3 million, reliability was 98.8%, and the 12-month rolling average engine availability was 96.8%.

More than 23,000 MW of GT capacity begins operating in this first year of what came to be known as the "gas-turbine bubble." From 2000 through 2004, a nominal 200,000 MW of GT capability is installed in the US. During the same period, WTUI attendance grows by nearly 30%.

Richard Smith and James McArthur are elected WTUI directors. Smith resigns in 2002 and his term is completed by Bob Nelson. McArthur resigns shortly after his election, with Jim Bloomquist completing his three-year term.

The Dynegy generating plants are sold to El Paso Merchant Energy (Fig 8). Four years later El Paso sells its powerplants to Northern Star Generation LLC, illustrating the volatile nature of the business.



**9. CCI has published a special issue for WTUI's annual meeting since the organization's 20th anniversary in 2010 (center of photo)**

**8. El Paso Merchant Energy's venture into power generation was short-lived**

**2001** Base-load cogeneration contracts begin transitioning to cycling/peaking agreements.

Ronnie McCray and Thomas Koehler are elected to three-year WTUI director terms.

TCT begins supporting technical sessions for the annual WTUI meetings. This effort continues today.

**2002** Don Driskill and Mike Horn are elected WTUI directors for three-year terms.

Edward Tomeo forms Enpower Corp via a management buyout of United American Energy Corp's western business unit, UAE Energy Operations Corp. Tomeo was president of the subsidiary company.

GE offers to buy WTUI.

TCT's Dale Goehring leads the company's participation in WTUI technical sessions and continues in that capacity until passing the torch to Steve Willard in 2008.

Bob Nelson, Jim Bloomquist, and Rich Recor are elected WTUI directors for three-year terms.

GE pulls its support for WTUI.

**2004** Aeroderivative Gas Turbine Support Inc exhibits only months after the company is founded by Alan Mibab, who had been attending the show for years in another vendor's booth. AGTSI has not missed a meeting since.

GE-authorized depots begin to provide WTUI technical support.

Jon Kimble and Jimmy Wooten are elected to three-year WTUI director terms.

Jim Bloomquist becomes WTUI's conference golf tournament chairperson.

**2005** Chuck Casey and Charlie Hook are elected WTUI directors.



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**10. Groton Generating Station** in South Dakota, owned by Basin Electric Power Co-op, is home to the world's first LMS100 gas turbine, rated a nominal 100 MW

Editors of the Combined Cycle Journal attend their first Western Turbine meeting. It was the beginning of a close collaboration with the WTUI Leadership Team (see p 6), benefiting CCJ's coverage of LM engines as well as users and vendors in this industry sector (Fig 9).

**2006** Barry Mazer, AP&M's owner and a big supporter of WTUI, dies in an auto accident.

Bremco Inc presents its HRSG repair capabilities in the exhibition hall for the first time. GM Bill Kitterman and Sales Engineer Bob Morse will participate for the 10th consecutive year in 2015.

First LMS100 engine, rated a nominal 100 MW and having an efficiency of 46% (LHV) in open-cycle operation, enters commercial service for owner/operator Basin Electric Power Co-op at the utility's Groton (SD) Generating Station (Fig 10).

IHI participates in its first WTUI exhibition. The company had been providing support for technical sessions since the millennium.

Jim Amarel and Mark Breen are elected to three-year WTUI director terms. Breen resigns shortly after his election and Frank Oldread completes his term.

Jim Bloomquist is elected to the WTUI position of VP, a position he continues to hold.

Turbine Technics first participates in the WTUI exhibition hall. Shawn Burdge was in the company booth then as he will be in 2015, Turbine Technics' 10th straight year.

Wayne Feragen is appointed WTUI's second webmaster and continues in that position.



**11. Riverside Energy Resource Center**, equipped with four LM6000s like the one shown, earned industry recognition for its zero-liquid-discharge system, which has demonstrated the plant's ability to satisfy the often conflicting goals of regulatory compliance and affordable capital and operating costs

Steve Johnson, a former WTUI director, makes a major career change and launches SJ Turbine Inc, a thriving business today.

**2008** Advanced Turbine Support LLC's President Rod Shidler and Field Service Manager Mike Hoogsteden display the firm's capabilities at WTUI for the first time. They haven't missed a meeting since.

Chuck Casey is elected secretary of WTUI, a position he retains until his election as president in 2013.

Gae Dow retires as WTUI conference director after 15 years of service (Fig 12)

Jim Hinrichs and Jack Dow become the first WTUI officer/director retirees to earn lifetime membership in the organization.

Jon Kimble succeeds Jim Hinrichs as

**2007** A new management team at GE reinstates the company's support of WTUI.

Bill Lewis and David Merritt are elected directors for three years. Lewis resigns in 2008 upon his election to VP; Alvin Boyd completes Lewis' director term.

CSE Engineering Inc exhibits at its first WTUI with Craig Corzine, the company's founder and CEO, in the booth. He was urged to attend by Steven Morton who had participated since 2000 as a user. CSE will run its consecutive exhibitions streak to eight in 2015.

Gas Turbine Controls participates in its first WTUI exhibition, touts the experience, and goes for eight straight at the 25th anniversary meeting.

Riverside Energy Resource Center, today a four-unit LM6000-powered peaking facility managed by WTUI Director Bryan Atkisson, earns CCJ's Pacesetter Plant Award for the design of a zero-liquid-discharge system that has demonstrated its ability to satisfy the often conflicting goals of regulatory compliance and affordable capital and operating costs (Fig 11).



**12. Gae Dow** retires as WTUI conference director after 15 years of service



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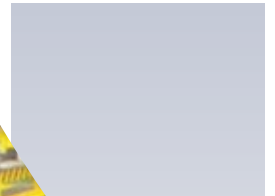
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**13. Bob Nelson's** determination to do the "right thing" and his commitment to making decisions based on sound engineering principles is remembered at SMUD's Cosumnes Power Plant

president of WTUI and serves in that capacity until his retirement in 2012.

Mark Breen and Harry Scarborough are elected to three-year WTUI director terms. Scarborough resigns in 2010 and David Merritt is appointed to complete his term.

Sulzer's first year at WTUI and the company hasn't missed a meeting since. Warren Holmes and Mike Curran represented Sulzer that first year to demonstrate its LM5000 power turbine repair capabilities.

WoodGroup Pratt & Whitney opens a shop in Florida to overhaul LM2500s and FT4s. The business is not sustainable.

**2009** Bob Nelson's battle with cancer ends at age 46. The former WTUI director was SMUD's superintendent of thermal projects. He was highly regarded by industry peers for his technical and management prowess, and well liked (Fig 13). One

industry colleague said, "You always felt good being around him." Nelson's recipe for professional success: "No serial number ones."

Charlene Raaker is appointed conference coordinator; she continues in that position.

Don Haines and Tony Skonhovd are elected WTUI directors for three years. The latter resigns in 2011 and is replaced by Rudy Barrett, who also resigns. Don Stahl is appointed to complete the board seat vacated by Skonhovd and Barrett.

Groome Industrial Service Group presents its capabilities in SCR and CO catalyst cleaning at WTUI for the first time. Jeff Bause, VP, of the company's HRSG Maintenance Div, has been a regular participant since.

HPI LLC attends its first WTUI exhibition; the company's participation continues.



**14. Terry Bundy Generating Station,** equipped with LM6000s, stands out for its recognized safety practices

Simply Mumtaz is retained as conference consultant; it continues in that role today.

Plants owned by Delta Power are sold to Juniper Generation LLC (operated by CAMS—Consolidated Asset Management Services).

Terry Bundy Generating Station, powered by LM6000s and managed by WTUI Director Brad Hans, receives CCI's Best of the Best Award for its water conservation program (Fig 14). It includes recovery of nearly 1000 gal/hr of condensate from inlet-air cooling systems during a hot, humid summer day.

**2010** Alvin Boyd, John Baker, and Brad Hans are elected WTUI directors for three years.

C C Jensen Inc's Axel Wegner gets hooked on the WTUI value proposition with the company's first experience exhibiting. He has returned every year since.

Gary Werth (G R Werth & Associates) attends WTUI for the first time, looking for users who might benefit from using his stack balloons to minimize air flow through their gas turbines during periods of prolonged shutdown to protect critical engine parts against moisture, salt, dirt, low temperature, etc. He installs duct balloons on several LM6000s within the next year and now attends the world's largest meeting for land- and marine-based aero users each spring.

IHI partners with Reed Services Inc in the Cheyenne Service Center equipped especially for supporting LM6000 owner/operators.

WTUI's 20th anniversary celebration is held aboard the USS Midway.

**2011** CAMS and Air New Zealand collaborate to launch Air New Zealand Field Services LLC in Bakersfield, Calif. Frank Oldread is named general manager.

Charlene Raaker's tennis bracelet gets stuck in the registration desk and she is forced to work one-handed until mechanics show up to free her. Anyone with a picture of Charlene playing tennis wins a prize.

Ed Jackson and David Merritt are elected WTUI directors through the 2014 meeting, but Merritt is elected a VP of the organization in 2013 and John Baker is appointed to complete his term on the board.

Lincoln Electric System's LM6000-equipped Terry Bundy Generating Station, managed by WTUI Director Brad Hans,

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TCT opens its state-of-the-art 220,000-ft<sup>2</sup> repair and overhaul facility in Airdrie (near Calgary).

**2012** Andrew Gundershaug and Don Stahl are elected WTUI directors for three-year terms.

Chuck Casey replaces Jon Kimble as president of WTUI; he continues in that position.

Don Stahl, a WTUI director and plant manager of Black Hills Corp's Pueblo Airport Generation Station, brings into commercial operation that 380-MW world-class facility's two LMS100 peakers and two LM6000PF-powered 2 x 1 combined cycles (Fig 15).

WoodGroup Pratt & Whitney withdraws from its LM2500 overhaul offering.

**2013** Daniel Arellano, Charles Byrom, and Bryan Atkisson are elected WTUI directors for three-year terms. Byrom retires in 2014

and Ed Jackson is appointed to complete his term. Arellano resigns from the board in 2014. His director's chair remains vacant until the 2015 meeting, when it will be filled by appointment.

IHI celebrates its 160th anniversary.

Jon Kimble is granted lifetime WTUI membership upon his retirement as the group's president. Chuck Casey is elected to replace Kimble.

Riverside Public Utilities' Clearwater Cogeneration Plant, managed by LM2500 Breakout Session Chair John Baker, contributes to an advancement in the state of the art developed by Fossil Energy Research Corp, a WTUI exhibitor, for determining the remaining life of SCR catalyst in-situ.

TCT expands its testing facility to better support the LM6000 PA, PB, PC, PD, and PF engines.

Wood Group and Siemens' TurboCare form the joint-venture company Ethos Energy Group, specializing in the maintenance, repair, and overhaul of gas and steam turbines.

WTUI officer corps is shuffled with Chuck Casey's election as the organization's

president. Alvin Boyd is elected secretary and David Merritt is elected VP. They continue in those positions.

**2014** Alliance Pipeline shares with LM users its experience in using HEPA filters on gas-turbine air inlet systems. Details are provided in CCJ's special publication for WTUI's 24th annual meeting. The company gave HEPA two thumbs up based on four years of normal pipeline use and rigorous analysis of results (Fig 16).

David Brumbaugh, president, DRB Industries Inc, is elected Majority Caucus Chairman for the Oklahoma House of Representatives. The company has exhibited at WTUI every year since its founding by Brumbaugh and wife Shelley nearly 10 years ago.

Jermaine Woodall and Devin Chapin are elected WTUI directors for three-year terms.

Jim Hinrichs, past president and the face of WTUI for two decades, passes unexpectedly during a back operation (see tribute, p 4).

**2015** MTU closes in on 20 years of participation at WTUI.

WTUI celebrates its 25th anniversary.



**15. Pueblo Airport Generation Station** produces up to 380 MW with its two LMS100 peakers (left) and two LM6000PF-powered 2 x 1 combined cycles (right)



**16. LM2500 compressor looks new** after having operated for more than 22,000 hours at base load with no water washes

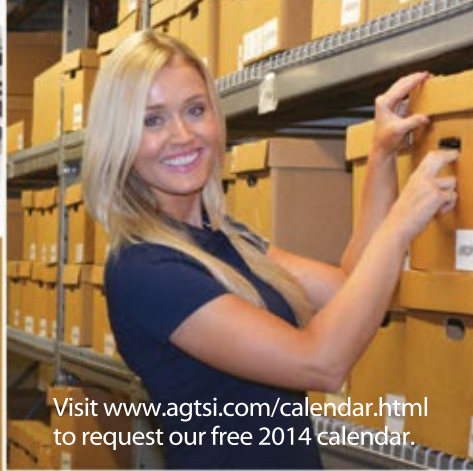


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# HISTORY

**Editor's note:** *"It is an interesting and challenging proposition to look back over time. Remembering and reconstructing events, like beauty, is in the eyes of the beholder. However, there are circumstances that demand a look back, and, typically, these*

*circumstances are related to people whose contributions have made, and continue to make, a difference. And that describes WTUI to a tee. Since its inception, it has been a group of people with a mission and that mission has been all about adding value."*

**T**hese words from Sal DellaVilla, CEO, Strategic Power Systems Inc, provided motivation for this section covering the many facets of WTUI history: the pre-incorporation years, the years since incorporation, the legislation that both stimulated and impeded industry growth and technology development, and the LM engines themselves.

WTUI has a history primarily because of people like Wayne Kawamoto, Mike Raaker, DellaVilla, Mark Axford, Steve Johnson, and a few others who have been around since before the beginning of the organization, have good memories, took good notes, and are loathe to deposit in the circular file anything that someday might be of value. All were of the opinion that the 25th anniversary offered the perfect reason for compiling a historical perspective on the world's largest independent user organization dedicated to gas turbines.

As you read the next few pages, keep in mind that the company and plant affiliations cited are consistent with the timing of the reference. In some cases, the individuals mentioned are still employed by those organizations, in others the companies may no longer exist, or plants have been renamed.

## Before incorporation

The history of WTUI dates back about 10 years prior to incorporation. During the late 1970s, the US was challenged with oil and gas shortages and record-high fuel prices—much of this caused by wasteful energy practices. Remember when automobiles were averaging 9 mpg and some power boilers were operating at efficiencies as low as 60%?

In 1978, President Jimmy Carter signed into law the Public Utility Regulatory Policies Act (Purpa), aimed at correcting some of the problems. For the first time, utilities were required to purchase electricity from qualified cogenerators at a price equivalent to what it would have cost the utilities to produce the same power with their least-efficient equipment. This had two effects:

It forced the utilities to shut down marginal equipment and it ushered in the era of high-efficiency cogeneration facilities.

The 15-yr power-purchase contracts typical of that time were particularly advantageous to companies with processes having fuel-to-product efficiencies of 80% or more. The Northeast and West Coast, saddled with the highest energy prices in the nation, were the prime locations for cogeneration plants. GE, one of the first companies to recognize this opportunity, began marketing its Turbine Business Operation's LM2500 package, initially capable of 17.8 MW. In the early 1980s, GE introduced the LM5000 package, capable of 50 MW.

Utilities were not going to take all this laying down. Concerned with the ability of small energy producers to provide electricity reliably, and consistently, they developed a set of strict rules that created a lot of pain for someone entering into a contract and failing to meet the requirements. Example: Failure to meet the 80+% availability requirement at the contracted capacity could result in the loss of a month's revenue; in the extreme it might require repayment of annual profits.

During the first few years of Purpa, the number of cogeneration sites on the West Coast grew dramatically—each usually having a unique process to earn Qualifying Facility status. However, the turbines, packages, and processes did not start and run as expected. GE engines were very good at operating for short periods, with a rest to perform maintenance.

But most sites were required to run for weeks—sometimes months—without a shutdown, depending on the process supported. Starter failures, igniter liberation, fuel-nozzle failures, etc, caused many sleepless nights for the operators as well as the OEM. Both parties stood to lose considerable sums if the turbines and packages could not be made reliable.

GE found itself running from site to site trying to put out fires and keep the owners from defaulting on their contracts. Generating units on both the East and West Coasts were experiencing the same types

of failures, making it obvious that owner/operators needed to share best practices and lessons learned among themselves and with the OEM.

GE's business leaders—like Bill Baker, Mike Hynd, Dan Harmon, and Horace Magely—were traveling cross country regularly to support their customers. To differentiate between the two distinct groups of owner/operators, the OEM began to refer to them as Western Turbine Users (WTU) and Eastern Turbine Users (ETU). The acronym WTUI came to being after the group formalized and incorporated in 1990.

To share information, users gathered at each other's sites for tours of the equipment and to share individual experiences. GE was always part of these meetings. The host site would supply meeting space and usually lunch or dinner. The group began with four attendees, growing to eight, 20, 40—about the point it was no longer feasible for a single operator site to manage and fund the quarterly get-togethers.

As far back as I can remember, GE hosted a sales and customer appreciation meeting in Cincinnati—years later, in Houston—which usually culminated with a relaxing team-building event. Many productive relationships among GE personnel and users were nurtured during these three-day meetings.

Many of the temporary fixes and improvements made by operators to keep their sites running in the early years were reviewed by GE and many became permanent fixes for all sites. A major contributor to fleet availability and reliability improvement was the sharing of parts. Each participating site would generate a list of its inventory and share that with the other participating sites.

We could get parts to each other much quicker than GE. This worked very well when the group was small, but it got a bit cumbersome as the group grew and some folks "forgot" to return parts. Parts-sharing continues today, but on a more personnel basis.

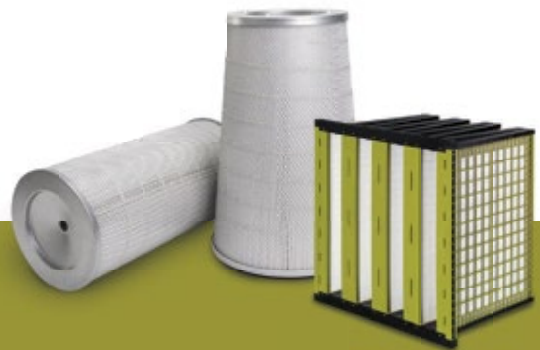
Package improvements were another benefit of user meetings. Example: Owner/operators realized turbines could fire hotter and produce additional power just by "turning up the wick." Output of the LM2500 increased from 17.8 to 21 MW over the first few years with very little hot-section life reduction. The increased revenues more than paid for the additional wear

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and tear on parts.

Plus, many cost-effective repair and overhaul procedures were developed working with small authorized repair facilities—like Batch Air Inc. Some of those were

borrowed from aircraft procedures and became standard, authorized repairs for combustors, blades, nozzles, bearings, and frame parts on land-based machines. They reduced the cost of operating LM engines

by a significant amount.

The option to use repaired parts versus new parts and expecting GE to warrant the engines was became an issue with the OEM in the early years. That was under-

## A turbine salesman remembers

In 1980, Mark Axford of Houston-based Axford Turbine Consultants LLC, arguably the most recognizable non-user at Western Turbine meetings, was selling Allison gas turbine/generator sets and compressor sets for Stewart & Stevenson (S&S).

He told the editors: "We had limited success; Solar gas turbines were significantly less expensive and manufactured with shorter lead times."

In 1981, S&S received an order for three LM2500 gensets for a platform offshore India. Suddenly, S&S was in the big leagues—a GE-authorized "packager" offering nominal 20-MW gensets with a unique single-lift design.

While there was no competition from Solar at 20 MW, S&S did have competitors. Its biggest rival was GE's heavy-frame Turbine Business Operations Div. TBO had senior management's approval to offer packaged LM2500 gensets. However, its sales team went to great lengths to convince customers that a Frame 6 or Frame 7 gas turbine was a better fit for their needs.

The LM2500 was too small for most US utilities, so S&S focused on its Houston connections in oil and gas and other industrial segments. "We worked hard to sell the single-lift design and full-load factory test to EPC customers such as Fluor, Bechtel, Parsons, and Ebasco," Axford said. "S&S had a streamlined organization and could sell an LM2500 genset at a lower price than TBO," he remembers.

Plus, EPCs liked doing business with a smaller outfit—one with more flexible business terms and conditions. S&S won its first LM2500 order in the US in November 1982. The engine was installed the following year at the Hawaiian Independent Refinery Inc by Ebasco Constructors.

Wayne Kawamoto was assigned general responsibility for the cogen unit at HIRI. "Even though Wayne was in his 20s," Axford remembers, "he was about to get his first gray hair." The LM2500 fuel system designed for HIRI was complex. It handled a variety of rich and lean liquid fuels along with a water injection system for NO<sub>x</sub> reduction.

Kawamoto said the gas turbine would have to light off on diesel fuel then switch over to naphtha fuels which had higher vapor pressures. The com-

plexity of switching fuels at high loads was a design never done before and as such that one gray hair was like a weed in manure. It grew out of control!

There were many trips during commissioning. "I remember visiting the refinery in 1983, escorting a prospective customer to show him the great S&S design," Axford said. "We were in the control room when Wayne Kawamoto popped in and announced: 'Cogen is down again, not sure how long it will take to get back on line.'"

Kawamoto and Axford became good friends, despite the reliability shortfalls during that first year. "Like many customers, Wayne was resourceful: He found his own solutions to technical problems when Stewart & Stevenson and GE could not provide answers fast enough," Axford recalled. Kawamoto found out about two other LM2500 sets packaged by TBO and installed in California during 1982: One at Proctor & Gamble's Oxnard plant; the other at Federal Paperboard's Los Angeles mill.



These gensets had simpler fuel systems, but some of the same problems discovered in Hawaii. Example: Instrument connector plugs that failed, in part, because of excessive heat in the turbine compartment. Kawamoto shared some of his homemade solutions and started participating in the informal users group that would later become known as WTUI.

Both GE and S&S maintained a close collaboration with LM users to improve the designs of the engine, controls, and package auxiliary systems. S&S began using Woodward controls and fuel

valves. It also redesigned the engine compartment with more ventilation air. Subsequent S&S LM2500 packages for Sunlaw (Los Angeles) and United Airlines (SFO) had noticeably better reliability.

The California cogen plants were very lucrative for owners because Standard Offer contracts offered by the utilities provided firm and bonus capacity payments on top of electrical sales revenues priced at the utilities avoided cost. Summer capacity payments were substantial and supported the financial structure of these projects. The two Sunlaw LM2500-powered combined cycles were operated and maintained under contract by S&S, and Sunlaw shared the summer availability and capacity earnings with S&S. This strengthened the linkage among the owner, operator, package builder, and engine manufacturer.

The success of LM2500- and LM5000-powered cogeneration plants in California during the 1980s caused the technology to spread to other areas of the US, and Canada, in the 1990s. In 1991, GE introduced the LM6000, offering users another engine option. About that time, TBO threw in the towel and S&S became the premier package builder of LM-series gensets. A few years later, in February 1998, GE bought the S&S turbine business.

As the aero-engine market expanded, users worldwide came to know WTUI as a forum run by turbine users for their mutual benefit. It was clear that WTUI discovered more problems, and identified better solutions, than OEM-dominated forums.

Leaning back in his chair, Axford offered his thoughts on why Western Turbine continues to be so successful. "Today," he said, "you can find a user's group for just about any make and model of gas turbine. But WTUI differs from most in that its bylaws and agenda are 100% controlled by turbine users. The annual conference has a podium shared by GE and competing service shops. Users compare notes on problems and solutions and share their findings with the OEM and service community. This superior recipe created by Western Turbine has stood the test of time. Customers like it . . . it's that simple."

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standable: Users were installing remanufactured parts, and if they failed during the shop warranty period, GE was responsible for the damage.

Users were in hands-on creative mode, continually developing new repair procedures and bringing on innovative vendors that developed such improvements as the Orange Box (individual T-54 thermocouples), longer-lived repairs for bearings and combustors, etc; some were adopted by GE as time passed.

As the number of LM sites grew, WTUI came to be recognized as the place to learn and benefit from both GE and other owner/operators. As the organization expanded, the cost of managing conferences was more than any one company could support. This forced WTUI in 1990 to begin the second phase of its history as an incorporated business. It permitted dues collection, golf outings, tennis tournaments, evening entertainment, and other managing tools that have made WTUI the world-class organization it is today.

*Mike Raaker, WTUI historian/ambassador*

## After incorporation

I will always remember the chain of events that led to the introduction of Strategic Power Systems Inc (SPS) to three of the founders of the Western Turbine Users: John Tunks, the organization's first president (California Cogeneration Operators Inc), Ernie Soczka (Destec's San Joaquin Cogen), and Bob Fields (Container Corp of America). The meeting took place at Ricky's Hyatt in Palo Alto, Calif, in fall 1990, just prior to WTUI's incorporation. The number of GE LM units operating in cogeneration service, especially in California, was rapidly increasing because of the Public Utility Regulatory Policies Act (Purpa).

Existing users, who already were meeting at various plants, wanted a more formal structure to support the expanding base of operators. They understood new users would require operating knowledge and experience, and would share their desire for continuous product improvement.

They also understood the need to establish and follow a uniform process that the Western Turbine Users, as an organization, could use to track and report the availability and reliability performance of the LM5000 and LM2500 fleets. The objective was to have unbiased and accurate data to document the performance of their gas turbines and plant equipment. The users wanted data and metrics they could share among themselves, and with GE. SPS hoped WTUI would agree that ORAP® (for Operational

Reliability Analysis Program) was the system they needed.

**The first link in the chain** of events was a call I received from Lou Pasquarelli, an old GE friend. Lou explained that both the Western Turbine Users and the GE Marine & Industrial business unit (today a part of GE Power & Water's Distributed Power business) were interested in tracking the reliability and availability of the LM product family to support the expanding user base.

He suggested I contact John Campbell (now deceased) who was GM of the Customer Service business unit to discuss the opportunity. John understood the market for the LM product line was growing and recognized that for continued success, product performance had to meet customer expectations. He recognized the benefits ORAP offered and invited me to Cincinnati to present the system. Afterwards, he decided that GE would fund and use ORAP to cooperate with and support the Western Turbine Users—cooperation and support that continues today.

In due course, John, Larry Lewis (then the GE point of contact, now retired), and I made several plant visits in California to introduce the LM users to ORAP. From the Shasta mountain range to Santa Clara, from Los Angeles to Bakersfield, the goal was to grow user participation on the ORAP system, and to begin the reporting and feedback process.

The objective was to obtain and process plant data as quickly as possible and to show meaningful results. We were on our way. We had the strong endorsement of GE and the Western Turbine Users, and our job was to demonstrate and add value for the users.

**WTUI veterans** know that the success of this conference did not just happen by accident. The word "serendipity" does not apply to WTUI. Its success has been built on the efforts of dedicated people with vision and a long-term commitment to their industry—and to each other. Now, after 25 years of hard work, a meeting that started out in a few plant conference rooms has been transformed into a world-class conference that attracts a global audience.

The first meeting attended by SPS staff was Sacramento, March 1991. There were 130 registered attendees—including users, vendors, spouses, and guests. The board of directors included Tunks (he had moved on to Stewart & Stevenson Services, S&S, by this time), Soczka, Fields, Jim Hinrichs (Sithe Energies), Wayne Kawamoto (Wheelabrator Norwalk and WTUI treasurer, an office he continues to hold), and Steve Johnson (Simpson Paper, Shasta Mill).

At that meeting, Hinrichs became the WTUI president, a position he was to hold for 17 years. Other founding members of the organization who were present included: Mike Raaker (Proctor & Gamble), Jack Dow (Sithe Energies), Jim Bloomquist (Chevron), and Brian Hulse (Destec Bakersfield). Tom Christiansen of SPS was given the opportunity to present to the users and to solicit their participation on the ORAP system. The goal was to add more users on ORAP and to produce a formal data analysis and report as soon as possible.

**The first ORAP report** went out to both participating users and GE in June 1991. It included data from 24 operating plants representing 19 LM2500s and 14 LM5000s, and provided an overview of the reliability metrics that the users desired—including component causes of downtime and engine removal rates.

Interestingly, these LM units operated with very high service factors (greater than 85%), and had hours-per-start ratios ranging from 135 to 250 hours per start—exactly what you would expect from cogeneration units. At the time, SPS had a commitment from an additional 20 operating plants to join and participate on the ORAP system.

**Newsletters.** From January 1993 through February 1994, WTUI and SPS issued monthly newsletters to all participating members that discussed various technical topics or other items of interest. In the February 1994 newsletter, for example, Johnson wrote "LM5000 Compressors: Cold-End Problems." He had already provided an article of interest on "LM5000 Lube Oil Chip Detection," where he informed that "a chip detection system is a very vital tool." Another article by Kawamoto on "Enhanced Steam Injection" addressed an approach that Wheelabrator Norwalk implemented for improved NO<sub>x</sub> abatement.

In the early 1990s, "fall mini conferences" were held to address specific technical issues. For example, Hulse, a board member at the time, arranged a conference at the Pacific Suites Hotel in San Luis Obispo, where issues such as gas-path coatings were discussed. The idea was to add value for the user community by regularly publishing newsletters and conducting mini-conferences.

**ORAP.** By the time the first newsletter was issued, ORAP participation had grown to 40 plants and new people were getting involved. The January 1993 edition notes that Brent Newton had joined the board, while the terms of both Soczka and Fields were ending. The visionary founders of WTUI had laid the groundwork for the



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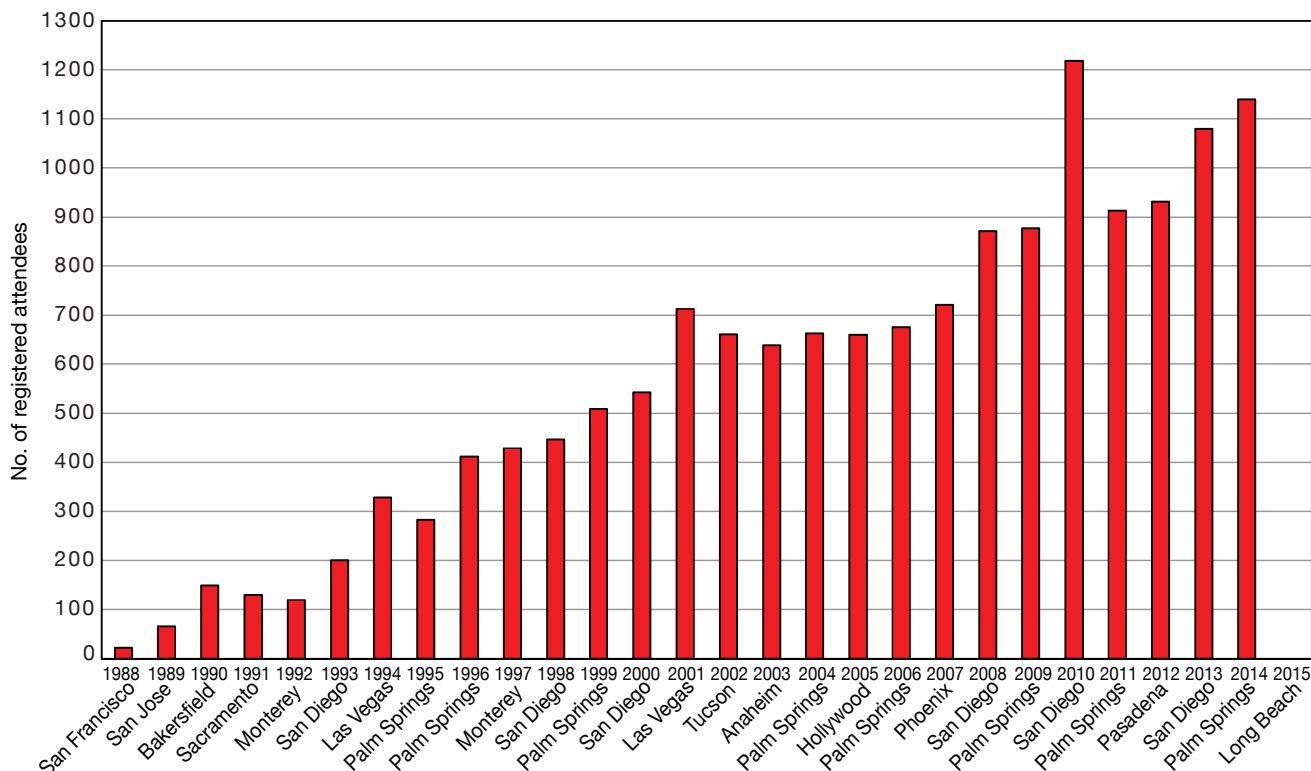


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**1. Attendance at the Western Turbine annual meeting is still growing after 25 years**

inevitable changing of the guard. WTUI was preparing for change.

Looking through these newsletters offers a memorable trip back in time. To illustrate: In February 1994, items of interest included the following:

- Announcement that Hulse had submitted the winning design for the WTUI logo, which still is in use today.
- Jack and Gae Dow were identified as the “go-to” team regarding the 1994 conference in Las Vegas.
- SPS would begin taking and issuing notes for each of the LM product line breakout sessions, a practice that continues today.

**Breakouts.** From the beginning, the two and a half days of breakout sessions covering each LM product line have provided the foundation for sharing knowledge and solving problems. These invaluable sessions provide the opportunity for users to openly discuss installation and commissioning issues, O&M concerns, lessons learned, and the opportunities for plant improvements.

Technical discussion covers the engine, package, controls and all ancillary systems. The intent is to share and document, thereby creating a history through the notes of relevant and meaningful “real life” experiences to help the operating community improve as a group.

Over the years, discussion leaders for the breakout sessions have included Jimmie Wooten (DPS Juniper), Frank Oldread

(Destec), Johnson (K&M Services), Grant McDaniel (Carson Cogen), Joel Lepoutre (S&S), Roy Burchfield (Sithe Energies), Norm Duperron (Bonneville Pacific Services), Mel Murphy (Kingsburg Cogen), Bob Anderson (Florida Power Corp), Charlie Hooch (Calpine), Kevin Koszalka (TGB Cogen), James Hardin (El Paso Cogen), and Bob Mason (Goal Line LP).

Also, Rich Frank (GECS Camarillo), Chuck Casey (Goal Line LP), Bob Nelson (SMUD), Chris Kimmich (Nevada Cogen), Bill Lewis (PPL), John Baker (Calpine), Bryan Atkisson (City of Riverside), James Charles (Ripon Cogen), Mark Breen (Wood Group), Chuck Toulou (Ripon Cogen), Don Haines (Panoche Energy Center), David Merritt (Kings River), Andrew Gundershaug (Calpine), Perry Leslie (Yuba City Cogen), and Jason King (DGC Operations).

The hard work and dedication of the discussion leaders is what makes the breakout sessions so successful and meaningful. Plus, the technical sessions have been strongly supported by GE and the depots, adding to their value.

**Winds of change.** WTUI conferences continue to grow annually, providing opportunities to renew old friendships and establish new ones. Equally important, the conference attracts a significant percentage of new users and attendees each year who bring fresh ideas and perspective vital to long-term health.

Continuing growth testifies to the hard work and dedication of the organization’s

leadership, and to the increasing value and need for face-to-face information exchange. Such success, however, brings change and occasionally presents very real challenges to the relatively small group of volunteers who make WTUI happen.

President Jim Hinrichs and the officers and directors in place during the first few years of the new millennium faced significant challenges as the need for WTUI’s services increased markedly while the duty cycle for the LM sector of the industry was migrating from base- to part-load generation and there was a question as to whether GE could continue to support WTUI with the same commitment as they had in the past.

**The good news** was growing conference attendance, which went from an average of 470 in the 1996-2000 period to 667 from 2001 to 2005. In the last four years, the average attendance was 1054 (Fig 1). With this success came the difficulties associated with venue selection; relatively few locations can accommodate groups of this size. Plus there were the additional work loads associated with registration, meeting attendee expectations, etc. More hands were needed; the volunteers could no longer do everything.

Both the organization and its owner/operator members were forced to adjust to market influences. The once dominant cogeneration market was contracting; units were operating fewer hours per start and they were beginning to cycle. SPS verified



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**2. Tripp and Sal DellaVilla, Strategic Power Systems Inc; Don Haines, plant manager, Panoche Energy Center (now with HPI LLC); and Steve Wenger, Camfil Power Systems (l to r) are all smiles despite their non-competitive scores**

the market shift using ORAP data that the company provided for the Combined Cycle Journal's report on the 17th annual conference in Phoenix.

SPS stated in that report, "Two operating profiles are distinctly visible: A base-load duty between 1995 and 1999, and a cycling duty between 2002 and 2006. The years 2000 and 2001 appear to be a transition period where the shift in duty cycle began." ORAP data also indicated that annual service hours had decreased by more than 40% comparing the new paradigm against the old. Further, that service hours per start had decreased by about 60% and the number of annual starts had increased—all as gas prices were spiking.

As the duty cycle was changing, the LM6000 and LM2500 solidified their posi-

tions as the product lines for growth, and component life, coatings, and emissions were the issues that had to be addressed.

**Growth of depot support.** It was during the market evolution that GE communicated to the board that it would not be able to sustain WTUI support at the same levels as in the past. The board took that in stride, solidifying its relationships with the depots and redoubling its efforts to assure that the annual meeting's technical content, and the currency and relevancy of issues covered, would continue to meet expectations.

Larry Flood (EPCO), Rich Recor (Sithe Energies' Greeley), Mike Horn (Calpine), Mike Pankratz (FPB Cogen), Joe Campanelli (Air Products), John Cates (Globelec), Robert Kofsky (Modesto Irrigation District),

and others put in extra hours to ensure that WTUI's mission would be sustained.

**Always all about people.** When SPS was located in upstate New York, a major benefit of the conference's timing was the opportunity to fly to the West Coast for a week and leave the bitter cold behind. Often, we would leave in a snow storm and return to a snow storm. The opportunity to participate in the Sunday golf or tennis event coordinated by the users (Hinrichs, Kawamoto, Bloomquist, and Ronnie McCray) always was a highlight.

My golf was bad (and still is), but the chance to catch up with old friends and the opportunity to make new acquaintances made it easy to laugh off the comments on my game. Golf with guys like Mark Dobler (Fulton Cogen), Jim Murray (Fulton Cogen), Tony Thorton (Turbine Technology Services), Ron Brooks (United Cogen), Don Haines (City of Santa Clara), Roy Davis (GE), Wayne Feragen (City of Colton), Mike Kolkebeck (City of Colton), Don Driscoll (SSOI), and others always provided the welcome opportunity to mix business with pleasure (Fig 2).

**The formal event begins** Sunday afternoon with the New User Orientation, which is followed by the opening of the exhibit hall. Jack Gunsett (Kinder Morgan) conducted the orientation for years, eventually passing the baton to Oldread, who later put it in Bob Boozer's (Reed Services) hands. The goal of the session is to introduce first-timers to LM engines, terminology, nomenclature, and other hands-on knowledge and experience to prepare them for the discussions that



**3. A room used for the general session about the time of the millennium would barely accommodate the LM6000 breakout session today**



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would take place during the breakout sessions beginning Monday morning. SPS also participates in the New User Orientation to introduce ORAP.

**Monday morning** the conference begins (Fig 3). Members look forward to the first session and to the ritual handing-out of much-desired WTUI jackets awarded to those users at the session whose names are pulled from the fish bowl.

The months of preparation by the board, the breakout-session chairs, and the depots (Air New Zealand Gas Turbines, MTU Maintenance, TransCanada Turbines, and IHI) kick the conference into high gear. Western Turbine is about organizations and people who see value in what the user group offers and provides, and they want to be a part of it. As the exhibit hall fills with friends, family, and colleagues, the mood is good-spirited, and all are ready for business and a fun time.

In our industry, there are many conferences and user groups, all founded with a desire to add value. And they do. But WTUI is special. It is celebrating its 25th year not just because of the desire and need to share information and knowledge, but rather because it is genuinely focused on the user.

There is a strong sense that the full WTUI membership is interested in fleet performance. By helping to drive improvement fleet-wide, members improve their own plants. Competition among users exists, to be sure; however, there is a very real sense that the WTUI membership wants the term “best in class” to apply to the whole fleet. And they want unbiased third-party data—data available through ORAP.

The hard work and effort that has carried WTUI to its 25th year is a significant feat, and SPS has had the pleasure of supporting the group for most of those years. It is clear that WTUI has a strong commitment to excellence, and a clear vision for continually adding value for its membership. In sum, WTUI is special—not only for its service to the users, but for the users’ service to it.

*Salvatore A DellaVilla Jr, CEO, Strategic Power Systems Inc*

## Legislative drivers of gas turbine technology: An anecdotal history

Today’s gas turbine technology is a product of many things. As applied in electric power generation, one of those things is regulation, the deregulatory variety and re-regulatory variety. From the first salvo

in the deregulation of natural gas, circa 1970s, to today’s euphoria around domestic shale-gas supply, regulatory actions and turbine technology advances have enjoyed a symbiotic relationship. Here’s a blow by blow, decade by decade.

**1970-1979.** In broad terms, the end of this decade proved to be the inflection point for changes to the domestic energy landscape. Landmark federal environmental regulations, most importantly the Clean Air Act (original act, 1970; important amendments, 1977) and the Clean Water Act (1972), were passed.

The nation suffered through two oil embargos (1973, 1978), which also, along with legacy industry regulations from the 1930s, created shortages of natural gas. In 1979, the accident at Three Mile Island (TMI) occurred, which led to a progressive regulatory gauntlet that would eventually put the nuclear industry in a coma for two and a half decades.

No new nuclear units—most of the planned ones cancelled and protracted completion cycles for those under construction—and the beginning of the environmental gauntlet around coal set the stage for the emergence of natural gas as a force in electricity generation. But not without some fits and starts.

From a turbine technology perspective, though, the most important pieces of legislation all came within the decade’s last three years:

- The Natural Gas Policy Act (NGPA) of 1978 initiated (but still with restrictions) the deregulation of the wellhead price of natural gas, allowing it to adjust with “market forces.”
- The Public Utility Regulatory Policies Act (Purpa) of 1978 opened up the generation market to non-utility entities as long as their facilities met certain size, fuel, and efficiency criteria.
- The Fuel Use Act (FUA) of 1979 prohibited utilities from using natural gas, a response to the oil crises and need to husband natural gas for heating homes and businesses, and as an industrial raw material.

Together, these three legislative acts drove the rise of gas-fired cogeneration and independent power facilities. Purpa’s efficiency threshold was low (a “joke” many would say)—a minimum of 5% of the fuel input had to be directed towards beneficial thermal use. This led to a flood of gas-turbine-based cogeneration plants at industrial facilities, as well as a flood of combined cycles which could meet the thermal output but still primarily make their money selling electricity to the local utility.

Purpa mandated that utilities offer long-term contracts to “qualifying” facilities for most, if not all, of the plant’s electrical output.

**1980-1989.** Meanwhile, California, often a land unto itself when it comes to energy, had already created the conditions which made it difficult to build coal-fired plants in the state (so the state’s utilities built them outside the state and shipped the power in, or contracted with others for the power).

California embraced the Purpa concept, and even began applying it to tiny power systems called at the time “packaged cogen,” a retread of the total energy systems popular in the late 1960s/early 1970s, pre-OPEC oil embargo. Applications for turbines and engines as small as hotels with swimming-pool heaters came into being under the California version of Purpa.

The FUA was repealed in 1986. As importantly, Federal Energy Regulatory Commission (FERC) Order 436 changed the interstate gas pipeline business, essentially forcing “open access” and allowing consumers (especially large consumers like powerplants) to purchase gas at low wellhead prices and contract for shipping to their facilities. In 1989, FERC passed the Natural Gas Wellhead Decontrol Act, which essentially finished what the 1978 act started.

In sum, the electricity and gas production and delivery value chains were being deregulated. One way to look at this is that the chain was being pulled apart, so that new entities could, or so the theory goes, focus on applying and leveraging efficiencies by focusing on one aspect. Meanwhile, coal plants were wrestling with massive new subsystems on the back end—scrubbers and selective catalytic reduction units—and trying to absorb the associated costs. Nuclear was still in a coma.

**1990-1999.** This decade would be marked by more landmark deregulatory initiatives, but also more specific moves in California, a massive demand crunch, and even more onerous rules on coal plants.

In 1992, Congress passed the National Energy Policy Act (NEPA). If Purpa cracked open the generation part of the value chain, NEPA cracked open electricity transmission. In 1996, FERC passed orders 888 and 889, both establishing open access to electric transmission lines.

Practically, this meant if you wanted to buy electricity from one supplier, one or more utilities were obligated to sell you transmission service to move those electrons to where they would be consumed. In 1996, California began the first grand experiment in retail electricity competition.

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Amendments to the Clean Air Act (CAAA), passed in 1990, not only forced more coal plants to add scrubbers and SCR but placed a new emphasis on NO<sub>x</sub>, air toxics, and interstate transport of air pollutants. Adding to the aggravation of coal advocates, EPA and its judicial, legal, and environmental advocates began to wield a new threat from a legislative tool in the 1977 CAAs, called New Source Review. NSR made it extremely difficult—in many cases, impossible—for coal-plant owners to expand output at pre-1977 facilities, or even make major repairs; otherwise, they could be judged a “new source” and subject to addition of emissions controls similar to new units.

As if that wasn’t enough, the specter of carbon regulation reared a head that got uglier and uglier, from the first significant Congressional hearing on Global Warming in 1988 (height of the summer and the AC in the building was not functioning) to the Kyoto Protocol in 1997.

However, the new NO<sub>x</sub> rules, combined with more stringent ones in California and other states, set up a ratcheting effect. Seemingly, each new gas-turbine project, showing it could meet a lower NO<sub>x</sub> level, caused the next project to meet a still lower NO<sub>x</sub> level.

The industry found itself in a “how low can you go?” environment, or a circle dance among the gas-turbine suppliers, the architect/engineers for these now privately financed IPP and merchant projects, and the various state and federal permitting agencies. These facilities were being permitted at lower and lower levels before the preceding group of turbines demonstrated performance.

Concurrently, new IPP/merchant generation companies and their financiers fell in love with gas-turbine efficiency gains, which would make the project *pro forma* more attractive (and the debt service paid off that much quicker). Soon, the turbine suppliers were carving each other up for the next order.

But machine design was being stretched to the ragged edge of combustion stability and metallurgy. The initial consequence was F-class machines being hauled back to depots and repair shops regularly from points around the world and insurers refusing to play ball for new projects. A complete crisis of confidence was averted mid-decade when the vendor-driven long-term service agreement (LTSA) entered to make the cost of overhauls and premature repairs, at the very least during the years of debt service, “predictable.”

All of this might have been digestible, except towards the end of the decade,

when an economic boom (and concurrent wildly ambitious electric demand projections), the rise of digital computer and telecommunication technology, darn close to unfettered competition in electricity supply, and end-of-millennia psychology, conspired to bring the party to an abrupt end (by the standards of an infrastructure industry anyway).

**2000-2009.** Moves by FERC in the previous decade, and subsequent ones, laid the groundwork for regional and/or state “independent system operators” (ISOs) and regional transmission organizations (RTOs). Movement of electricity between a buyer and a seller was now, from a transactional perspective, in the hands of a single entity for large states (ERCOT in Texas, CAISO in California, NY-ISO in New York) and for large regions (PJM and MISO). Traditional utilities were still responsible for the physical transmission infrastructure.

The penultimate consequence of 20+ years of gas and electricity market deregulation, private financing of powerplants, choking environmental restrictions on coal, and a somnambulant new nuclear business was the addition of approximately 200,000 MW of gas-fired capacity between 1999 and 2004. With few exceptions, gas-fired units became the only option that could optimize among all the constraints imposed on a new project. As the decade moved on, wind and solar facilities, taking advantage of generous federal tax credits, renewable portfolio mandates, and state-level incentives, began to challenge gas.

Most of that 200,000 MW was in service, under construction, or far along the development pipeline by the end of 2001, after California’s grand experiment in electricity markets imploded and a once-small pipeline company, later called Enron, became a household word. In six short months, Enron’s CEO went from being so familiar in the halls of power he was called “Kenny Boy” by President George W Bush, to declaring bankruptcy.

Enron’s demise took a significant chunk of the merchant and IPP business with it. Many issues were at play in the calamitous California market experiment but one of the most egregious was that the market experts deregulated the wholesale market while protecting the retail ratepayers, essentially bankrupting the traditional utilities, caught in the middle.

It took the industry some years to swallow all that added gas-fired capacity. Units built and designed for base-load operation, taking advantage of ever lower heat rates and output gains from advancing turbine technology, operated more like peakers

until the end of the decade, when the shale-gas revolution brought the forward price projections down, in the words of one utility executive, “as far as the eye can see.”

The CEO of one of the largest gas-fired project developers (today the largest owner/operator of said plants) had been saying at the beginning of the decade that gas would displace coal even in coal country. It would take a decade, but that vision eventually came to fruition.

**2010 and later.** The gauntlet around coal, which began in 1977, is worse today than ever, with the Obama Administration’s enactment of carbon-emissions reductions. Existing coal units are being retired or mothballed in droves.

Nuclear found a way to “get up on one knee” when four new units found their way to construction (also taking advantage of generous federal subsidies, in this case loan guarantees), but the old bugaboos of construction cost and schedule overruns and catastrophic events overseas (Fukushima) have returned and promise to haunt the industry.

Costs for wind and solar have declined substantially. In the meantime, existing nukes have difficulty competing against GT plants with low-priced gas supply and renewable plants with generous subsidies and must-take contracts. Strangely, we have a case in this country, most prevalently in California, of “supply destruction,” environmental and market-based economic burdens that can no longer be tolerated for many otherwise perfectly sound coal units and a significant number of nukes.

At this point, one could rightfully speculate that, unless carbon capture and sequestration (CCS) technology enters the picture soon (though not likely on a commercial basis for at least another decade), generation in the future will be characterized by two types of plants: Those that can run 24/7 (and in some cases 365, or close to it, if need be) and those that run at the pleasure of the wind and the clouds. Gas-fired units likely will predominate in the former category.

*Jason Makansi, president, Pearl Street Inc*

## LM engines

The early history of GE land and marine (LM) gas turbines began in the late 1950s and continued through 1970. It started with the introduction of a few small LM products and the larger LM1500 gas turbine. The latter was derived from the OEM’s popular J79 fighter engine, widely known for its thousands of applications in the US

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Air Force (USAF) and the US Navy's (USN) F4 Phantom fighter. The initial LM1500 application was aboard a hydrofoil ship.

**In 1969**, GE launched the LM2500, a nominal 20,000-shp gas turbine based on the TF39 engine, which powered the USAF's largest transport aircraft—the C5 Galaxy. The first ship to use the LM2500 turbine for main propulsion was the GTS Admiral W M Callaghan (AKR-1001). Two LM2500s replaced the twin-screw vessel's non-GE first-generation turbines, which had been installed only two years earlier.

After several successful USN applications—such as on the Spruance and Ticonderoga classes of ships—the first LM2500 industrial application was on a pipeline, in 1971, followed by the first power-generation application in 1979. The LM2500, with its versatile free power turbine, high efficiency, light weight and high reliability, quickly became the oil-and-gas (O&G) industry's engine of choice for pipeline compression and oil platform power applications.

The need for higher output led to the introduction in 1996 of the LM2500+ engine, which eventually was rated a nominal 42,000 shp. Essentially a turbocharged base LM2500, the “plus” engine has found widespread acceptance in the O&G industry. It has an additional HP compressor stage in front of the original Stage One. Also, the plus has more-capable hot-section materials and other refinements.

Further technological improvements led to the introduction of the fourth generation LM2500+G4 engine, with a nominal rating of 46,000 shp. Today, there are well over 2400 engines from the versatile LM2500 family operating worldwide. Applications include propulsion of naval, ferry, and cruise ships; power generation; O&G platforms and pipeline and LNG compression—a testament to the LM2500's longevity and success.

**In 1978**, GE introduced the LM5000, a larger machine based on the company's CF6-50 aircraft engine, with a nominal output of 38 MW. More than 100 of these workhorses were produced. The LM5000 has a twin-spool gas generator driving a free power turbine. Many LM5000 units are still in service and are specially favored in cogeneration applications. They laid the foundation for an even bigger and vastly more successful engine to come.

**In 1988**, GE introduced the LM1600 for small-pipeline applications. The high-performance engine has a two-spool gas generator and a free power turbine. Like the LM1500, it was derived from a fighter aircraft engine—GE's F404 engine powering the F/A-18 flown by the USN and Marines.

About 100 of these units are still in service.

Building on the LM5000 experience, GE recognized the success and potential of aero engines. In the early 1990s, it saw a market for a larger power-generation machine.

**In 1991**, the innovative LM6000PA was introduced: It could drive an electric generator either from the cold end or the hot end. This GT was based on GE's highly successful CF6-80C2 engine, which powers many wide-body aircraft—such as the Airbus A310 and Boeing 747/767 models. The LM6000 family quickly grew to the PC model, which is a higher-output engine, rated a nominal 43 MW.

Today, the family includes a PG single annular combustor (SAC) model rated a nominal 54 MW and a PG Dry Low Emissions (DLE) combustor model rated a nominal 48 MW. There are now more than 850 LM6000 units worldwide, serving in a wide variety of applications—including base-load and peaking power generation, combined cycle, cogeneration, and mechanical-drive LNG.

**In the early 2000s**, US interest in an efficient 100-MW-class gas turbine capable of fast starts and load-following ability gained traction. GE developed the LMS100 engine to meet these needs. It used some parts and technology from GE's heavy-duty frame gas turbines and the company's latest aircraft engines. Examples: 6FA compressor technology is used in the LMS100's LPC, while the HP compressor and turbines are derived from the CF6-80E1 aircraft engine.

The LMS100 has an all-new lightweight two-stage intermediate-pressure turbine and a five-stage free power turbine for operational flexibility. The engine also is intercooled—that is the LP compressor discharge air is cooled before it enters the HP compressor. This is largely responsible for the engine's high efficiency and makes it one of the most efficient simple-cycle gas turbines in the world. The first LMS100PA (SAC) unit was commissioned in the US in July 2006. Today there are more than 50 of these units in service; the expectation is that many more will be installed in the next five years.

**The business side.** In the years since the first LM engine was introduced, the actual management of the business itself has undergone several changes. Up until the late 1990s, the LM business was commonly referred to as GE Aeroderivative Engines, and was an integral part of GE Aviation.

At that time, the LM business became part of GE Power Systems, then GE Energy, and today GE Power & Water. While the LM

engines still are manufactured by GE Aviation in Evendale, Ohio, the aero product line is within the company's Distributed Power business and part of the GE Power & Water portfolio along with the Waukesha and Jenbacher gas-engine product lines.

Despite all of these organizational changes, GE's commitment to WTUI has remained steadfast over the last 25 years.

In the early days of the LM business under GE Aviation, the company's primary focus was on manufacturing engines and parts. GE worked with some of its authorized airline engine repair shops and convinced them to take on the responsibility of repairing the new LM engines in-shop. Over time, GE also worked with its packagers—they built the powerplant around the gas-turbine core—to develop service and repair capability. These firms included Stewart & Stevenson Services, Kverner, Thomassen Stewart & Stevenson, Avio, IHI, and MTU.

The early-1990s meetings, where a group of WTUI users banded together to see if they could help each other out, were pivotal in making the LM product successful and gaining it wider industry acceptance. They were key to exchanging operational experience, creating the back and forth dialogue around areas of improvement, new and evolving matters, and the solutions developed. There were numerous frank discussions between the users and GE at that time. Some of the key GE players: Rudy Garza out of the Ontario shop, Jim McDonel from Cincinnati engines customer support, and Shaun Riley as one of the engine product-line leaders.

The WTUI conference had product-line breakout sessions in which the GE team prepared and presented all of the material for the engine experience and matters, and package sessions, where the material and areas of improvement were presented by the packagers.

In the mid-1990s there were some fruitful discussions around the LM5000 engine. Over a period of years, Paul Maciulewicz, Jim Gardner, and Kumar Khemchandani from GE, and Mike Pipes from S&S, were right in the middle of these discussions. Some of the product improvements were tested at customer facilities—like the Destec sites around Bakersfield, where GE worked very closely with Brian Hulse; Fulton Cogen, where GE worked with Mark Dobler and Jim Murray; Sithe Energy with Rich Recor; and many others. They were supported from the S&S side by some expert engineers like Randy Kleen, Michael Williams, Harley Ross, Robert Baten, and Jack Patton, and later on by a young and energetic field controls engineer, Nick Voorhis.

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#### HISTORY

In the late 1990s, GE began acquiring some of its authorized packagers and services providers, moving to a more direct end-user service model, which improved direct communications with customers. In the opinion of many people, the removal of an intermediary on significant matters helped improve communications, and ultimately increased GE's direct accountability to its customers, which benefited many users.

With the reintroduction of the GE-sponsored users conferences in the early 2000s, each organization was focused on providing the best support to the LM users, and they needed time to work through how they could each accomplish this shared goal through different meetings.

It was during this period that the responsibilities for assembling the material and presenting during the WTUI engine product breakout sessions shifted from GE to several of the company's authorized service shops. GE instead focused most of its support efforts on creating content and leading the engine and package breakout sessions for its own users conference. Even during this period, GE continued to send a key but limited group of members of the services and sales teams to attend the WTUI conferences and meet with the users.

After a few years, and right after the conclusion of another successful Western Turbine conference, some of the WTUI board members (including Jon Kimble and Jim Hinrichs) approached GE to talk about improving GE's visibility and support of the WTUI conference. This was an opportunity for both groups to speak fruitfully about their future together.

Since then the two organizations have continued working closely with each other to find ways that GE and WTUI can best support end-users. This close cooperation now includes GE booths at WTUI staffed by numerous GE technical and product experts, and GE product-line-specific materials and presentations given to end-users and authorized service providers during WTUI.

Most recently, at the conclusion of GE's own 2014 Americas User Conference in Orlando, GE announced the date and location for the 25th annual Western Turbine Users conference, and further suggested that the customers attend that valuable session—clearly a sign of good cooperation.

*Madhu Madhavan and Mike Pipes, GE Power & Water/Distributed Power, with Gil Badeer, Tayo Montgomery, Rick Hook, Preetham Balasubramanyam, and Kumar Khemchandani*





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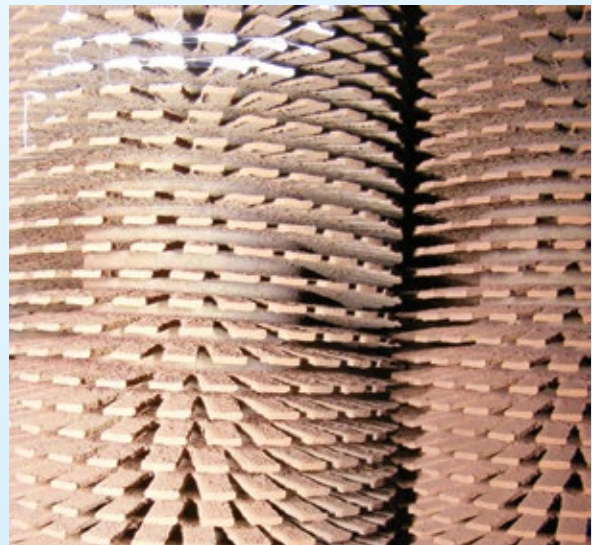
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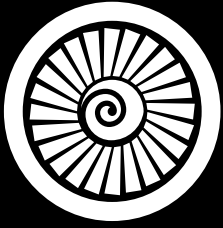
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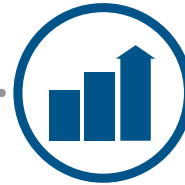
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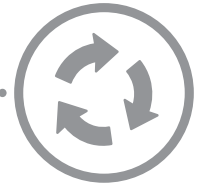
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## Camaraderie, perhaps, best defines Western Turbine

### Bill Caldwell

*VP and director, 1990-1992*



Although the official history of WTUI begins in 1991, the group actually started meeting in the late 1980s and Bill Caldwell was there from the beginning. "This whole thing started in Northern California as a result of deregulation. Cogeneration plants were going in and guys from a number of industries—airline, pulp and paper, oil and gas—had these new engines and were trying to figure out how to keep them running.

We were basically stumbling around trying to get our technical questions answered and to get and service parts. After a while, the guys down in Southern California heard about us and wanted to get involved. By around 1989-1990, we had reached a critical mass and we realized the industry was growing. It was time to get organized."

The group may have had technical expertise, but running a volunteer organization wasn't part of their skill set. "We didn't know what we were doing. One guy had to figure out the bylaws, one guy took care of finances, and somebody else had to learn how to actually host a meeting. We relied a lot on our secretaries and support staff because they often knew more about that stuff than we did." Bill was on the first Board of Directors and his company, Independent Power Associates Inc, has been involved since.

"As the maintenance team at the United Airlines cogeneration plant, we faced problems we could not have solved without the other WTUI members. At one point, we were having trouble with the fans used in the Stewart & Stevenson package and we had to turn to the other users to figure out

how to resolve the problems."

Getting to know new vendors was an added bonus to WTUI participation, Bill said. "With assistance from the other users and the new vendors, our group was able to apply lessons learned, improve reliability and increase our capacity and availability figures." And that is what WTUI is all about.

### Jack Dow

*VP and director, 1994-1997; secretary 1998-2008*

### Gae Dow

*Conference director, 1993-2008*



Together, Jack and Gae Dow have put more hours into WTUI than they can count. It all started back in 1993 when Jim Hinrichs couldn't attend a meeting and asked Jack to go in his place. The board was looking for a president and since Jim wasn't there, Jack volunteered him. While Jim readily accepted the post, he decided to put Jack to work as well.

In the many years since that fateful meeting, Jack has served as a board member, an officer, a conference speaker, and, most importantly, exhibit organizer, lining up vendors and planning the exhibit hall. But one of the most important tasks he performed was getting Gae involved as conference planner.

"Jack took care of the exhibit hall, the floor plan, and the vendors while I took care of the hotel and attendees. Although Jack was working long days, he'd put in the extra hours on nights and weekends to get the exhibition planned and to help me with computer glitches or data entry. Every February, during pre-conference crunch time, we lived the conference 24/7. We talked about it morning, noon, and night.

"Sometimes my phone would ring at 3:00 in the morning with a call from an attendee from Japan or Australia and we'd need to deal with it," Gae said. But it was always worth it, she added, because the "board and the officers were so wonderful and dedicated. They were the ones who really did all the work. All of them working 10-, 12-, 14-hr days and then putting in countless hours as WTUI volunteers."

It was in Palm Springs at one of the early meetings that Gae saw firsthand the type of hard-working volunteers she was working with. "Attendance at the luncheon was much higher than we had expected and people kept pouring in to eat even though there were no seats left. So the board, sitting up front with reserved seats, gave up their table so others could use it. They spread out around the room, waving their arms to flag down attendees and making sure everyone got seated as chairs became empty. For those guys, the meeting was always all about the members." Gae retired as conference director in 2008, saluted by the membership with a standing ovation.

### Don Driskill

*Secretary and director, 1993-1996; director, 2002-2005*



Don Driskill's history with WTUI goes back to the early days when the meetings consisted of just a few tables of users who talked over technical issues and toured LM2500 facilities. "The meetings were quite small," Don recalled, "and unlike the packed exhibit hall we have today, there were very few vendors. Some of the vendors didn't even bother with tables; they just walked around meeting and talking with users. We were a pretty unsophisticated bunch back then." Unsophisticated

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or not, the group was full of smart, talented industry professionals many of whom have stayed active and connected to WTUI.

"It's amazing to me that so many of the same people have remained in the industry over the years. They may have changed companies and they may have different business cards, but there's a core group that is still around. In fact," Don said, "we need the WTUI meetings just to maintain and update our industry contacts."

For Don, it is the industry contacts that make WTUI such a valuable organization. "Being involved has impacted my business in so many ways. The sharing and openness as to what works and what doesn't work have been absolutely invaluable to my business. The face-to-face contacts make that critical phone call so much easier—the phone call you have to make when you need to solve a problem or borrow a part.

It's the network of people who have the same issues and concerns you have that gets you through the challenging times. People are always willing to help because they know tomorrow they could be in the same situation."

**Brian D Hulse**

*Director, 1993-1996*



Looking back at the 25-yr history of WTUI and thinking about the organization's amazing growth makes Brian Hulse smile. "From a small group, having an afternoon coffee klatch to becoming a globally recognized professional organization, it's not often that an equipment users' group can simultaneously grow and maintain focus on a single product line within one OEM's array of offerings."

Over the years, there have been a number of board and membership votes on bringing other gas turbines—both aeroderivatives and non-aeros—into the conference. Each time, the idea has been rejected and the spotlight has remained on the GE LM family of engines. "Keeping that intense focus, I believe, has kept the organization relevant and perpetuated the bond between it and the users. There is no mystery or ambiguity in what the organization is all about."

By staying the course over the long haul, WTUI has become an industry constant. It is not just an annual conference, says Hulse, but it has become a user resource known worldwide for its openness and sharing of technical information. The WTUI web portal has been nurtured from a single landing page that talked about the group

to a multi-layered site that supports user forums, buy-and-sell, a jobs board, and more—all in an easily accessible format that emphasizes usability.

"Being a board member in the early 1990s was excellent experience for me, and I hope I was able to contribute to the success of WTUI in some small way. When designing what was to become the original WTUI logo, I was very conscious of the iconography (LM engine, lightning bolt signifying power, year of incorporation) and tried to portray a sense of gravitas. I think, over time, WTUI has wholly fulfilled its goals and more." Hulse's great contributions to both the development of WTUI's image as well as its growth is undeniable.

**Steve Johnson**

*VP, 1992-1995; director, 1992-1998*



Steve started working with aeroderivative gas turbines in early 1975 when employed by Gas Turbine Corp—living in Venezuela and working extensively in Latin America for four years. In late 1979, he met Jim Hinrichs, then a young engineer, and they became forever friends.

In 1980, work began on the world's first LM5000 cogen plant at Simpson Paper's Shasta mill in Anderson, Calif. For the next 13 years, Steve was always there, "living and breathing every moment of that plant's operating hours. Every day was a different day. There were many challenges.

"In the 13 years I was there we changed the engine about three-dozen times; we got so good at this, we could have the gas generator out in the turbine hall within four hours and get a lease engine reinstalled and ready to run 10 to 12 hours later.

"We had every lease engine that GE ever had in its inventory installed at least once, a few several times. One month we actually had to install three lease engines; they didn't last more than a week or so. One new LM5000 ran for only two hours. We were learning how to deal with the new problems and how to overcome them while maintaining 98.5% reliability and 96.5% availability all those years. Back then, GE's support was superb."

In fall 1983, donuts, coffee, and lunch brought together a group of users to discuss different issues and experiences. "We were

the founding fathers of WTUI, way back then." Steve wrote numerous and very detailed articles for the user organization, calling attention to issues with LM5000. He was an expert on the engine and served a 13-yr term as breakout session chair for LM5000.

In 2007, Steve launched SJ Turbine Inc, which now has a huge inventory of LM BOP parts and a worldwide client base. "We proudly have our booth at WTUI every year with my son Ray, a third-generation gas-turbine man." With experience all across the Americas, Steve has been in the thick of it from the very beginning, working tirelessly to improve equipment operations and reliability.

**Wayne Kawamoto**

*Treasurer, 1990-present; director and assistant secretary, 1990-1994*



Wayne Kawamoto and LM2500s go way back—to the beginning, in fact. He was a young engineer when the first US Stewart & Stevenson package was installed in Hawaii, and he's been working on LM2500s—and with WTUI—since. He became active in the organization in 1986, has served on the board of directors, and has been treasurer "since Day One" of incorporation in 1990.

As treasurer, Wayne has tracked the growth of the organization since its inception. "It's amazing," he said. "In the beginning, the highlight of our meeting was ordering lunch. Sometimes it was pizza and other times a sandwich. I'd take out my calculator and divide the bill among the 10 or 12 people present. That would be our membership costs for the day's meeting.

"Now, our annual revenues are \$700K-\$800K. Our 'luncheon bill' is more than \$380K. That's a huge tab. At our first conference, we put out one 6-ft table and charged vendors around \$40 to put their business cards on it. Now we've got 70,000 to 80,000 ft<sup>2</sup> dedicated to over 250 vendor booths. Our growth has just been tremendous."

What accounts for the organization's growth? "We started out trying to manage our issues outside of GE, and as the organization grew, our approach to problems became even more independent. We know the engine and we've got the experience in the field, so we began to develop and design our own solutions to the challenges we faced. If we need something more rug-

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"People may join thinking they're going to find out how GE wants them to use the turbine, but that's not what we're about. We're about solving problems the best way possible based on GE's technical expertise and operating experiences from the field. In the end, it's our members' design solutions that work best." Wayne said that while WTUI may have started out like a stubborn weed, it's been nurtured into an incredibly robust, fruitful plant that has given back to everyone who has participated.

**Jon Kimble**

*Director, 2004-2007; president, 2008-2013*



In the early 1990s, I was assigned a project to gather what information I could about operating and maintaining LM2500 packages. Wellhead was considering repowering an existing plant with a new prime mover and we were just starting the background work. The manager I worked for recommended I attend the Western Turbine Users conference.

I knew very little about GE machines. But I only had to attend one WTUI meeting to realize, if you wanted to learn something practical about these engines, this is one of the places you came. Not only did you get no-nonsense, real-world info about what you'd face if you acquired one of these plants, the people you met were so nice, enthusiastic, helpful, and friendly. I was very impressed.

As the repowering project advanced, our group continued to attend WTUI conferences because we needed the information, appreciated the value of the discussions and technical presentations, and required access to industry vendors. WTUI became a trip we looked forward to every year because there is camaraderie in this group that is quite special. And it's fun.

Upon reflection, I'll say that the mission WTUI undertakes to offer a low-cost conference to the members in a pleasant venue, while ensuring the information presented to the users is relevant and timely, is challenging. Thankfully, the depots and the chairs of the breakout sessions mount a highly coordinated effort each year to assemble and organize the technical content. Their efforts are outstanding.

Of late, GE has elected to send an advance staff of product managers and engineers that really enhance the exchange. The product and services providers that attend the conference, participate in the exhibit hall, and generously spon-

sor the activities, continually express their appreciation for the opportunity to meet directly with their customers. The member feedback is, far and away, always positive.

WTUI membership continues to grow—a clear testament to the quality of both GE's power products and the conference program. During my term as president, sometimes we felt our conferences were successful, other times we weren't so sure, but we always tried hard. Of course, you can't do something like this alone, and the WTUI officers and directors, session chairs, and support personnel are first-rate and get along really well.

I always got a shot-in-the-arm just being around them. It is quite something to be a part of steering this group. Like most service organizations, you really do get more out of it than you put in. It's truly by and for the users. I wholeheartedly recommend it to anyone who wants to learn more about

LM engines.

"Hello!" to all my old friends and "Welcome!" to all the first-timers. Congratulations to WTUI for 25 years of great service. Good luck and continued success.

**Ronnie McCray**

*Director, 2001-2002*



Ronnie McCray got his start in WTUI in 1992 while working for Stewart & Stevenson at Sunlaw Energy in California. At the time, information about LM2500s was scarce and problem-solving consisted of kicking around possible solutions with other operators.

"One of Sunlaw Energy's LM2500s tripped during summer peak because of a malfunctioning fuel valve; the plant had no spare. Contractual obligations dictated that the unit be returned to service quickly.

Plant Manager Gene Kelley called a Shell facility in Bakersfield which allowed Sunlaw to borrow a valve because their LM2500 had been removed for repair. Gene chartered a helicopter and flew to Bakersfield to pick up Shell's fuel valve. The helicopter landed in the parking lot of our plant, the valve was installed, and the unit returned to service. We were able to refurbish our unit and send Shell's valve back before their LM2500 left the depot. We couldn't have done it without being connected."

When an LM2500 in Artesia, Calif, had a C-sump high-oil-temperature indication, it was Ronnie who answered the call for help. High oil pressure and temperature indicated a restricted oil-supply orifice. Plant Manager Doug Dowd had analyzed the information and asked if there was anything that could be done short of removing the engine for repairs. Ronnie went to the site with a vacuum pump, disconnected the C-sump oil-pressure line, connected the vacuum and 20 minutes later the unit was returned to normal operation.

As Ronnie puts it, "Participation in WTUI is invaluable. The camaraderie of the entire group, the ease with which the whole group welcomes new members, and how everyone is willing to share operational knowledge enhances one's own knowledge and experience in this industry and it makes you more qualified to do your job."

**Frank Oldread**

*Director, 1999-2002*



The first WTUI meeting Frank Oldread was scheduled to attend, he had to miss—ironically—because of an engine failure at his plant. Since then, he's only missed one other time and that was because he was stuck in Shanghai during the SARS epidemic. Since his first meeting, Frank has worked with the same group of plants, which have had five different owners and six different names.

"I've attended a lot of meetings," Frank said, "but one of my fondest memories was at a meeting in Las Vegas when Gae [Gae Dow, the conference organizer] hired a couple of show girls to act as greeters. Needless to say, there was a lot of greeting going on." According to Frank, the key to WTUI's success is the contacts. "You can always find somebody who has already seen the problem you're dealing with. With WTUI, it comes down to people and communications."

Sometimes, though, sharing information isn't enough and you actually have to share parts. "We've got 12 operating units in California and two spare engines, so we end up sharing parts at least three or four times a year and we've done it with probably a dozen different companies—including

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ing competitors.”

The camaraderie even among stiff competitors is yet another thing that sets WTUI apart. “I saw a customer approach a depot rep with a problem. They talked for a few minutes and then the rep walked the customer over to another depot’s booth to find out if they’d had encountered the problem.”

When asked about the group’s growth, he said, “At a conference in the mid-1990s, there were six vendors and eight or nine guys in the LM6000 room. Last conference, I stopped in to the LM6000 breakout session—it was in an auditorium with well over 100 people.” Frank predicts that as long as there are engineers trying to keep engines running, WTUI is going to keep on going and growing.

**Mike Raaker**

*Director, 1994-1997; VP, 2002-2010; historian/ambassador, 2011-present*

**Charlene Raaker**

*Conference director, 2009-present*



“What the heck is ‘Wah Tue eee’?” That’s a question Mike and Charlene Raaker have been answering for the past 20 years. The term Western Turbine Users (WTU) actually was coined by GE when referring to a group of folks on the West Coast who owned and operated LM2500 cogeneration packages. The “I” was added to the mix in 1990 when the group incorporated and became Western Turbine Users Inc. And the rest is history—a good history with constant growth and good friends.

“As part a small volunteer organization in the 1980s,” Mike said, “Charlene and I used up many of our frequent flyer miles, traveling back and forth from Cincinnati to attend the gatherings—first in plant conference rooms, then in hotel conference rooms, and finally, where we are today, filling huge hotels and conference centers, in all the warm cities on the West Coast.”

The growth of the organization wasn’t envisioned or planned; it just happened. As Mike and Charlene put it, “The organization was, and is, about the owner/operator and keeping our plants viable, and we have never wavered from that goal.”

“We’re sure the growth was helped along by the fact that meetings are held in March in a warm climate and they open with a round of golf. Plus, spouses

eat free. The friendships made during the past 30 years are too many to count and our space here is limited, so we won’t try.” Even when Mike and Charlene retire—don’t worry, they are not going away anytime soon—if you need to call WTUI one of them will answer the phone: They are both very proud to be Wah Tue eees.

**Ernie Soczka**

*Chairman of the board, 1990-1993*



“Ya’ll come.” That was as formal an invitation as the original group of LM2500 users got, according to Ernie Soczka, the first chairman of the board. “John Tunks was president,” Ernie recalled, “and Steve Johnson was there at the beginning, too.”

“At the time, we were trying to solve problems by exchanging information about the LM2500’s technical issues and about working with GE and Stewart & Stevenson. We wanted to make sure we knew who was having what problems and figured that we could more effectively solve them and work with the OEM and packager if we worked together instead of one on one.”

During the early days, Steve Johnson would charter a plane, pick up Ernie on the way and they’d fly down to meet with John Tunks and Wayne Kawamoto and a few of the other early participants. They elected officers and set up their first official meeting. The first meeting sponsored by WTUI as an organization was in Sacramento. We were nervous because we had to pay to guarantee the rooms and we wondered if enough people would show up. We planned for 100 and ended up with 120.”

One of Ernie’s favorite memories of WTUI was when he played his first-ever game of “business tennis” with Jim Hinrichs. Asked what he missed about being involved with the group, he said, “I miss the technical problem-solving. Because the LM2500s were designed for aircraft, they’re very light and so we’d encounter problems you couldn’t anticipate. For instance, brackets would break on the casing and so we’d replace those with brackets we’d make out of heavier material only to see them place increased stress on the casing itself.

“It was a great technical challenge figuring those things out. And, of course, I miss the people. There was always such an excitement, an eagerness, and camaraderie to put our heads together to solve

problems and make a difference.” With the strong foundation Ernie helped build, WTUI is sure to keep making a difference well into the future.

**John Tunks**

*President and director, 1990-1992*



John identified early on with the small, informal association of folks that would later incorporate as WTUI. “In the late 1980s, I found myself in the cogen trade and began to participate in the group’s periodic information-sharing get-togethers.” As manager of Stewart & Stevenson Services’ West Coast O&M group, he certainly had a lot to contribute. The early meetings started with a handful of operators and some of GE’s product support people, but it quickly grew.

“In the few years I worked on the West Coast, the gatherings seemed to have legs that kept growing and growing.” The organizing participants of the group realized that with the incredible growth they were seeing, there needed to be a more formal means of managing their activities. And thus began the incorporation of the Western Turbine Users.

John worked with one of the lawyers at the firm Thelen Marrin, who volunteered his services to develop the WTUI Articles of Incorporation. “The officers were elected and I found myself in the newly created position of president. While this new, more formal organization came to be, we still had a great time putting together our primary mission which was the annual conference.”

“The last of these conferences I attended was held in Monterey, Calif. We were sweating about having enough participants to meet the quota required by the hotel.” As it turned out, there was a great turnout and the attendees enjoyed remarkably pleasant weather for the golf tournament planned for the conference.

The Monterey conference is memorable to John for more reasons than just the weather, though. “It was held at the time the Rodney King verdict was announced. My memory of driving back to LA and coming over the mountain to see the pillars of smoke from the fires the rioters had set was eerie and disturbing. Not long after that I left Stewart & Stevenson to begin my quest to build a boat and sail around the world, but that’s a story for another day!”



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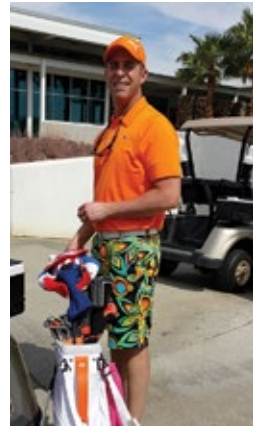
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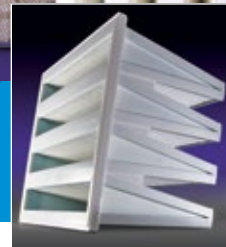




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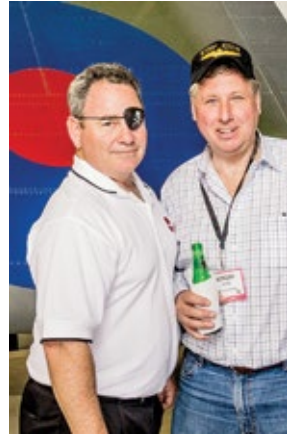
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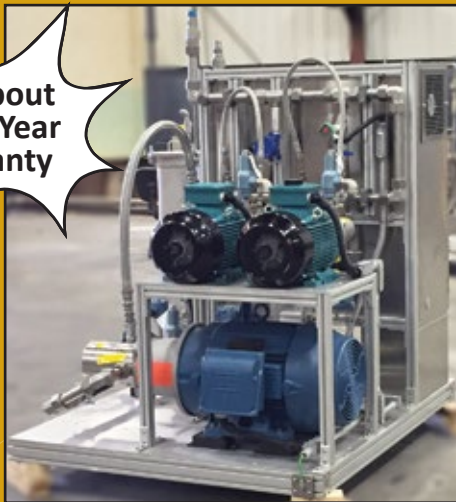
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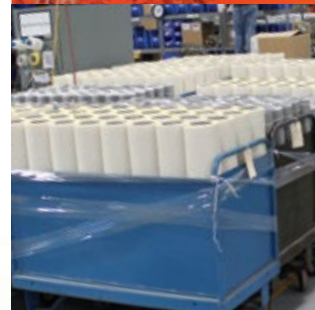
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# Aero engine portfolio highlights three options for electric generation

The LM2500 engine started out in the 1960s as a TF39 aircraft derivative—a nominal 17.9-MW “twin-shank” machine. The next major upgrade came in 1983 with the infusion of CF6 commercial engine technology into the LM2500; it became a higher-power “single-shank” machine. Note that single shank and twin shank refer to the high-pressure (HP) turbine configurations.

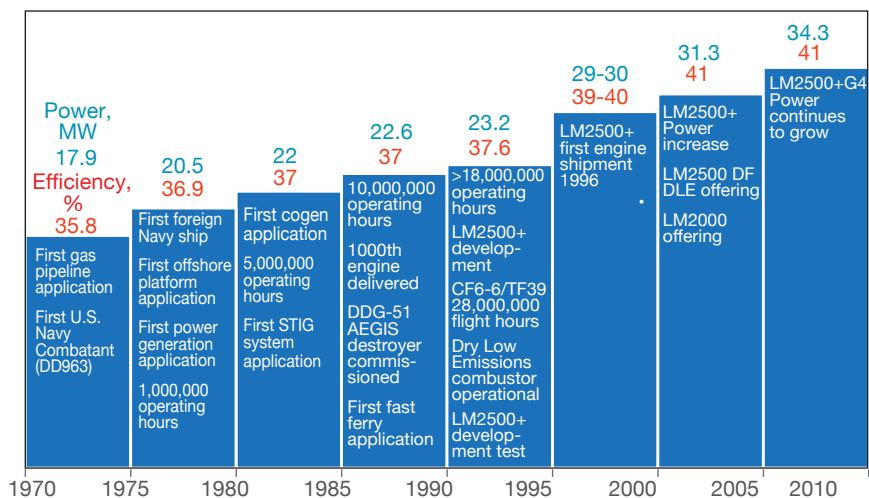
GE gained considerable field experience with the 1983 uprate of the LM2500 and was able to gradually increase the engine’s power over time (Fig 1). By the early 1990s, output had been bumped up to 22.8 MW ISO (gas/dry) without any sacrifice in component life or reliability. Today, this standard single-shank LM2500 engine is more commonly referred to as the LM2500 “base” engine.

For many years, the LM2500 base-engine combustion system was a single annular combustor (SAC). It required water or steam injection to operate with low NO<sub>x</sub> emissions. So the next evolutionary step was to introduce the Dry Low Emissions (DLE) combustor to the LM2500 base engine, which made it possible to achieve 25 ppm NO<sub>x</sub> on gas fuel, but without the need for water or steam injection.

Later, a 15-ppm-NO<sub>x</sub> DLE combustion system was introduced for the LM2500 base engine to meet more stringent emissions requirements for certain customers.

The mid-1990s saw the next significant jump in output with the introduction of the LM2500+. The “plus” engine retains a great deal of commonality with the base engine, but it has an additional stage of HP compression. It also has a more modern compressor, variable stator vane system (VSV), single-crystal metallurgy in the HP turbine section, and changes in the six-stage power turbine to accommodate the higher mass flow.

All these changes enabled the plus engine to operate at a higher firing temperature and produce a significantly higher output of 42,000 shp nominal. The plus engine also is offered with a SAC or DLE combustion system. A dual-fuel DLE com-



**1. LM2500 product-line timeline (above)** shows a 90+% increase in output and 5.2% efficiency improvement over the engine’s 40+ year history

**2. The first LM2500+ shipped from the factory in 1996.** This model offered higher output and efficiency—29-30 MW, 39% to 40%—than the base engine

bustion system was introduced in 2000.

The **LM2500+ G4 engine** was introduced in the mid-2000s. It has the same footprint as an LM2500+ (Fig 2), but produces about 3 MW (10%) more power at ISO conditions, and about 20% more on hot days, compared to its predecessor. It also has about 17% more exhaust energy than the plus engine, which makes it well suited for cogeneration and combined-cycle service.

The main changes that enable the G4 engine to achieve all this are a redesigned stage-zero blisk (bladed disk) with increased air flow, more rugged inlet guide vanes, changes in VSV schedules, improvements in the SAC combustor, technology improvements in the DLE combustor ver-

sion, material and cooling-scheme changes in the HP turbine section, and some minor changes to the power turbine section.

Today, there are well over 2400 engines from the versatile LM2500 family operating worldwide. Service applications include propulsion of naval, ferry, and cruise ships; power generation; oil and gas platforms; and pipeline and LNG compression units—all with high reliability, availability and performance.

**LM6000.** In the late 1980s, GE began to look at using the newly certified CF6-80C2 aircraft engine as the basis for a small simple-cycle product that would set new standards of thermal efficiency at more than 40%. The original concept was dubbed the “40 × 40” (40% simple-



**3. LM6000PC** was a popular engine for peaking service

cycle efficiency and 40 MW ISO). The new product was to be called the LM6000 engine, denoting a product approaching 6000 hp, and was a near-perfect match for 60-Hz power generation, because the low-pressure (LP) spool was well suited to operation at 3600 rpm.

That was the basis for the launch of the LM6000PA, which went into service in 1991. NO<sub>x</sub> abatement was still with water or steam, and a combination of water scarcity and tighter regulations led to the development of the DLE version of the PA model, called the PB, in 1994.

It soon became apparent that the market would demand more powerful machines, and the PC (SAC) and PD (DLE) models followed in 1997. The PC and PD

essentially had the same footprint as the PA and PB, but the LP turbine was improved, allowing these machines to generate more power, more efficiently, in simple-cycle service. The PA is upgradable to a PA-uprate, which basically behaves like a PC engine. Many PCs were pressed into service in the North American “peaker” segment in the early 2000s (Fig 3).

It was not long before the need for increased hot-day power became evident. GE responded with the Sprint™ (Spray Intercooled Turbine) upgrade which uses water injection at the engine inlet to improve hot-day power output. Much of the North American LM6000 fleet is now Sprint-equipped. The mid 2000s also saw the introduction of the LM6000PF, which



**4. Refinements enable the LM6000PG** to produce a nominal 54 MW

has newer DLE technology, enabling it to meet a more stringent 15-ppm NO<sub>x</sub> standard. The LM6000PF was the first gas turbine capable of 15 ppm or lower NO<sub>x</sub> emissions with a simple-cycle efficiency above 40%.

The need for higher power output and combined-cycle operation encouraged further development of the LM6000 engine, beginning in the mid-2000s. It resulted in the LM6000PG (SAC) and PH (DLE) models (Fig 4), both of which have the same turbine footprint as their respective predecessors; all changes are internal to the turbomachinery.

Increased air flow is achieved by operating the basic LM6000 LP compressor at a higher speed (~3930 rpm). The hot sec-

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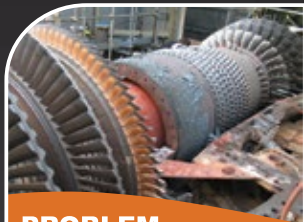
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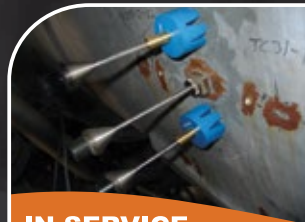


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- Clashing
- Rubbing



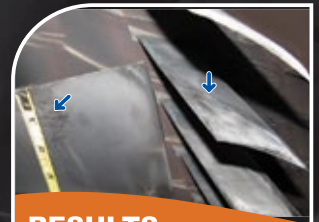
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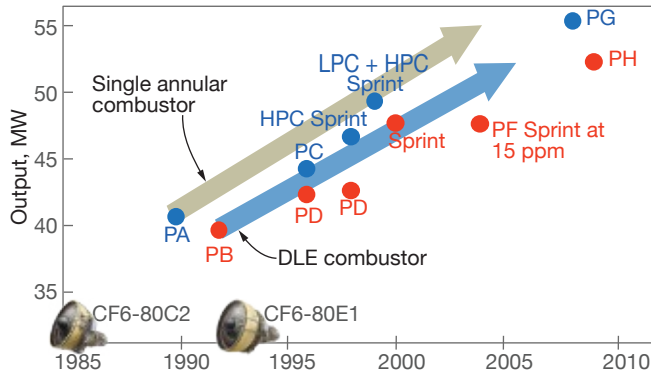
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**5. LM6000's success** is the result of using proven, advanced technologies to deliver greater value

tion is derived from the CF6-80E1 aircraft engine, and there are changes to the combustor and LP turbine as well. Combined, these changes enable the PG engine to produce a nominal 54 MW (ISO/25-ppm NO<sub>x</sub>, water injection) and the PH engine about 48 MW nominal (ISO). Today there are more than 850 LM6000 units in worldwide service, operating in a wide variety of applications (Fig 5).

**The LMS100 engine** was developed in the early 2000s. GE took a bold new approach to the 100-MW-class "hybrid" intercooled aeroderivative. It used some parts and technology from its bigger cousins—GE's heavy-duty frame gas turbines. For example, GE's 6FA compressor technology is used in the LMS100's LPC; HP

compressor and turbines are derived from GE's CF6-80E1 aircraft engine.

The LMS100 also has an all-new lightweight two-stage intermediate-pressure turbine and a five-stage free power turbine for flexibility. Additionally, LPC discharge air is cooled before it enters the HPC. This integrated arrangement allows fast starts, has very good load-following characteristics, and high part-load efficiencies.

The first LMS100 PA (SAC) engine, rated 103 MW nominal at ISO conditions, entered commercial service in the US in mid-2006. It can be water-injected to achieve 25-ppm NO<sub>x</sub>. The PA was followed by a DLE version, the PB engine, rated at 100 MW nominal/25 ppm NO<sub>x</sub>. The first pair of PBs was installed in Rus-



**6. First LMS100**, a 100-MW intercooled engine, entered commercial service in 2006.

sia in 2013. Initially, the 50- and 60-Hz power turbines were slightly different, but today there is one single power turbine specific to each model that is optimized for all applications.

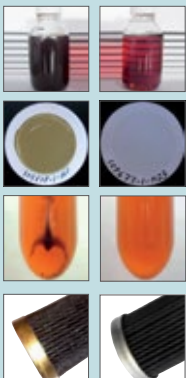
LM engines have enjoyed continued worldwide success and acceptance, in part because of the millions of hours of operational experience with the basic design features that were accumulated on their parent flight engines from GE Aviation. In addition, GE has continually strived to improve its LM engines to meet customer expectations.

*Madhu Madhavan, GE Power & Water/Distributed Power, with Gil Badeer, Tayo Montgomery, and Rick Hook*



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TransCanada Turbines' test cell is located in Calgary, Alberta beside the Calgary International Airport. Operating for fourteen years, this test cell is capable of testing all marks of the Rolls-Royce Avon, RB211 and RB211 DLE, as well as the General Electric LM1500 and LM2500. TransCanada Turbines performs all tests with natural gas.

In 2013 TCT completed commissioning on a state of the art LM6000 testing facility, conveniently located adjacent to our existing test cell. It is fully capable of testing the LM6000 PA, PB, PC, PD and PF gas turbines'. Among other features and enhancements, the new test cell features a quick change design to allow for quick turnaround times when testing engines.

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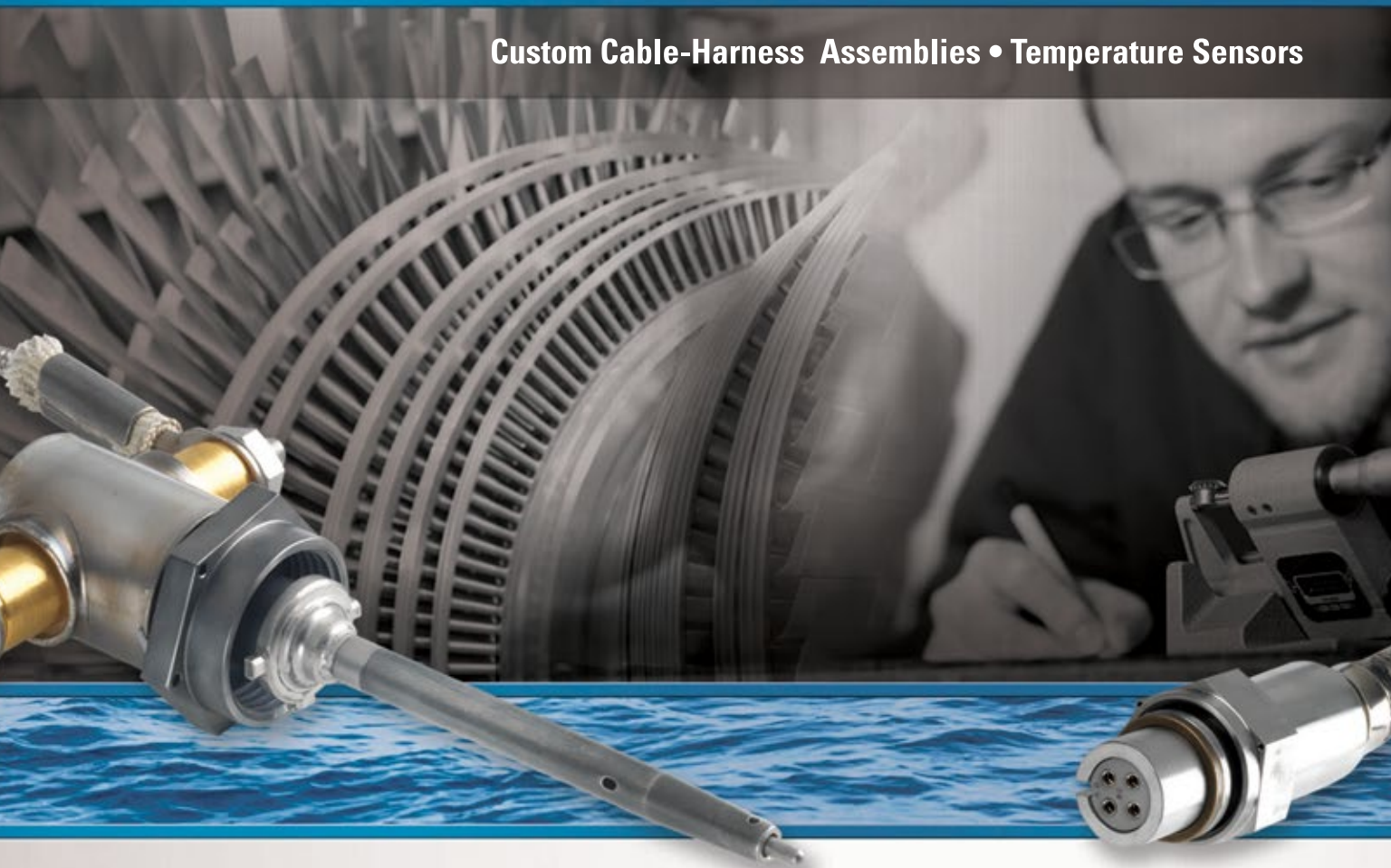
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# THE DEPOTS



## AIR NEW ZEALAND GAS TURBINES

**I**t's been an interesting assignment for Air New Zealand Gas Turbines to reflect on its affiliation with WTUI and provide a brief historical account of that relationship. My first reaction was to delegate this assignment until reminded that I had been representing our company at the conference since 1993. Garry Oliver, my boss back then, attended the first two conferences in 1991 and 1992.

Garry and I were heavily involved in managing and supporting Air New Zealand's aircraft maintenance—specifically, overhaul and repair of the GE CF6-80 and RB211-524 engines. At that time,

the Marine & Industrial section was a very small operation compared to the aircraft engines division. Prior to being drawn into the M&I business, I couldn't understand why Garry and a small team of about six shop-floor mechanics were so passionate and dedicated to it.

My first WTUI conference in San Diego (1993) changed all that. I was more than happy to leave the so-called glamor of the aviation world and start a career working in an industry that was developing rapidly. Most impressive to me was the efforts of the dedicated people involved—their can-do attitude to resolving the technical

issues on the LM2500 and LM5000 gas turbines that both the OEM and the users were grappling with at the time.

Since its inception, WTUI has provided a forum for the Air New Zealand team to exchange technical information and experience, to meet users and owners face-to-face and build on relationships that, in many cases, have lasted over 25 years (Figs 1-3).

Another very satisfying facet of WTUI for the Air New Zealand team has been the opportunity to meet and develop relationships with the many GE people and other independent vendors that support the industry. A unique outcome of the conference for ANZGT participants has been the way the relationships among the GE independent authorized depots have developed.

It would be fair to say that through the 1990s the independent depots took a side-line role at the conference, had little technical input in the breakout sessions, and were there to primarily promote service offerings to the customer base. We were "booth dwellers" as once described to me by one of WTUI's iconic personalities, Brian Hulse.

One of the most significant developments for Air New Zealand Gas Turbines and its ability to contribute to the WTUI conference in a much wider sense came in 2003. The board of directors invited the depots to coordinate and facilitate the technical breakout sessions at the conference. Success hinged on a collaborative effort among MTU, TCT, IHI, and ANZGT.

Inviting four fiercely competitive companies to come together in this way could have been a recipe for disaster; however, the opposite occurred. The desire of each of the depots' leaders and teams to do what was right for WTUI by sharing collaboratively with conference attendees their technical knowledge and experience was agreed to unanimously.



**1. Team Air New Zealand Gas Turbines**



**2. ANZ stand at WTUI, 2001**



**3. ANZ's growing presence at Western Turbine**

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**4. How to make a “Kiwi” smile**

From Air New Zealand Gas Turbines’ point of view, this collaboration has been a major feature of the conference, defined by the unique relationships among the depots, GE, WTUI, and the owner/operators of LM engines. It has never compromised the ability of the depots to promote their services, ensure fair competition, and maintain their very high standards of technical expertise.

The Air New Zealand team has always

come to the conference proud of the culture and personality of the New Zealand people, “the Kiwis” from down under. We have always respected the diverse spectrum of people and cultures that attend the conference (Fig 4). This has always made WTUI “special.” Air New Zealanders have always felt welcome and valued participants.

The people from the industry who have

volunteered to take positions on the board and other roles to ensure the WTUI conference continues to operate and prosper are held in very high regard by us. Air New Zealand Gas Turbines can attribute much of its success, growth, and development over the past 25 years to its association with the WTUI and the users who support it.

On behalf of all the Air New Zealanders who have attended, supported, and contributed to WTUI conferences over the past 25 years, I thank all the board members, organizers, volunteers, owners, and operators who have given their time, and in many cases their business, to us and the other depots.

To close it is important for me personally, and on behalf of Air New Zealand, to thank GE for its support over the years. Air New Zealand Gas Turbines has never underestimated the value of this support; it has underpinned the strength of our technical expertise and knowledge.

From all of us at Air New Zealand Gas Turbines: Long live WTUI!

*John Callesen, Manager, Air New Zealand Gas Turbines*

# IHI

## Realize your dreams

IHI was established in 1853, during the dawn of the modern age in Japan. Today, it has many diverse businesses serving a broad range of industries—including gas turbines for electric power generation. In 2013, IHI celebrated its 160th anniversary. To make dreams come true for people worldwide for years to come, IHI Group draws on its technologies to contribute to the development of society.

IHI produced Japan’s first jet engine in 1945. Since then, the company has amassed a vast spectrum of technologies—some through international joint development. Aircraft engines, including design, fabrication, and maintenance, is one of these. To date, IHI has shipped over 560 GT packages—including the LM series.

In 1960, the company signed an agreement of licensed production with GE to pro-

vide aviation gas turbines to the Japanese Air Self-Defense Force. It put into action cooperative design, production, and quality control. This was the beginning of a good relationship between the two companies. IHI developed the IM100, IM300, IM1500 gas turbines and related packages based on the LM100, LM300, and LM1500.

In the 1970s, IHI developed the IM5000 gas turbine, comprised of an IHI power turbine and the LM5000 gas generator. The first IM5000 was delivered to a Japanese customer in 1978; IHI followed up with deliveries to US customers in the 1980s (table).

IHI designed LM2500 packages for electric generating plants in the 1980s and also for the Japanese Maritime Self-Defense Force. This helped to expand the aeroderivative gas-turbine market prior to



**5, 6. IHI has been growing its presence at WTUI since expanding its US operations in 2008**



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introduction of the LM6000.

In the 1990s, IHI-designed packages were supplied to powerplants using LM1600 and LM6000.

Meanwhile, on the service side, IHI began organizing overhaul facilities to support LM2500 maintenance in the 1970s. This effort continued over the years, and since the 1990s the company has been certified as a Level 4 GE-authorized depot for maintenance of LM6000 gas turbines.

In 2008, IHI expanded its operations in the US (Figs 5, 6), offering the company's high-quality gas-turbine maintenance services to more customers and prospects. Two years later, it formed a partnership with Reed Services Inc and a branch office and shop were opened in Cheyenne, Wyo. The Cheyenne Service Center (CSC) is equipped with a comprehensive customer support system—including maintenance tooling for all LM6000 models, a LM6000PC lease engine, and an experienced field-service engineering team (Fig 7).

**Service capabilities.** IHI provides a wide array of services covering the lifecycle of LM engines—from design to package delivery and maintenance. The company has a package contract with GE and provides customers in Japan and elsewhere with an IHI-designed GT package. IHI has considerable experience with simple-cycle, cogeneration, and combined-cycle GT applications and as an EPC contractor. Important to note is that only IHI and GE have the capability to supply LM6000 power-generation packages worldwide.

Moreover, IHI also has developed GE-approved proprietary control systems. The CSI series, especially the latest offering, CSI-III+, makes it possible to control entire plants as one integrated system. Customer plant operational data can be monitored by the proprietary IHI "imonitor" service in real time at company headquarters. A comprehensive support system is part of the imonitor service.

IHI has accumulated a wealth of advanced technology and know-how. This has been refined through the company's aviation GT maintenance operations, resulting in highly reliable maintenance services for the GT engine sector. The same high-level processes used in aviation-engine field and shop inspection and maintenance also is applied to aeroderivative gas turbines, giving customers confidence in the company's industrial services.

IHI has two LM-series Level 4 maintenance facilities in Japan, at its Mizuho and Kure Works (Fig 8). These shops established LM-series maintenance areas with aviation GT production and maintenance

### IHI IM5000/LM5000 installations

Customer	Location	Year (no. of units)
Meidensha Corp	Numazu, Japan	1978(1), 1991(1)
Power Development Board	Kuhluna, Bangladesh	1980(2)
Simpson Paper Co	Anderson, Calif	1982(1)
Dow Chemical Co	Stade, Germany	1983(1), 1985(2)
Simpson Paper Co	San Gabriel, Calif	1985(1)
Power Development Board	Chittagong, Bangladesh	1986(3)
Simpson Paper Co	Ripon, Calif	1987(1)
Procter & Gamble	Oxnard, Calif	1989(1)
Carson Energy	Carson, Calif	1989(1)
Tenaga National Bhd	Kapar, Malaysia	1994(2)*

\* LM5000s; all other units installed were IM5000s



**7. Cheyenne Service Center** has tooling for all LM6000 models, plus a lease engine

**8. LM-series Level 4 maintenance facilities** are located at IHI's Kure Works (photo), as well as at its Mizuho Works

areas. The company has the only LM maintenance facilities in Asia authorized by GE.

Engines removed for scheduled or unscheduled maintenance at the Mizuho Works are disassembled down to the parts, and after inspection and repairs, they are reassembled. GE stipulates a major overhaul of LM-series gas turbine after every 50,000 hours of service. IHI can repair almost all component parts in-house,

ensuring smooth implementation of high-quality overhauls.

After completion of the overhaul, it conducts engine running tests to confirm performance and function levels. A dedicated test cell at Kure No. 2 Works is used for this purpose. The facility has special equipment and technology to accept many gas turbines and undertake a range of highly effective post-maintenance tests on them.

LM-series GT maintenance requires hot-section repair; IHI responds effectively to this need. The Mizuho Works can deliver highly reliable hot-section modules for replacement at the customer's facilities. These modules have been disassembled, inspected, repaired, and reassembled at Mizuho.

The CSC offers all field services and module replacement at the repair facility or the customer's site. Finally, IHI has lease engines in stock for LM6000PA, LM6000PC, and LM6000PD models. They allow continuity of generation service when a customer's engine is undergoing maintenance.

### WTUI milestones

- 2000. IHI accepts the offer by IM5000 users to participate in WTUI. A package session was held from 2000 to 2005.
- 2006. IHI extends its support of WTUI by exhibiting with a 10 x 10-ft booth. Since 2009, IHI has participated with a 20 x 40-ft booth and has supported the depot party.
- 2008. IHI participates in its first LM6000 breakout session, sharing its technical knowledge.

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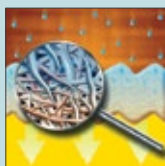


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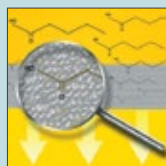
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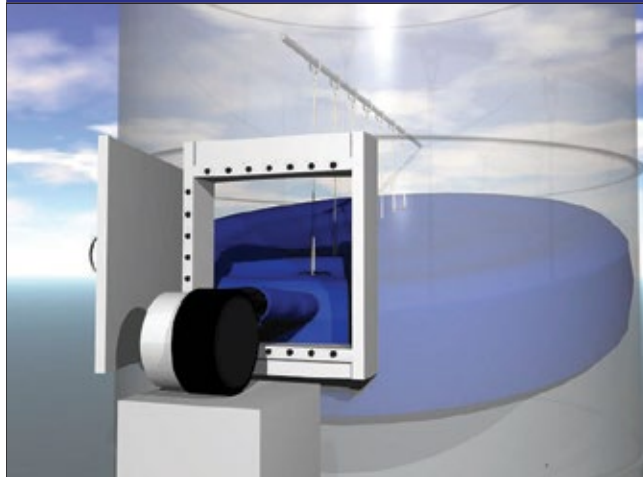
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**M**TU Aero Engines, with headquarters in Munich, Germany, is a global leader in the development, manufacture, and support of commercial and military aircraft engines and industrial gas turbines. Maintenance, repair, and overhaul (MRO) of industrial gas turbines (IGTs) is a cornerstone of the company's activities, ranking high among MTU Maintenance's core competencies.

The company is an authorized service provider for all types of GE LM2500, LM5000, and LM6000 gas turbines. Its customers are engaged in power-generation, marine-propulsion, and compressor-station applications—onshore and offshore. MTU Maintenance benefits from a global repair and service network and from a broad knowledge base in the development, manufacturing, and repair areas.

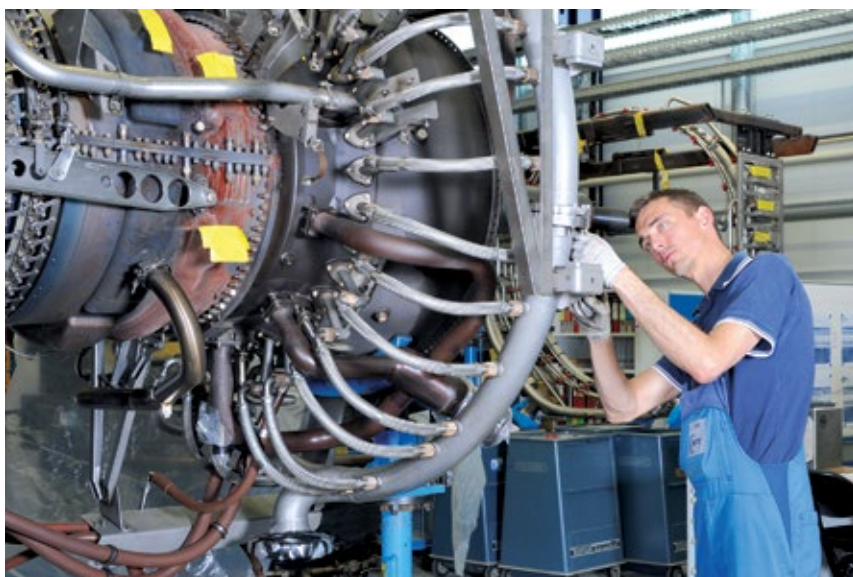
It closely cooperates with MTU shops in Hannover, Munich, and Kuala Lumpur (Malaysia). Plus the company has Level II shops in the US, Thailand, Brazil, and Australia, allowing MTU to serve customers in their domestic markets with minor repairs, module exchanges, training, and parts supply.

At MTU Maintenance Berlin-Brandenburg, IGTs are maintained and repaired in accordance with quality standards equivalent to those applied in aviation, which are among the most stringent in the world. Efficient shop workflows and highly developed processes ensure short turnaround times—from teardown through parts inspection

and repair, to reassembly and subsequent testing (Figs 9-11).

**The Ludwigsfelde shops** south of Berlin, the company's center of excellence for IGT repairs, have been serving industrial customers for more than 30 years. Shop capabilities include the following:

- Dedicated module shops.
- Electronic piece parts tracking system.
- Proprietary stringent rotor stacking procedure.
- Latest balancing technology.
- Hot-section replacement.



**9-11. Efficient shop workflows** and highly developed processes at MTU assure short turnaround times. Technician completes overhaul of an LM6000 in Fig 9 (above), build-up stand for an LM engine is in Fig 10 (left), and the teardown/re-assembly line at Ludwigsfelde is captured in Fig 11 (below)



## MTU and WTUI

MTU's industrial gas-turbine experts have been sharing their knowledge with Western Turbine users for almost two decades. This collaboration includes presentations on technical issues and solutions, as well as recommendations for operators.

The MTU team values its relationship with the WTUI leadership and conference attendees and looks forward to participating in the meeting each year. It is a productive venue for sharing information on the company's product line and service offerings.

- Engineering support for every type of gas turbine.
  - Quality system based on FAA-approved flight engine system—minimal tolerances and highest quality standards.
- Regarding the last point, it's important to note that MTU safeguards its high quality standards via an integrated management system that monitors environmental pro-



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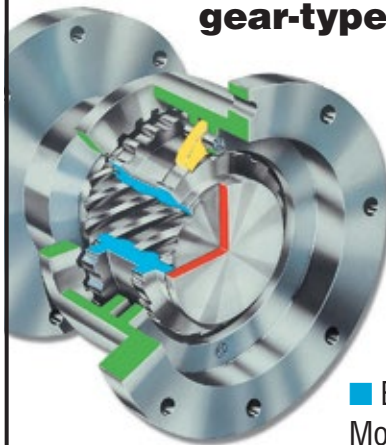
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tection efforts as well as the quality of its products and services and the effectiveness of the company's health and safety program. The quality management processes and systems involved are audited and certified regularly by internal and external experts.

**Onsite services** also are available. Ludwigsfelde's specialists are on call around the clock, 365 days a year to serve customers. A hotline service is provided for the immediate organization of onsite work. The company has long-term agreements with some customers and, if requested, can handle maintenance management as well as craft labor.

Services range from removal and commissioning, onsite repair, periodic inspections, remote monitoring, and vibration analysis—plus engineering consulting and customer training. MTU Maintenance makes sure customers are optimally supplied with services, spare parts, and leased gas turbines. Specific onsite services include these:

- Periodic inspections and Levels 1 and 2 onsite maintenance.
- Individually scheduled preventive maintenance.
- Rotable units, tooling management, spare parts supply/management.
- Remote monitoring and trend analysis.
- Vibration surveys, trim balancing, laser alignment, DLE mapping.

- Engine control services.
- Training.

**Package services** include modifications, retrofits, and upgrades of ageing powerplants to ensure their reliability, per-



### 12. MTU prides itself on the company's advanced IGT test cells

formance, and environmental compliance. The portfolio of flexible operating options lists environmental and control solutions, as well as measures for power augmentation. Plus, the company is equipped to relocate used plants when and where required.

**Repair beats replacement.** The facility near Berlin uses innovative high-tech repair techniques that help customers save money without sacrificing quality. MTU experts perform 80% of all component repairs in-house—true to their motto, "repair

beats replacement." Simply put, it costs less to repair most parts than to replace them, and the quality and reliability of a repaired part matches that of a virgin part. Extensive exchange of experience and know-how among the MTU shops help the company's specialists to continuously develop and improve repair techniques to optimize engine reliability and availability.

**Testing.** MTU Maintenance prides itself on having one of the world's largest and most advanced IGT test cells (Fig 12). It can accommodate LM2500 and LM6000 gas turbines in their true service environments; LM5000 tests are conducted on an aero-engine test bed. Thorough testing after an overhaul is important to assure optimum

maintenance quality. Test capabilities available to owner/operators include the following:

- Natural gas supply.
- Emissions measurements on DLE engines.
- Combustor mapping.
- Slave power turbine for testing LM2500 gas generators.
- LP compressor booster trim balancing.
- Spectrum analysis of vibration measurements.
- Digital data recording of all relevant GT parameters.
- Witnessing of test data.



## TRANSCANADA TURBINES

The Independent Alternative

**TransCanada** Turbines Ltd's (TCT) association with Western Turbine Users Inc dates back almost to the time of its formation in 1998 as a joint venture between Wood Group Gas Turbines and TransCanada PipeLines Ltd.

TCT was approached by the WTUI leadership team in 2001 to help support the technical sessions at its annual conference. This created an unprecedented joint-venture atmosphere among the largest Authorized Service Providers (ASPs) in

the LM market. Despite competing globally against each other on a daily basis, TCT worked alongside its competitors to share, document, and prepare technical material for the LM users.

After months of collaboration, in 2002 Dale Goehring led the way for TCT at Western Turbine, presenting on what the ASPs were seeing in the fleet and what operators could do to address/prevent those issues. Prior to that time, attendees were accustomed to seeing the OEM on-stage presenting the technical material.

In 2002, attendees were exposed to a radical change in conference format:




**13. TCT opened its 220,000-ft<sup>2</sup> Airdrie custom depot in 2011. It is equipped with state-of-the-art engine test facilities. Note the GT inlet and exhaust structures on the building roof and the load banks to the left**

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#### 14. Airdrie relies on a cellular-based process flow system for quicker inductions and more efficient turn times

Competing ASPs were standing shoulder to shoulder to share their collective knowledge with the users. This both embraced the spirit of WTUI, to share know-how and experiences, and helped to solidify the meeting as a truly technical environment focused on the long-term benefits of the equipment and its users.



At the 2007 meeting in Phoenix, Goehring began transitioning TCT's technical presentations to Steve Willard. The following year, Willard took on the role as the company's presenter full-time; he has been a significant part of the WTUI conference since. During (and even after) the meetings, he is always willing to sit down with users and expand on any past, current, or new LM issues, and work with owner/operators to resolve their concerns.

In 2011, the ASPs joined together once again to introduce a joint hospitality event. It was so well received by the membership, the "depot evening" has continued as an annual tradition.

Through its 13 years of participation at WTUI conferences, TCT has established itself as a respected services provider in the LM market, as evidenced by the support it provides customers and by the growing support it gets from the LM users. TCT knows a job will be successful when no one is hurt and it is done correctly.

**Capabilities.** TCT is the only independent aeroderivative repair and overhaul service provider in the world licensed by both General Electric and Rolls Royce. With 17 years of industry experience, TCT provides reliable support for the LM2500, LM2500+, and LM6000, as well as RR's Avon and RB211 product lines.

In 2011, TCT opened a state-of-the-art 220,000 ft<sup>2</sup> custom depot in Airdrie, Alta (just north of Calgary) to continue providing first-class service that consistently exceeds customer expectations (Fig 13).





The new facility introduced a cellular-based process flow system that allows for quicker inductions and more efficient turn times through the use of 18 overhead cranes, nine balance machines, an automated cleaning line, and expansion of in-house component repair technologies (Fig 14). To better serve customers, TCT also has invested significantly in a large pool of assets for rotatable exchange (including engines and a variety of modules).

Over the years, TCT has established several Level 2 facilities—including Bakersfield, Houston, Syracuse, and Cumbernauld, UK. All four Level 2 facilities are equipped with Level 1 and 2 field tooling. The Level 2 facilities are also the bases for our 50 TCT-employed and OEM-trained field service technicians.

TCT operates its Package Power Parts business from each branch facility. This division is able to provide parts sales, service, and technical guidance to almost any location worldwide. It stocks a large inventory of LM2500 and LM6000 spare parts for both turbines and power packages.

Prior to returning engines to customers after a shop visit, TCT conducts performance tests at its Calgary test center. In 2013, TCT expanded its engine testing facility to better support the LM6000PA, PB, PC, PD, and PF engine lines locally. The new facility offers emissions mapping and monitoring services and serves as the base of operations for Canadian Field Service teams. Should customers not be at the test facility during their engine's overhaul, TCT offers online remote test witnessing, as well as recording and playback options.

The company's top priority in every function of its business is health and safety. Its health and safety management system meets the requirements of OHSAS 18001:2007; the company received OHSAS 18001:2007 certification in 2010.

Throughout each process, procedure, and engine workscope, quality is a major part of TCT's business. All facilities are ISO 9001:2008 certified, allowing the company to provide quality assurances to its clients regarding the inspection, repair, overhaul, testing and field service of their equipment.

As a process-driven organization, TCT has documented and implemented quality processes and working procedures that cover all business-critical processes to ensure a consistent approach to the way TCT works. Combining its quality system with the comprehensive OEM technical support services, operators are assured their engines are assembled to the highest standards of quality.

Ultimately, however, the key differentiator in TCT's service offering is based on the people in the business, and the customer-service focus that is empowered in everyone in the organization (Fig 15).

Finally, TCT is proud to be a part of the 25-yr history of the Western Turbine Users conference and it looks forward to supporting the group in the years ahead.

**15. The key differentiator in TCT's service offering is said to be its empowered employees**

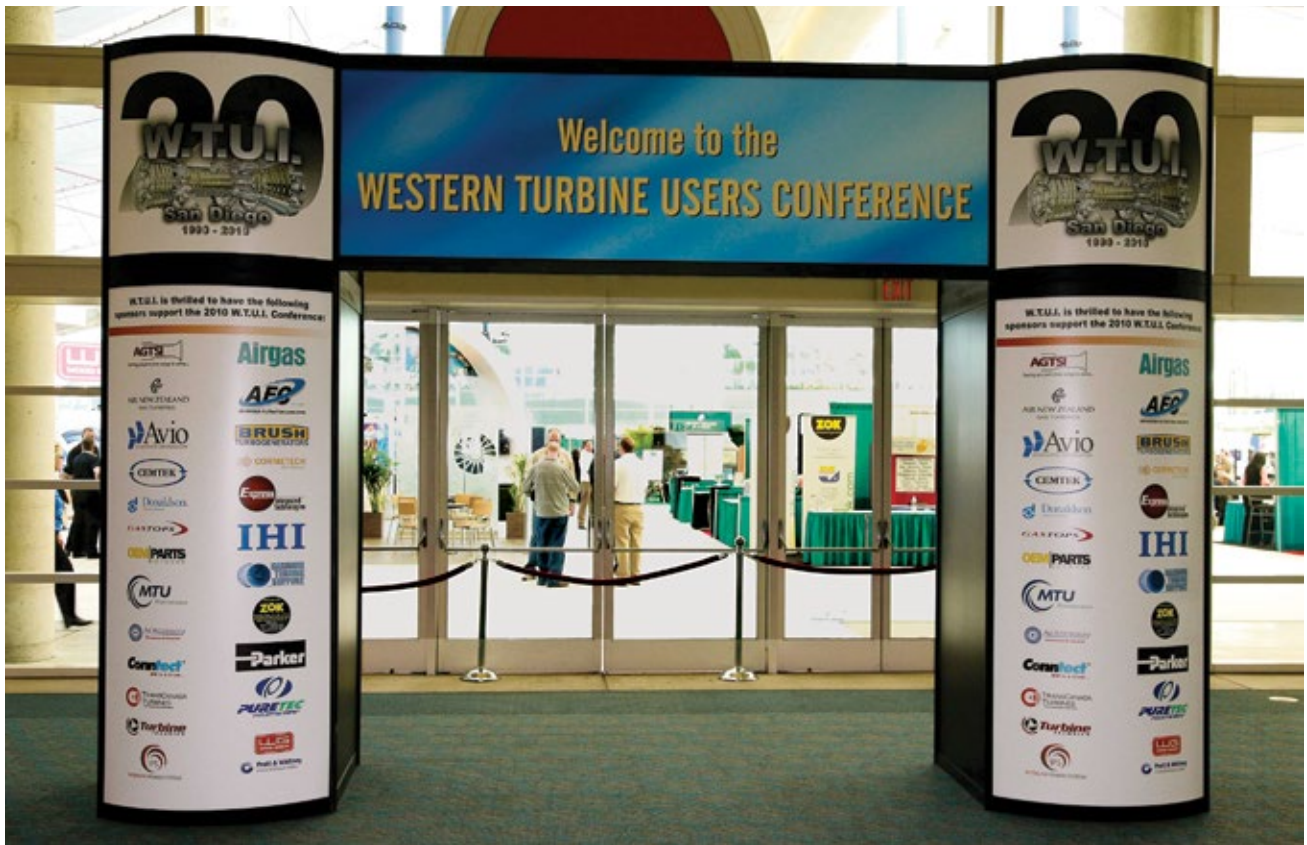


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# VENDOR REMEMBRANCES



## Rick Wade

*EthosEnergy Group*

From his company's small tabletop display to a 40-ft booth space, Rick Wade, business development manager, EthosEnergy Accessories & Components LLC, has witnessed the phenomenal growth of both the WTUI conference and his company over the last eight years. "It is the by far the best, and definitely biggest, user conference in North America," he says. "Maybe even the world."

"Through years of successful new product and process development, often spawned from WTUI member feedback, today we are an OEM-authorized option for LM fuel nozzle repairs as well as for the servicing of many engine accessories." Clearly, WTUI has been invaluable to the maturation of his company, and Wade's dedicated participation and collaboration with other attendees certainly has contributed greatly to this growth.

In addition to the conference being a fantastic opportunity for vendors to nurture relationships with all their customers in one place, Wade believes it fosters a truly supportive atmosphere in which users and vendors both are able to discuss relevant issues and learn from each other in mutually beneficial ways.



He especially enjoys the chance to play with other golfers and hackers alike in a fun, competitive format. Generally their outings during the annual golf tournament have been spectacular, on first-rate courses, but there are always some things you cannot predict. "Remember Pasadena at the Angeles National Golf Club?" Wade

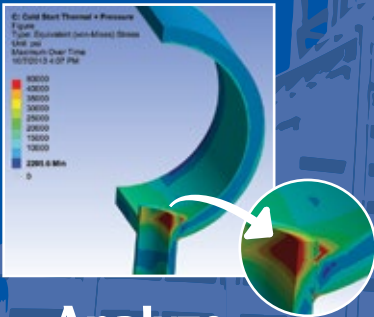
asks, recalling the several occasions they've played in rain and in windy as well as freezing-cold weather.

With the annual golf tournament and the Monday night dinner, WTUI offers an invaluable venue for business development and a place to create special memories and lasting relationships.





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## John Fintland

*Advanced Filtration Concepts Inc*

Approaching close to 20 years of participation with WTUI, John Fintland, AFC's president, recognizes the conference as an important aspect to the growth of his business. "The first show I went to in Palm Springs (1996)," he said, "had perhaps 20 vendors filling two rows. It took a user 20 minutes to visit every supplier in the room; now the show takes up an entire convention center!"

Fintland has returned every year since

and is just as committed to the organization today as he was 18 years ago. "The fact that WTUI attracts users from around the world has given AFC global recognition. I remember when it was solely a West Coast event; that's certainly not the case today. I've met users all the way from Africa, New Zealand, and Kazakhstan, to Mexico, Canada, and our own backyard."

According to Fintland, the fact that the vendors have two and a half days to meet and mingle with the users puts WTUI on a different level from the other GT shows.

"Plant operators and engineers are not just passing acquaintances; many have become friends," he said.

"Working with engineers such as Mark Battaglia of Berry Petroleum has driven us to be more application-specific and to focus on solving problems for generators rather than simply selling a product. Serving customers such as Berry, NRG, Calpine, and Southern California Edison has reassured AFC that we're on the right track with our commitment to being service- and detail oriented. Those lessons have allowed us to grow in other industries as well."

Finally, WTUI plays a vital role in the development and growth of AFC and the GT filter brands it chooses to represent.



## Mike Pipes

*GE Power & Water*

After leaving the US Navy, Mike Pipes, today the LM2500 services product manager for GE Power & Water/Distributed Power, quickly found his way into a new industry.

Since 1993, this former officer has been involved with LM engines, after joining the field engineer-





ing group of Houston-based Stewart & Stevenson Services.

Pipes is passionate about improving engine and package offerings and addressing the issues customers face on the ground. "My first five years in the industry were pivotal. I gained an understanding of the challenges customers face when equipment or services don't perform as expected."

During this time, Pipes spent many hours inside LM2500 and LM5000 exhaust collectors working on improvements to the alignment process. He developed the first alignment procedure that could be done without removing the exhaust collector from the package, brought the laser alignment tool into common use by S&S, and collaborated with colleagues and GE engineers to develop the Sprint™ performance enhancement product for the LM6000.

Pipes managed the field engineering department for two years after S&S was acquired by GE. He then accepted a project leadership role for conversions, modifications, and upgrades, later advancing to manager. "It was during this time that I was able to strengthen the OEM's relationship with WTUI," he said.

In Pipe's view, the conference has really



matured over the years. "I first attended in 1996, so I missed WTUI's simple beginnings. Then, it seemed more focused on the time spent outside of the conference rooms; now, however, I believe that the group and its sponsors are more focused on the original intent of the gathering—finding ways to improve plant operations and reduce maintenance costs."

For Mike, WTUI is about bringing people together to share knowledge and best practices. Collaborating with other users and with the OEM is what makes this user organization successful, and it is what will ensure its success into the future.

### Gregory J Labas Conntect Inc

"The first WTUI show Conntect did was in Las Vegas," company president Greg Labas recalls. "It was the second or third year the group invited vendors and it was so small that we just had simple tables with banners hung over them. Now, of course, everyone shows up with large, intricate booths and it's a whole different show." But one thing hasn't changed and that is the opportunity to make personal connections with other participants. "We're there with our customers, the guys who buy our stuff"

Attending WTUI, he said, is not like going to other conventions where there are all kinds of people, students, and others who aren't your customers. "At the WTUI show, you know you're talking directly to the people who run the plants. And on top of that, there's a lot of camaraderie."

Being involved with the WTUI has been a key part of Conntect's success. "In the beginning, we didn't know exactly who the customers were," Labas continued, "we had to go out and work to identify them. But with WTUI, we didn't have to spend time identifying customers; instead, we could spend time getting to know them. After a while, each convention seems like





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‘old home week’ and you get to see old friends—and do business.”

Conntect is proud of its high-quality products and services, but the fact is they are services that the users need, but aren’t essential to keeping the engines running. So by getting to know the users through WTUI, Conntect builds trusted relationships. “We can then go to the plants, sit down and talk to them, communicate the value of our services and learn about the challenges they’re facing. Then we talk about what works and what doesn’t and why. There’s just no better feedback than that.” And no better relationships than with the users from WTUI.

**Bob Auguston**

*Rochem Technical Services USA Ltd*

“The people who organize and attend WTUI are amazing! Our company has been at WTUI since the Rio Bravo conference in Bakersfield. We think this is one of the best user conferences, and it provides the best value and opportunity to connect with the users and operators.”



Attending the conference definitely has paid off for Regional Director Bob Auguston and Rochem Technical Services. “WTUI has helped our company better understand the needs and operational challenges of the aeroderivative segment of the gas turbine market,” he said. “From this, we’ve been able to develop and provide products and services to meet these challenges.” From Auguston’s perspective, attending the WTUI conference each year is smart business.

According to him, WTUI as an organization works because of the dedication of everyone involved, including the officers, the leaders of the breakout sessions, the depots, the users, and the vendors. “Our company looks forward to participating in the conference for many years to come.”

**Keith Flitner**

*Parker Hannifin*

The path to WTUI for Keith Flitner, global





account manager for Parker Hannifin’s energy marketing team, started with a degree in aerospace engineering from San Diego State Univ. The company had been an active supporter of WTUI for many years.

Flitner said Parker’s growth in the power generation market has paralleled WTUI’s. “At first we focused on our role as the lead supplier for LM fuel nozzles and repairs. For years our booth in the exhibition hall was staffed by some now retired Parker people, such as Frank Hanzlik and Mike Roth. More recently, the company expanded its presence to include information on over 60 Parker divisions that manufacture thousands of products used around the world in electric generating plants.”

What really has impressed Flitner is the social nature of the WTUI. After the 20th anniversary in 2010, the company decided to expand its presence at the meeting and add a hospitality night. This has become annual event to recognize friends and associates for their achievements during the past year.

Another comment offered by Flitner about WTUI involves participants who are attending for the first time. He said it’s always great when a user comes by our booth and is able to finally connect a face with the Parker name. The stories that are shared and history exchanged is always

fun and interesting. Without a doubt, the WTUI proves every year to be a valuable forum for the industry.

**Dan Harmon**

*General Electric Co, retired*

As a GE representative for the LM6000 in the early nineties, Harmon got involved with the WTUI conference just as that engine model was being introduced. “I was there as the breakout session went from sparsely attended to the largest session as the technology was adopted and the WTUI conference went global.”

The conference has been successful, Harmon said, because of its focus on the operator. “But as an OEM representative, I always felt welcomed, especially by Jim Hinrichs, but also by every session chairman and most operators.”

Harmon supported WTUI first as the LM6000 customer service engineer, then LM6000 product line manager, and finally as the LM6000 product champion. “In developing the LM6000, we tried to design for reliability using lessons learned from LM5000. My philosophy from the beginning to the end was foremost to listen to the customers and be honest with them on the product issues. Nobody feels reliability more than the equipment operators. I believed strongly that for GE to be success-

ful, our customers had to be successful.”

Because GE is large, it has a natural tendency to be slow relative to the needs of the customers. Harmon’s job was to listen to the customer, assess the impact of product issues on them, and then create the sense of urgency within GE for change.

The WTUI conference, he said, was hands down the best forum we had to get the data direct from a large group of operators. “They were not shy about telling us both the good and the bad about the product and processes so we could improve. It often took collaboration between the OEM and the customer to solve issues,” he said.

Harmon supported the conference for many years. “I met some outstanding individuals and always looked forward getting to know people in their jobs as human beings.” Although now retired from GE, Harmon believes its participation in the conference is important for everyone involved.

**Rick Parker**

*Zokman Products Inc*

“All of my experiences with WTUI—and I’ve had a lot of them—have been good,” said Rick Parker, president, Zokman Products Inc. “I’ve been involved with the organization for 21 years. My first conference was in 1994, in Palm Springs, and I haven’t missed one since.”





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Asked about how the organization has changed over the years, he said, "Most notably, there were fewer users back in the early 1990s, which makes sense. When I first started attending, there were fewer than 50 LM6000s out there, and now, there are nearly 1200. The group and this sector of the industry have grown exponentially, which has been great for our business. The more units, the better!"

Rick started out with a small sales ter-

ritory that covered the Midwest. "It was a real grind," he recalled, "but the customer relationships I established over the years made it all worthwhile." Today, the reach of Zokman Products has expanded, to say the least, as his company now is the master distributor of Zok compressor cleaners for the Americas.

Now Parker brings to WTUI representatives from Falcon Crest Aviation, Reed Services, PETSIA International, GPI International,

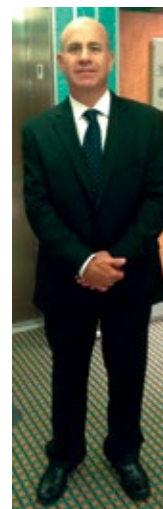
and Ingen do Brasil. Together they cover sales for the entire Western Hemisphere. "Because the event's the focus on the technical issues for the LM fleet," he said, "WTUI brings users from Canada all the way down to Argentina." Truth be told, it is the rare user on the show floor who doesn't know the ZOK Man.

### Dave Martin

HPI LLC

"Oddly enough, I found out about WTUI from a competitor who had exhibited, so I figured it would be a good idea to check it out. That was 1997 and I have been to every WTUI since then," said Dave Martin, business development manager for HPI LLC. He has worn three hats in the 18 years he has attended WTUI, starting with SKF's Condition Monitoring Div, moving to Meggitt's Vibro-Meter Div, and recently joining HPI, which specializes in controls, O&M services, NERC cybersecurity solutions, and turbine MRO.

He is one of the few attendees to participate in the WTUI biathlon: golf and



## VENDOR REMEMBRANCES



### Reg Morse Bremco Inc

"Bremco attended its first WTUI meeting about 10 years ago with Bill Kitterman and Bob Morse manning our booth," President Reg Morse said. "This gave us the opportunity to display our services to new and existing clients. We found many customers attended this show and they often brought colleagues to our booth to introduce us to them directly."

The conference has proven extremely beneficial to our company; it allows us to plan meetings with key vendors, plus customers and prospects attending the exhibition. WTUI has become one of our most important meetings because of the number of key people participating from across the country. We certainly appreciate the effort the leadership team has put into providing a first-class venue which continues to satisfy the needs of all who attend.

### Mike Kassner GasTOPS

GasTOPS has been active in WTUI for more than 15 years. "The annual conference and exhibition is a mainstay in our corporate marketing activity to the North American LM engine owners and operators," said Mike Kassner, director of business development, "and the company is grateful for

tennis. A native of Sonora, Calif, Martin is very familiar with the back roads of the state where many LM units can be found. "In the days before GPS, a lot of plants were not easy to find but we did, especially in the Oil Patch!"

The growth of the WTUI annual conference and exhibition has seemingly paralleled his own business success. "I think it was 2002 in Tucson when I noticed an inflection point for WTUI. It went from about 20 or 30 booths in a small room

to a full-blown exhibition with like 100 vendors." He continued, "I was with Vibro-Meter for 13 years and our sales increased 28-fold during my time there and more than a quarter of that business came from the LM fleets."

Martin credits his long-time relationships with the likes of Steve Lancaster, Audun Aaberg, John Vermillion, Wayne Feragen, Chuck Casey, and Wayne Kawamoto as a big reason he keeps coming back, not to mention, all the new faces over the years.





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The online monitoring system senses metal particles in engine lube oil, monitors the progression of damage, and provides early indication to operators via warning and alarm limits. MetalSCAN was first used on GTs 20 years ago; today it is installed on more than 300 engines. The system can be installed by the OEM at the factory or

retrofitted in the field.

Kassner closed saying, “The engaged and dedicated WTUI organizers have consistently created a high-quality, professional event that is an ideal venue for exhibiting and sharing experiences. My fondest memory was the evening aboard the USS Midway in San Diego a few years ago. It comprised a tour of the aircraft carrier, an elaborate dinner, a 10-piece band, and spectacular fireworks. It was one of the best-staged corporate events I have ever seen.”



## Lester Stanley, PE

*HRST Inc*

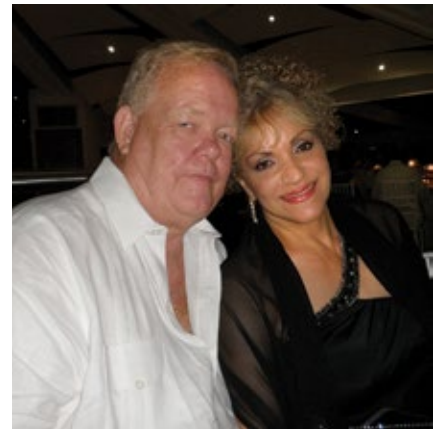
In the mid-1990s, years before our company was formed, engineers now part of HRST attended WTUI as employees of a boiler manufacturer. I’ll never forget Jack Dow’s scolding when I attempted to take down the booth an hour before the official end of the conference. Jack and wife Gae ran a tight ship.

WTUI “after hours” events were legendary: Drinks in the hotel bar, drinks in the Monterey aquarium, live heavy-duty rock-n-roll to the remnants of Bad Company, plus the Doug Flutie Band, etc. Thankfully, cell phones with cameras were not around yet, so no photos exist to damage the careers of the participants! Remember the impromptu guitar solo by a gifted user at one of these “concerts” just before the millennium?

Another personal favorite memory is renting a six-person sailboat in San Diego with engineers from a major SCR supplier, and requiring an emergency docking after about two hours for a restroom break. Root cause: Beer and light winds.

Once HRST formed, our small team, with virtually no marketing

## VENDOR REMEMBRANCES



budget, knew it needed to attend WTUI if we wanted HRSG service business. But profits were slim and purchasing a professionally designed booth display was out of the question; so as good engineers, we improvised.

In 2003, I built a custom plywood support frame in my garage, with carefully positioned hinges, to support a pair of my coveralls and hard hat, and a very expensive (\$400) flat display panel that would mount to the frame and poke out the chest of the coveralls.

Boothman was born (photo)! It was a big success. Plus, it was inexpensive, folded to fit in my suitcase, and was an eye-catcher for users on the show floor. Hotel towels were temporarily removed from the room and stuffed in the coveralls to provide form. Even today, we refer to our PowerPoint slide set showcasing our products and services as the Boothman file.

Users attending WTUI have been instrumental to technology development and business success at HRST. Example:

Around 2006, an LM6000 user from Canada spoke to us about the repetitive economizer tube leaks his unit was experiencing. Our investigation revealed overnight shutdowns caused 5C water to enter the back end of the heat exchanger, which was full of 100C water from residual shutdown heat.

Pow! The startup each morning gave the economizer a huge thermal shock. By the end of the following year, we had developed and installed HRST's first Shock-Master economizer. The leaks stopped. A few years later, this same technology was retrofit into an LM6000 HRSG operated by another WTUI member with the same positive result.

## Briefs

### Turbine Technics Inc

Shawn Burdge represented the company at its first WTUI exhibition in 2006; the user group's 25 anniversary is Turbine Technics' 10th year of participation, and Burdge is still in the booth.

Significant relationships, both in business and in friendship, have been developed through WTUI participation. Many users have become regular customers





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and collaboration with other vendors on the show floor has enabled the company to expand its product line.

### TVS Filters

Fran Redisi has participated in WTUI exhibitions since 1996; booth partner Dal Scivley since 2007. They said many users have contributed to TVS's success by suggesting product-line improvements such as high-efficiency media, longer-length filters to extend life and reduce

pressure drop, and use of heavy-duty frames for prefilters.

### National Mechanical Services Inc

NMS, a field-service company specializing in generators, heavy rotating equipment, and outside machinery repairs,



was founded by Bill da Silva in 2003. A no-nonsense man with a steely resolve at work in the field, da Silva was a fun guy to be around in a casual environment. He had a big heart and warm smile and was always good for a joke or entertaining "war" story. Following his untimely passing about four years ago, da Silva's wife and daughters took over his office and continued building the business as he would have—including annual participation in the WTUI exhibition.





**Groome Industrial Service Group**

VP Jeff Bause showcased his company’s services for cleaning SCR and CO catalyst for the first time at WTUI in 2009; it was Groome’s first user group meeting. Bause remembered John Baker urging Groome’s participation in Western Turbine while they worked collaboratively to resolve some of Baker’s O&M issues

at his former plant. Today the company works in 30 states and has developed additional services with the encouragement of Western Turbine users.

**Sulzer**

Warren Holmes and Mike Curran were in the Sulzer booth at the company’s first WTUI meeting in 2008. LM5000 power turbine and industrial frame unit repair capabilities were showcased. Today the

company is licensed by GE as a repair facility for LM5000 PTs.

**W L Gore & Associates Inc**

WTUI has been a reliable resource for collaboration during the development of the company’s line of hydrophobic HEPA inlet filters for gas turbines. Alliance Pipeline was the first user member to share case studies on its early experience with our product at the group’s 2012 show. Since then, we have learned more as Alliance expanded its use of HEPA filters. The sharing of this information through WTUI has had a significant impact in broader adoption of Gore filters for GTs.

**Gas Turbine Controls Corp**

WTUI has given us the opportunity to expand our operations to the West Coast, with particular emphasis on the LM market, Sam Leyton said. GTC has been showcasing its Speedtronic spares in the exhibit hall every year since 2007. The show has helped the company develop and strengthen relationships with key LM-focused vendors that it may not have met had GTC not been exhibiting.

**CSE Engineering Inc**

CSE has exhibited at WTUI every year since 2007 and its general manager,







## Amy Sieben opens her own shop to serve HRSG users



A registered professional engineer with more than 25 years of boiler-related and power-industry experience, Amy Sieben, PE, launches ALS Consulting LLC.

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- Inspections (online and offline)
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- Specs for new units, retrofit projects
- Bid evaluation
- Cycling studies
- Low-load studies
- RCA and problem resolution
- Design upgrades, in-kind replacement
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- Expense and capital budgeting
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Steve Morton, has attended every meeting since 2000—the first seven years as a user. Several of the company's largest and most loyal customers also participate in this event, providing another opportunity for collaboration.

### AGTSI

Aeroderivative Gas Turbine Support Inc was founded by Alan Mibab in 2004 and has participated in WTUI since that year. Mibab

understood the value of the conference and exhibition well, having participated under a different company name for six years before AGTSI opened its doors. LM users have contributed significantly to the company's success.

### Advanced Turbine Support

Advanced Turbine Support is participating in its seventh consecutive WTUI meeting this year. The event has contributed

significantly to the company's success. Example: It helped to cement the relationship between Advanced Turbine Support and TransCanada Turbines that led to the former becoming a TCT-approved inspection vendor. Collaboration with users led Advanced Turbine Support buying a Sweeny Turning Tool to facilitate LM borescope inspections.

### C C Jensen Inc

Sales Manager Axel Wegner is the face of C C Jensen at powerplants nationwide; he participates in WTUI every year. Wegner said users have been instrumental in the development of the company's four-in-one filtration unit to address different contaminants by simply changing to special filter inserts to remove particles down to 0.5 micron, water, acidity, and soluble and insoluble varnish. The company's compact HDU fine filter prevents turbine hydraulic related trips while prolonging bearing and lube-oil life.

### Duct Balloon

Gary Werth has been demonstrating stack balloons for use during unit layups for the five years he has been attending WTUI. They prevent the free flow of air through a unit when it is shut down guarding against the ingress of dirt and moisture.



# SPONSORS, 2010-2014

Each sponsor is listed by its official name at the time of the company's most recent sponsorship. One or more of these entities may be operating under a different name today, or may no longer be in business

 <p><b>A &amp; I Accessory Ltd</b></p>	 <p><b>Advanced Filtration Concepts</b></p>	 <p><b>Aeroderivative Gas Turbine Support Inc</b></p>
 <p><b>Airgas Specialty Products</b></p>	 <p><b>ANZGT</b></p>	 <p><b>ap+m</b></p>
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 <p><b>Thermo Fisher Scientific</b></p>	 <p><b>TransCanada Turbines</b></p>	 <p><b>Turbine Technics Inc</b></p>
 <p><b>Universal Acoustic &amp; Emission Technologies Inc</b></p>	 <p><b>Wood Group Pratt &amp; Whitney</b></p>	 <p><b>Woodward Inc</b></p>
 <p><b>Young &amp; Franklin Inc</b></p>	 <p><b>Zokman Products Inc</b></p>	

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A & I Accessory Ltd  
A & I Component Support Ltd  
AAF International  
Advanced Chemical Technology  
Advanced Filtration Concepts  
Advanced Turbine Support LLC  
Aeroderivative Gas Turbine Support Inc  
Aero-Link Marine & Power  
AGTServices Inc  
AHM Associates  
Airgas Specialty Products  
Airgas West  
Alpha Industrial Power  
Alstom Power  
Ametek Power Instruments  
Ammonia Process Safety Management  
Analysts Inc  
ANZGT  
ap+m  
APSM  
ARB Inc  
Arrow Products Support  
ATCO Environmental Systems  
Atlas Inspection Technologies Inc  
Avio  
Avista Technologies Inc  
Avogadro Group  
Babcock & Wilcox Co  
Barnhart Crane & Rigging  
Baseload Power and Generation Parts & Services LLC  
BASF Corp  
Bently Pressurized Bearing Co  
BP/Castrol  
Braden Manufacturing LLC  
Bremco Inc  
Brush Aftermarket Inc  
Brush Turbogenerators  
BSI Turbines  
Buffalo Pumps  
C C Jensen Oil Maintenance  
CCJ ONLINE Inc  
Caldwell Energy

California Analytical Instruments  
Callidus Technologies by Honeywell  
Camfil Power Systems  
Cashman Equipment  
CEMTEK Environmental Inc  
ChemTreat Inc  
Chromalloy  
CLARCOR Industrial Air  
Clean Air Engineering Inc  
Cogeneration & Onsite Power Production  
Combined Cycle Journal  
Component Repair Technologies Inc  
Conntect Inc  
Continental Controls Corp  
Controlled Motion Solutions Inc  
Cormetech Inc  
Coverflex Manufacturing Inc  
CPG Inc  
CR Energy Group  
CSE Engineering Inc  
CTI Industries Inc  
Cust-O-Fab Specialty Services LLC  
Custom Instrumentation Service Corp (CISCO)  
Danfoss High Pressure Pumps  
Danfoss Nessie  
DeepSouth Hardware Solutions LLC  
Dees Fluid Power  
Delta Air Quality Services Inc  
Deltak  
Detector Electronics Corp  
Diesel & Gas Turbine Worldwide  
Doble Engineering Co  
Donaldson Company Inc  
Drake Controls LLC  
DRB Industries LLC  
Duct Balloon  
Eagle Burgmann Expansion Joint Solutions  
ECT Inc  
Edison ESI  
Electrical Maintenance Consultants  
EmeraChem LLC  
Emerson Process Management  
Energy Parts Solutions  
Engineered Turbine Components  
Environex Inc  
Esterline Sensors Services/Weston

Everest Sciences Corp  
Evoqua Water Technologies  
Exponent Inc  
Express Integrated Technologies LLC  
Fiorentini USA  
Fossil Energy Research Corp (Ferco)  
GARD Specialists Co  
Gas Turbine Controls Corp  
Gas Turbine Efficiency  
GasTOPS Ltd  
GE Energy  
GE Measurement and Control  
GE Power & Water  
GE Tech Development  
GE Water and Process Technologies  
Global Air Filtration  
Global Industrial Solutions  
Global Trade Media  
Goodrich Corp  
Goyen Pentair  
Gradient Lens Corp  
Groome Industrial Service Group  
GT Ice  
Hach Co  
Haldor Topsoe  
Hamon Deltak  
Harco Laboratories Inc  
HDR Technical Services  
Heat Transfer Solutions  
HEICO Aerospace  
Hill Brothers Chemical Co  
The Hilliard Corp  
Horiba Instruments Inc  
HPI LLC  
HRST Inc  
Hydranautics, a Nitto Denko company  
Hydratight Sweeney  
Hydraulic & Servo Dynamics  
HydroAir Hughes/Dees Fluid Power  
Hy-Pro Filtration  
IHI Corp  
IMR Test Labs  
Industrial Cooling Solutions Inc  
Industrial Solution Services Inc  
Industrial Tests Inc  
Innovative Control Systems Inc  
Innovative Steam Technologies  
Integral Cables Inc



Integrated Turbomachinery Inc	Pall Corp	Sulzer
Interlink Power Systems Ltd	Parker Hannifin Corp	Swan Analytical USA
Intertek APTECH	PAS MRO	Sweeney
Intertek Asset Integrity Management	PAS Technologies Inc	Switch Filtration
Iris Power, Qualitrol	Petrochem Insulation	Synapp North
JAD Chemical Co	Petrotech Inc	Synergy Catalyst
Jet Aviation Specialists Inc	PIC Group Inc	T2E3 Inc
Johnson Matthey	PME Babbitt Bearings	Tarco Systems Inc
Kellstrom Power Group	Pneumafil Corp	TAS Energy Inc
Kiewit	Power and Process Equipment Inc	Taw Miami Service Center Inc
Kobelco Compressors America	Power Engineers	TDC Filter
Koch Filter	Power Plant Services	TDI-Tech Development Inc
Koenig Engineering Inc	Power Process Equipment Inc	Tech Development Inc
Liburdi Turbine Services Inc	Powergenics	Teledyne Monitor Labs Inc
Lindsay Engineering	Precision Engine Controls Corp	Tezzco Inc
Lone Star Controls	Precision Iceblast Corp	Thermo Fisher
Ludeca Inc	ProEnergy Services	Thomas Construction Resources
Lufkin Industrial Inc	Puretec Industrial Water	TIC/Kiewit
Macemore Inc	QinetiQ Ltd	TransCanada Turbines
Mainsaver Software	Quality Generator Services	Turbine Air Systems Ltd
Maxim Group	Quality Industrial & Marine	Turbine Blading & Parts LLC
Maximum Turbine Support	Redline PdM	Turbine Controls & Excitation Group
McGuffey Energy Services	ReGENco LLC	Turbine Generator Maintenance
MDS Coating	Revak Turbomachinery Services	Turbine Technics Inc
Mechanical Solutions Inc	RF Systems Lab	Turbine Technology Services Corp
Mee Industries Inc	Rhinestahl Corp	Turbo Machined Products LLC
Meggitt	Richard Wolf Industrial	TurboCare
Metrix Vibration	Risk Management Professionals Inc	Turner EnviroLogic
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Midwesco-TDC Filter	Rockwell Automation	United Controls Group
MISTRAS Group Inc	Royal Systems Group	Universal Acoustic & Emission Technologies
Mitsubishi Hitachi Power Systems Americas Inc	Score Energy Ltd	US Petrolon Industrial Inc
Mobile Excitation Services LLC	Sentry Equipment Corp	US Water Services
Modern Power Systems	SICK Mahihak Inc	UTC Aerospace Systems
Moran Iron Works Inc	Siemens Industry Inc	Vaisala
MTU Maintenance Berlin-Brandenberg	Sigma Energy Solutions Pty Ltd	Valin Corp
Munters Corp	SJ Turbine Inc	Veotec (Americas)
NAES Corp	SKF Condition Monitoring Inc	VIM Technologies Inc
Nalco Co	SKF USA Inc	W L Gore & Associates
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Pacific Industrial Systems Technology	Strategic Power Systems Inc	Young and Franklin
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# USER ATTENDEES, 2009-2014

## A

Audun Aaberg  
Robert Abston  
Scott Adair  
David R Adams  
Baltazar Aguilera  
William Aguilera  
Tom Akers  
Jose Alba  
Meredith Albertelli  
Manuel Alberto  
Eustacio Alderette  
Dave Alexander  
Russel Alexander  
Jeff Allen  
Brian Alligood  
Freddy Alvarez  
Ariel Alviz  
Jim Amarel  
Bob Amon  
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Dan Arellano  
Napoleon Arellano  
Joe Armendariz  
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Hernan Arrigone  
Enrique Arroyo  
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Nick Ashworth  
Bryan Atkisson  
Travis Atkisson  
Frank Aufdermaur  
Carlos Avalos  
Olawale Ayadi  
David Ayers  
Shebnem Azizova

## B

Jerry Babic  
John Baker  
Mike Baker  
Jan Willem Bakker  
Mardel Baldwin  
Thomas Ball  
David Balseca  
Mike Balzer  
Jason Bandy  
Rick Barbye  
Erasmus Barcelos  
Michael Barge  
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Rudy Barrett  
Charles Barter  
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Aaron Beadle  
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Leroy Earl Beatty  
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Warren Blake  
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Jim Bloomquist  
Chris Bluse  
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Steve Bolton  
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Mike Bonomo  
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Jerry Bosse  
Justin Bosserman  
Ty Bowling  
John Bowtell  
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Phil Brewer  
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Taylor Brown  
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Karl Bryan  
Kevin Brydon  
Michael Buchanan  
Derek Bunt  
Greg Burdick  
Michael Burger  
Don Burkard  
Jim Burke  
Mike Burton  
Charles Byrom

## C

Ann Caballero  
Jon Caccamise  
Bill Caldwell  
Mike Calic  
Nathan Callis

Shannon Camero  
Thomas Campone  
Tom Campone  
John Cannon  
Richard Cano  
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Mike Carpentar  
Rodney Carstenson  
Dale Cart  
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Gail Carter  
Chuck Casey  
Mike Cashon  
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Brian Cassidy, PE  
Chase Cassity  
Matthew Cassle  
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Bill Cotton  
Rodney Crockford  
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Thomas Crowley  
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Nick Cruz  
Paul Cummins  
Allen Cupples  
Bryan Currie  
David Curtis  
Josh Curtis  
Tom Cutler

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Steven Davis  
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Rick Empey  
Keith Enox  
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Antonio Estrada

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Stephen Farrell  
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Howard Forepaugh  
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Socrates Furtado

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Mike Gabriel  
Kevin Gaddis  
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Antonio Garcia  
Jeffrey Garcia  
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Robert Gonzalez  
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Alfonso Granillo  
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Fern Grenier  
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Ed Irvin  
Spencer Ishikawa  
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Ed Jackson  
Joe Jackson  
Scott Jacobucci  
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Kevin James  
Ted Jankowski  
Ralph Jannelli  
Michael Janny  
Greg Jans  
Robert Janssen  
David Jansson  
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Roger Jasper  
Christopher Jewell  
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Azim Jivan  
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Dustin Johnson  
Lewis Johnson  
Rodney Johnson  
Steve Johnson  
Brad Jones  
Eddie Jones  
Ernest Jones  
Jim Jones  
Mark Jones  
Mike Jones  
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Makoto Kaneko  
Eric Kang  
Uni Kano  
Ken Karasch  
Jim Karney  
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Colin Kearney  
Paul Keech

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Arthur Kocian  
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Scott Kuder  
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Ken Lance  
Shawn Landry  
Barry Langberg  
Prayut Laoteng  
Kenneth Larsen  
Allen Laven  
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Fred LeBlanc  
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Jerry Likewise  
Francis Lim  
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Steve Longney  
Albert Longno  
Kristine Lopes-Amos  
Antonio Lopez  
Rudolfo Lopez  
Aaron Love  
Silvia Lozano

Eduardo Lucena  
Julian Lucero  
Jeffery Lund  
Mogens Lyhne  
**M**  
Emory Mack  
Kenneth MacKenzie  
Tiemen Maebe  
Marty Magby  
Glen Magone  
Terry Mahoney  
Jeff Maier  
Karl Maier  
Abdul Waheed Malik  
Brian Mallory  
Sloan Mambrini  
Tim Mann  
Michael Manoucheri  
Paul Mansfield  
Allen Manso  
Sam Manson  
Ted Margeson  
Sen Marrero  
Jaymes Martens  
Jeff Martin  
Ward Martin  
Jose L Martinez  
Tony Martinez  
Francis Martyn  
Bob Mason  
Tony Matlavage  
John Mauri  
Alicia May  
Welden Mayo  
Roman Mazur  
Rick McAlice  
Tim McCandless  
Mike McCollough  
Grant McDaniel  
Mark McDaniels  
Joe McFadden  
Eric McFetridge  
Robert McGinnis  
Rachel McGrath  
Darryl McInroy  
David McIntyre  
Chris McKenzie  
Scott McLellan  
Robinson McMahan  
Ryan McMillan  
Robert McNeill  
Rick McPherson  
Aaron Mdemu  
Dottie Mears  
Ray Meche  
Ricardo Medina  
Thomas Mee  
John Melley  
Erick Mendez  
Roberto Mercado  
David Merritt  
Frank Messineo  
Michael Metz  
Jim Metzger  
Jason Meyer  
Charlie Michalak  
Jeff Mikalacki  
Dean Miller

Jason Miller  
Jim Miller  
Paul Miller  
Richard Miller  
Shawn Miller  
Levon Mkrtchyan  
Michael Mngodo  
George Mollison  
John Molloy  
Albert Montano  
Scott Montgomery  
John Moore  
Roger Moreno  
Anthony Moretto  
Dan Morgan  
Tim Morrison  
Danford Mpalanzi  
Keith Muchnick  
Rob Munn  
George Munoz  
Cory Munro  
Christopher Murphy  
Mel Murphy  
Ron Muse  
Robert Myres  
James Mysliwiec  
**N**  
Tim Najour  
Rob Nave  
Robert Neff  
Patricio Neffa  
Larry Neighbors  
Aaron Neill  
David Nelson  
Jeff Nelson  
Marc Nerinckx  
Marc Nering  
Allen Netardus  
Andrew Nethercott  
Ray Newman  
Mark Newsted  
Theodore Nguyen  
Joe Nichols  
Randy Nielsen  
Timothy Nishikubo  
Gary Normoyle  
Bosco Noronha  
Doug Norwood  
Doug Nuttman  
**O**  
Henry Oberholster  
Mike O'Brien  
David Odorizzi  
Jason Offutt  
Rafael Oganessian  
Matthew O'Hara  
Frank Oldread  
Glade Olds  
Ricardo Oliveira  
Buck Oliver  
Patrick Ombrellaro  
Eugene Ori  
Charles Orphanos  
Jose Ortiz  
Warren O'Shields  
Laura Oshust  
Richard Owen

**P, Q**

Anthony Pacaldo  
 Bill Pacini  
 John Packard  
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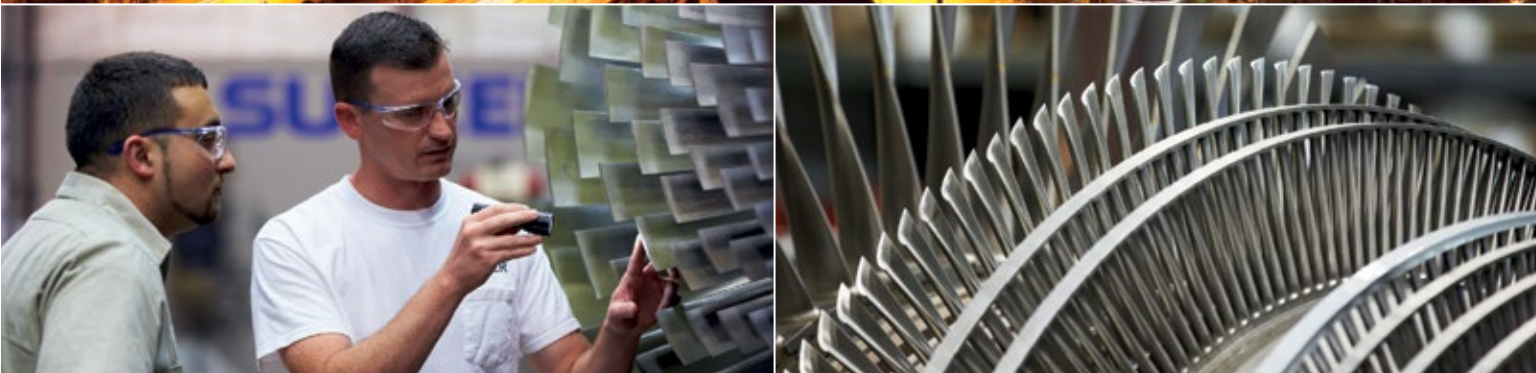
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