YEAR IN REVIEW 2017

LASTING LEGACY

Turbo Lab caps eventful year with retirement of director Dr. Dara W. Childs at TPS

TEES | TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

Childs retires after celebrated career

During his time as Turbo Lab director, Dr. Dara W. Childs helped take the program to new heights **6**

THANK YOU FOR MAKING 2017 A WONDERFUL YEAR!

There were many changes in 2017, some planned for and others unexpected. We thank you for your continued support of the Turbomachinery Laboratory. Without you, we wouldn't be able to make a vital impact on the turbomachinery and related industries through research, education and workforce development. Thanks for making our mission possible, and for making it fun.

— Turbo Lab Symposium Staff

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TEXAS A&M ENGINEERING EXPERIMENT STATION

TEXAS A&M UNIVERSITY

ABOUT US

Turbo Lab faculty, staff and students conduct cutting-edge research for industry and government entities in a state-of-the-art facility located adjacent to the university's main campus on George Bush Drive in College Station, Texas. The 37,000-square foot high-bay facility is equipped with 12 top-of-the-line vibration-damped test cells and a variety of compressors that provide air for test rigs with capacities ranging from 4,000 standard cubic feet per minute (scfm) at 120 pounds per square-inch gauge (psig) to 1350 scfm at 300 psig. An adjacent reciprocating compressor rig features connections for high-pressure air.

OUR MISSION

The Turbomachinery Laboratory, a center of the Texas A&M Engineering Experiment Station (TEES) and a member of the Texas A&M University System, makes a vital impact on turbomachinery and related industries through three pathways:

RESEARCH

Turbo Lab faculty and students team up with industry partners to conduct research into important problems of reliability and performance of turbomachinery through the Turbomachinery Research Consortium (TRC). The TRC is a unique organization of major turbomachinery developers and users who have joined with the Turbo Lab to find answers to important questions through cutting-edge research. In addition to TRC research, the Lab conducts industry and government-sponsored projects.

EDUCATION

The Turbo Lab produces engineers ready to work by offering undergraduate and graduate engineering education through Texas A&M's Department of Mechanical Engineering. The Turbomachinery Research Consortium blends the Turbo Lab's impact areas of education and research by teaming graduate students with industry to find solutions to real-world problems. Turbo Lab students are highly sought after for industry positions upon graduation.

WORKFORCE DEVELOPMENT

The Turbo Lab impacts the turbomachinery industry by providing a platform for the continuous exchange of ideas among working professionals. These platforms include the annual Turbomachinery & Pump Symposia (TPS) in Houston, the biennial Asia Turbomachinery & Pump Symposium (ATPS) in Singapore, and various short courses held throughout the year.

TPS SEES ANOTHER RECORD YEAR

Despite reschedule, symposia welcomes 89 new companies

The Turbomachinery Laboratory at Texas A&M University hosted another record-breaking Turbomachinery & Pump Symposia despite a three-month delay due to Hurricane Harvey.

The 46th Turbomachinery and 33rd International Pump User's Symposia (TPS 2017) was originally scheduled for Sept. 12-14 with short courses on Sept. 11. Due to the impact of Hurricane Harvey on Houston and surrounding areas, the Turbo Lab announced on Aug. 29 that the event would be rescheduled for Dec. 12-14 with short courses on Dec. 11.

Undeterred by the reschedule, TPS 2017 attracted 89 new companies to the George R. Brown Convention Center, topping last year's record by 10 companies. In total, the exhibition hosted 359 companies, just one shy of last year's record-setting 360 companies. The exhibition spanned 216,000 gross square feet, featuring full-size equipment and emerging technology and industry trends from leading turbomachinery, pump and related organizations.

Eighty-eight percent of the exhibit floor for TPS 2018 is already reserved.

Four-thousand-six-hundred-

359 COMPANIES

89 NEW COMPANIES

4,620 DELEGATES

46 COUNTRIES REPRESENTED

98 TECHNICAL SESSIONS

twenty unique delegates representing 46 countries visited the exhibition or attended technical sessions. Engineers and technicians from novice to experienced chose from a combination of 15 short courses, 23 lectures, 16 tutorials, 23 discussion groups and 21 case studies. The technical program is selected by the Turbomachinery and Pump Advisory committees and led by experts in their disciplines. Topics included compressors, steam and gas turbines, expanders, pumps and drivers, and auxiliary equipment such as couplings, bearings, gearboxes, dry gas seals and annular seals.

Technical content from TPS 2017 will be available June 2018. Proceedings from previous symposia are free for anyone to download at turbolab.tamu.edu/proceedings.

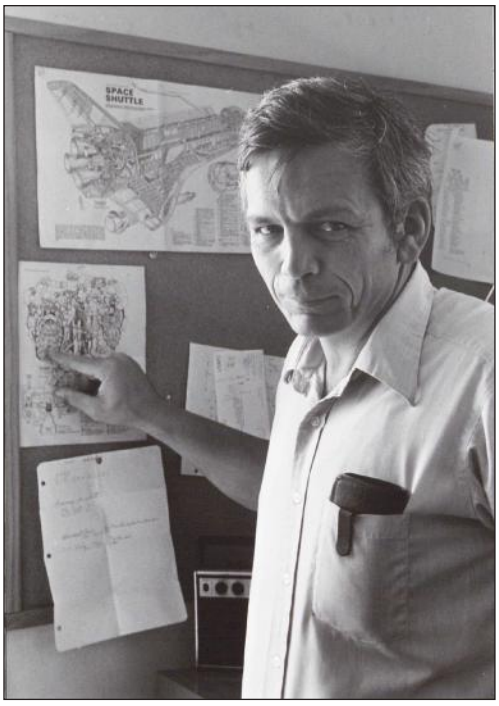
"We are grateful to all of our authors, leaders, delegates, exhibitors and advisers who make TPS a staple event for the industry," said Greg Gammon, director of operations for the Turbo Lab symposium office. "We saw great success, despite needing to reschedule the event with just two weeks notice. We know this would not have been possible without support from our industry partners, as well as our Houston vendors."

Dr. Dara W. Childs retired Dec. 13 from his post as director of the Turbo Lab and chair of the TPS advisory committees. He was honored with a banquet dinner during the symposia. The search for the next Turbo Lab director is underway.

Industry giant Dr. Dara W. Childs retires after 55 years of teaching, researching turbomachinery, pumps

AN IMMEASURABLE IMPACT

Not many people can say they owe their lifelong career success and worldwide professional reputation to instability. Such is the case for Dr. Dara W. Childs, former director of the Turbomachinery Laboratory at Texas A&M University. Childs' critical thinking and wit combined with a smattering of good luck have molded him into a world-renowned giant in the turbomachinery and pump industries. After more than 55 years of research and teaching, Childs stepped down as chair of the Turbomachinery and Pump Advisory Committees following the completion of the 46th Turbomachinery & 33rd International Pump Users Symposia (TPS 2017) and retired from Texas A&M in January.



EARLY CAREER

Childs got his start in NASA's competitive American Society for Engineering Education (ASEE) program, whose focus was to develop the space shuttle main engine. Following a summer NASA-ASEE appointment at Marshall Space Flight Center (MSFC), he landed a contract with NASA-MSFC in 1975 to analyze the vibration characteristics of the high-pressure oxygen and fuel turbo pumps of the engine.

"They hadn't previously considered the impact of the fluid forces on these things," Childs said. "I found some work by this really smart, nice guy in Scotland named Henry Black that gave an outline for analyzing the seals. So, I put together a model that had all of the fluid forces that you could think of were important, and the study showed that the hydrogen pump's vibrations would be unstable."

And, therefore, inoperable.

Childs handed over his report to NASA, but didn't get the response he had hoped for.

"They said, 'That's really nice, Dara, we'll call you if something happens,'" Childs said.

Several months later, while Childs was taking leave from his post as a professor of mechanical engineering at the University of Louisville to be a visiting faculty member at the Technical University of Twente in Enschede, The Netherlands, he began getting phone calls from NASA ASEE researchers.

"When they tried to run the space shuttle main engine, it was worse than I predicted. It was terribly unstable," Childs said. "I said, 'Look, do you want me to come back early?' They said, 'Yes, please.'"

The instability problem cost NASA $1 million a day for six months. NASA offered Childs funding for a research program, and he began searching for a university at which to build it.

He inquired at The University of Texas (where he earned his Ph.D. in engineering mechanics in 1968), Oklahoma State University (where he earned his bachelors and masters in civil engineering in 1961 and 1962) and Texas A&M University. Harry Whitmore, former associate director of the Texas A&M System's Texas A&M Engineering Experiment Station (TEES), welcomed Childs and his newly-acquired research program, agreeing to invest $35,000 in a data acquisition system.

"My research career was built from the one 1975 study I led that predicted the space shuttle main engine pump would be unstable. We got a flood of funding, including my colleague, Gerald Morrison. That's why we're in this building," Childs said, referring to the 37,000-square foot high-bay Turbomachinery Laboratory research facility, adjacent to Texas A&M's main campus.

Before the Turbo Lab research facility was erected in 1993, Childs and his turbomachinery colleagues were stationed in a World War II hangar on what is now the RELLIS campus. When Childs brought his NASA-funded program to Texas A&M in 1980, there were several other thriving turbomachinery research programs across the country. Now, there are programs at Ohio State, Penn State and Purdue universities, but they've downsized or closed due to a lack of funding.

TURBOMACHINERY & PUMP SYMPOSIUM

The Turbo Lab at Texas A&M continues to flourish because of funds from the Turbomachinery & Pump Symposia (TPS), an industry-wide professional continuing education program and exhibition held annually in Houston.

Childs has chaired the TPS Turbo and Pump Advisory Committees since 1984 when he was named director of the Turbo Lab. The advisory committees consist of industry leaders who solicit and hand-select the technical programs for TPS.

"The association with the advisory committee members has been a real blessing," Childs said. "Almost all professors end up working only with other professors, and I have the privilege of working alongside successful industry engineers. These advisors are the best in their fields in the world. The advisory committees are the single greatest resource that the Lab has."

When Childs joined the committee, several of the founding members of the Turbo Symposium were a part if of it, including Aggie graduates Charlie Jackson and Ed Nelson. Jackson and Nelson spearheaded the first Turbomachinery Symposium, attended by 200 people on the Texas A&M campus. In 1984, Pete Jenkins, former Turbo Lab director, started the Pump Symposium. The two were combined in 2011 into a single event that has grown significantly over their 46- and 33-year histories, attracting more than 5,000 delegates annually.

"I am amazed at the things Dara has been able to do," said Mike Drosjack, retired senior principal engineer with Shell who joined the Turbomachinery advisory committee in 1986.

Childs attended Oklahoma State University on a football scholarship. Drosjack said Childs carried his "football attitude" into heated conversations during committee meetings.

"He has this ability to manage these discussions, which could be pretty pointed, without getting furious with anyone. He's very patient and skilled in these situations that were like herding cats. … He's a little bit cranky, but everybody loves him for it. They know his heart is in the right place."

Drosjack said Childs' technical reputation is admired globally. "He's a technical wizard, he really is. He's one of the top researchers for this industry in the world."

Of all the things to know and respect about Childs, his love for his students and his "sense of purpose to teach the world" are most distinctive, Drosjack said.

Childs has ensured over the history of TPS that technical proceedings from each event are available online for free for the educational benefit of anyone who wishes to access them.

"He has never treated the symposia proceedings as a profit center," Drosjack said. "One of the basic charters of Texas A&M is to teach people. That's at the top of his pile. The fact that the symposia proceedings are available all over the world is incredible. Most other technical papers you have to pay for and formally request access."

> “It’s been a really good run. I had a good time. I have been in love with Texas A&M. I love the students. I love my colleagues. I am very grateful to Texas A&M for the opportunity to have a career here.
>
> **Dr. Dara W. Childs**, former Turbo Lab director and TPS Advisory Committee chair

TURBOMACHINERY RESEARCH CONSORTIUM

While Childs’ NASA ASEE grant was a pivotal moment in his career, much of the federal research support dried up with collapse of the Soviet Union. Childs and his Turbo Lab colleagues diversified and shifted to 95 percent private industry funds.

In 1984, Childs and the late John Vance, a rotordynamic researcher and former Texas A&M professor, co-founded the Turbomachinery Research Consortium (TRC). The TRC is an organization of major turbomachinery developers and users who join with the Turbo Lab to find answers to important questions about turbomachinery performance and reliability through research. The TRC has 36 member companies and 17 active projects, conducted by Turbo Lab graduate students and faculty.

Annual membership dues of $25,000 plus subsidies from TPS support TRC research projects and approximately 15 graduate students annually.

“We want quality graduate students and we’re going to pay for them,” Childs said. “There are employers waiting to hire our students. We produce award-winning research papers, but the students are the ones who walk out these doors and represent us. They are the product of the Turbo Lab.”

The research productivity and capabilities of Turbo Lab faculty rivals that of faculty within any other department, Childs said.

“Much of that success is due to the base they work from,” he said. “We rely on compressors and other equipment in the Turbo Lab. All of this is possible because of the success of the symposia.”

RETIREMENT

Childs’ last day as chair of the TPS advisory committees was Dec. 14, 2017, the final day of TPS. Childs was honored with a banquet dinner during the event. Childs extended his advisory committee retirement date after Hurricane Harvey caused TPS to be rescheduled from its usual September dates to December.

“It’s been a really good run,” Childs said. “I had a good time. I have been in love with Texas A&M. I love the students. I love my colleagues. I am very grateful to Texas A&M for the opportunity to have a career here.”

When asked about retirement plans, Childs grinned and evoked a quote from former New Orleans Saints coach Bum Phillips: “‘I’m not doing a damn thing and I don’t start that ’til noon.’”

#TPSHelpsHouston donors (pictured) raised $10,750 to aid relief efforts for victims of Hurricane Harvey. Left to right: Martha Barton and Brooke Conrad of the Turbomachinery Laboratory; Rick Pollick, Nick Hackett and Drew Devitt of New Way Air Bearings; Joshua Siegel of the Turbomachinery Laboratory; Ryan Marks and Bobby Brown of PSC Couplings; and Elisa Maenhout, Charli Matthews and Rebekah Mechtensimer of Empowering Brands

Partnership raises $10K in relief funds

Turbo Lab, New Way team up to assist Hurricane Harvey victims in Houston

Turbomachinery & Pump Symposia (TPS) exhibitors and partners stepped up in the wake of Hurricane Harvey to respond to needs in the TPS host city.

The Turbomachinery Laboratory at Texas A&M University, host of TPS, partnered with New Way Air Bearings to raise $10,750 for #TPSHelpsHouston, a fundraising campaign to provide relief to Houston area residents affected by Hurricane Harvey. The fundraising campaign was launched in early September, shortly after Hurricane Harvey hit Houston and surrounding areas, resulting in a three-month delay of the annual TPS.

"When we saw displaced Houstonians in the convention center where we exhibit at TPS each year, we knew we had to do something," said Drew Devitt, founder of New Way Air Bearings. "We wanted to give back to the city that has supported TPS for so many years."

> "It's heartening to see our TPS partners' concern and willingness to help. We are glad to be able to offer assistance to our friends in Houston as they continue to recover.
>
> **Martha Barton**, Turbo Lab exhibitor services director

Donations to the #TPSHelpsHouston relief fund will be processed by ShelterBox USA, a nonprofit that supplies aid to those displaced by disaster. All funds raised through #TPSHelpsHouston will support emergency shelter efforts in Houston and nearby regions.

Contributors include New Way Air Bearings, Turbo Lab symposium staff, PSC Couplings, Compression Energy Management, Keene Turbomachinery Services, Dynamics Scientific Production Center, L.A. Turbine, Empowering Brands and anonymous donors.

THANK YOU!

The Turbomachinery Laboratory and New Way Air Bearings would like to thank all of the companies that contributed to the #TPSHelpsHouston campaign.

COMPRESSION ENERGY MANAGEMENT

EMPOWERING BRANDS™

EMPOWERING PUMPS™
EMPOWERING VALVES™
EMPOWERING MOTORS™
EMPOWERING COMPRESSORS™

KEENE Turbomachinery Services

L.A. Turbine™
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PSC Couplings

D&Dynamics
SCIENTIFIC PRODUCTION CENTER USA, Inc

NEWWAY® air bearings

DRIVING INDUSTRY INNOVATION

Turbomachinery Research Consortium remains valuable resource

> Conducting TRC research is a great opportunity for students because it's like you're getting your foot in the door without having even knocked, because the industry leaders are coming here to Texas A&M to learn about your research.
>
> **Jeff Moore**, Southwest Research Institute

Since 1981, the Turbomachinery Research Consortium at Texas A&M University has connected students with major industry leaders through cutting-edge research initiatives.

The TRC is a group of 36 companies that contribute annual grants of $25,000 to fund projects that are investigated by 15 to 20 Texas A&M graduate students and faculty in the Turbomachinery Laboratory. Each year, the Turbo Lab, a center of the Texas A&M Engineering Experiment Station (TEES), hosts a meeting for the TRC where faculty members and students present research proposals for TRC member representatives. TRC members provide feedback on the projects, then select which proposals receive funding.

"That's the great part about it — the feedback," Turbo Lab graduate student Clay Norrbin said. "I've presented at TRC for the last three years, and each time after my presentation, people from industry approach me and ask if I have tried a certain approach to my project or tell me they have experienced similar issues in the real world. It really helps to give us guidance whether to narrow or expand the scope of the project."

Twenty-three proposals were presented this year during the 2017 meeting held May 31 to June 2 at Pebble Creek Country Club and the Turbo Lab research facility in College Station. The goal of the proposals is to find answers to questions relating to performance and reliability of turbomachinery — rotating equipment that extracts or adds energy to fluids.

Jeff Moore of Southwest Research Institute has been on both sides of the podium at TRC. He said presenting at TRC when he was a student at the Turbo Lab is how he landed his first job out of school.

"Conducting TRC research is a great opportunity for students because it's like you're getting your foot in the door without having even knocked, because the industry leaders are coming here to Texas A&M to learn about your research," Moore said. "The TRC annual meeting allows students to make a positive impression on representatives from member companies. If you have someone from TRC who is helping to pull your resume through the process, you're going to be a lot more successful."

Over the last decade, Moore said his group inside of SwRI has hired at least seven Aggies, and most of them have come through the Turbo Lab. Aggies are an attractive hire, Moore said, because of the education and experience they gain with the resources at the Turbo Lab.

"We're a hands-on organization in terms of the kind of work we do — design work, research, laboratory," Moore said. "Those are the exact skills that the students who come through the Turbo Lab are gaining. They are doing highly theoretical work, but also going out and getting their hands dirty doing experimental work, validating the models and proving the technology, specifically in the area of turbomachinery. So, we do work with design, rotordynamics, combustion, fluid dynamics, controls — all of those skillsets, the students are gaining at the lab."

Following the meeting, TRC representatives reviewed proposal material and announced research awards in July. Work on the selected projects began in September.

APPROVED 2017-18 TRC RESEARCH PROJECTS

Project Name | Status | Lead Researcher

Computational Model for Tilting Pad Journal Bearings | Continuation | Dr. Luis San Andrés

CFD Based Impeller Rotordynamic Force Coefficients | Continuation | Dr. Alan Palazzolo

Pressing Needs for Seals/Gas Labyrinth Seals | Continuation | Dr. Luis San Andrés

Novel Carbon-Graphite Gas Bearings for| Turbomachinery | Continuation | Dr. Luis San Andrés

Software Development for Morton Effect Prediction (Thermally Induced Rotor Instability) | Continuation | Dr. Alan Palazzolo

Experiment Investigation of Morton Effect (Thermally Induced Rotor Instability) | New | Dr. Alan Palazzolo

Software for Torsional Vibration of Machinery Trains with Variable with VFD | Continuation | Dr. Alan Palazzolo

Wet (Bubbly) Seals: Identification of Force Coefficients | Continuation | Dr. Luis San Andrés

Rotordynamics Software with Nonlinear Magnetic Bearings, Flexible Rotor and Flexible Foundation Effects | Continuation | Dr. Alan Palazzolo

Flow Optimization Design Tool for Impellers and Seals Rotordynamics | New | Dr. Paul Cizmas

Drag Reducing Textured Surface Journal and Thrust Bearing | Continuation | Dr. Alan Palazzolo

Development a New Test Rig to Examine Mechanical Seal Failures due to Lateral Vibration and Pressure Fluctuations | New | Dr. Adolfo Delgado

CFD Analysis of Wet Gas Pocket Damper Seal and Validation Against Test Data | New | Dr. Luis San Andrés

Gear Box and Coupling Guard Heating and Windage Losses | Continuation | Dr. Alan Palazzolo

Solid Modeler Implemented Rotordynamics with Support Structure and Flexible |Continuation | Dr. Alan Palazzolo

Dynamic Characterization of Fully Partitioned Damper Seals | New | Dr. Adolfo Delgado

Pad Bearing Coating | New | Dr. Adolfo Delgado

Turbo Lab names ATPS 2018 chairs

Calafell, Gupta take on leadership roles for second symposium

The Turbomachinery Laboratory announced in May 2017 the chair and vice chair of the second biennial Asia Turbomachinery & Pump Symposium (ATPS).

Dag O. Calafell, II, was named chair of ATPS 2018, and Manoj Gupta was named vice chair.

Calafell has 40 years of experience in management, engineering, and operations in the oil and gas industry with end-users, namely Exxon, ExxonMobil, and Koch Industries, and with machinery manufacturers.

ATPS 2018, set for March 13-15 at the Suntec Singapore International Convention and Exhibition Centre, is modeled after the longstanding Houston Turbomachinery & Pump Symposia (TPS), held annually since 1972. ATPS is an international assembly for turbomachinery and pump end-users and manufacturers. It features a renowned technical program that is hand-selected by an advisory committee of engineers, and an international exhibition. The inaugural 2016 event drew more than 900 attendees from 38 countries.

"ATPS is an invaluable networking opportunity for end-users and suppliers alike — made even more essential at this time of flux for the industry," Calafell said. "I look forward to a robust, meaningful symposium sharing leadership insights and successes that strengthen our industry. Together we can create opportunities despite the challenges we face."

Gupta, director of digital solutions at Dresser-Rand — A Siemens Business, holds a bachelor's degree in naval and ocean engineering from the Indian Institute of Technology, a master's degree in mechanical engineering from Texas A&M University and a master's degree in finance from the University of Houston. He has published multiple papers in the field of turbomachinery, has a patent and is recognized as a centrifugal compressor expert with expertise in high-pressure compression application.

Gupta was instrumental in facilitating the inaugural ATPS technical program and advising and assisting symposium leadership and staff. His leadership in the Asia region is a key foundational element for the continued success of ATPS.

"Our industry can benefit from digital disruption to transform our practices," Gupta said. "By collaborating on solutions through venues like ATPS, we can enhance our sustainability. We have adapted in the past and we can now."

ATPS | 12-15 March 2018 | Suntec Singapore | atps.tamu.edu

SHORT COURSES

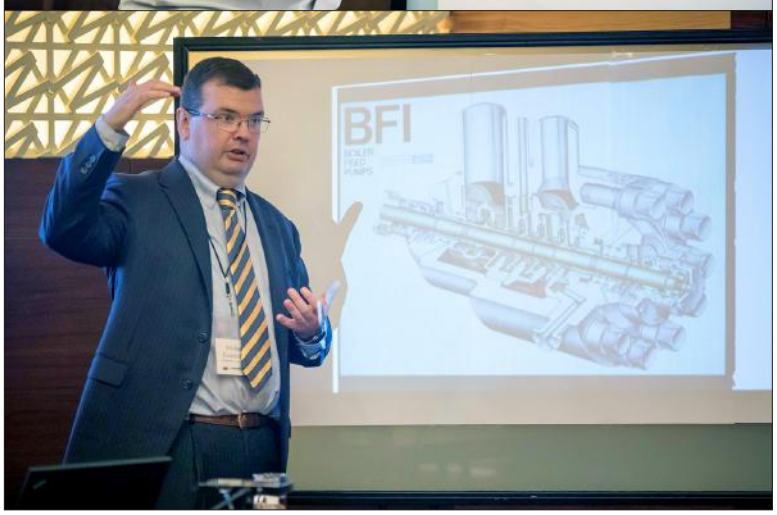
In addition to the highly-regarded technical sessions in conjunction with symposia, the Turbomachinery Laboratory offers extended short courses throughout the year. The courses are taught by respected industry leaders and academics.

In addition to being an excellent resource to learn new skills or freshen up one's knowledge. The courses also count toward Continuing Education Units or PDH credits. The Turbo Lab offered five short courses in 2017, and plans to host three in the U.S. in 2018.

turbolab.tamu.edu/short-courses

> "You're leaving the courses with very practical information that you can directly apply to your plans to solve problems — as opposed to purely theoretical information. These courses are very valuable from that standpoint.

Cyrus Meher-Homji, Engineering Fellow and Turbomachinery Technology Manger at Bechtel Corportation, TPS Turbomachinery Advisory Committee member



2017 Extended Short Courses

Fundamentals of Fluid Film Bearings for Machinery Engineers
July 10-12 | Singapore | Instructors: James M. Byrne, Dr. Minhui He

Shaft Sealing Technology for Centrifugal Compressors
July 10-12 | Singapore | Instructors: Daniel Goebel

Rotating Equipment Function Overview & Best Practices
July 10-13 | Singapore | Instructors: Michael Forsthoffer

Rotordynamics
March 21-24 | Houston, Texas | Instructor: Malcolm Leader

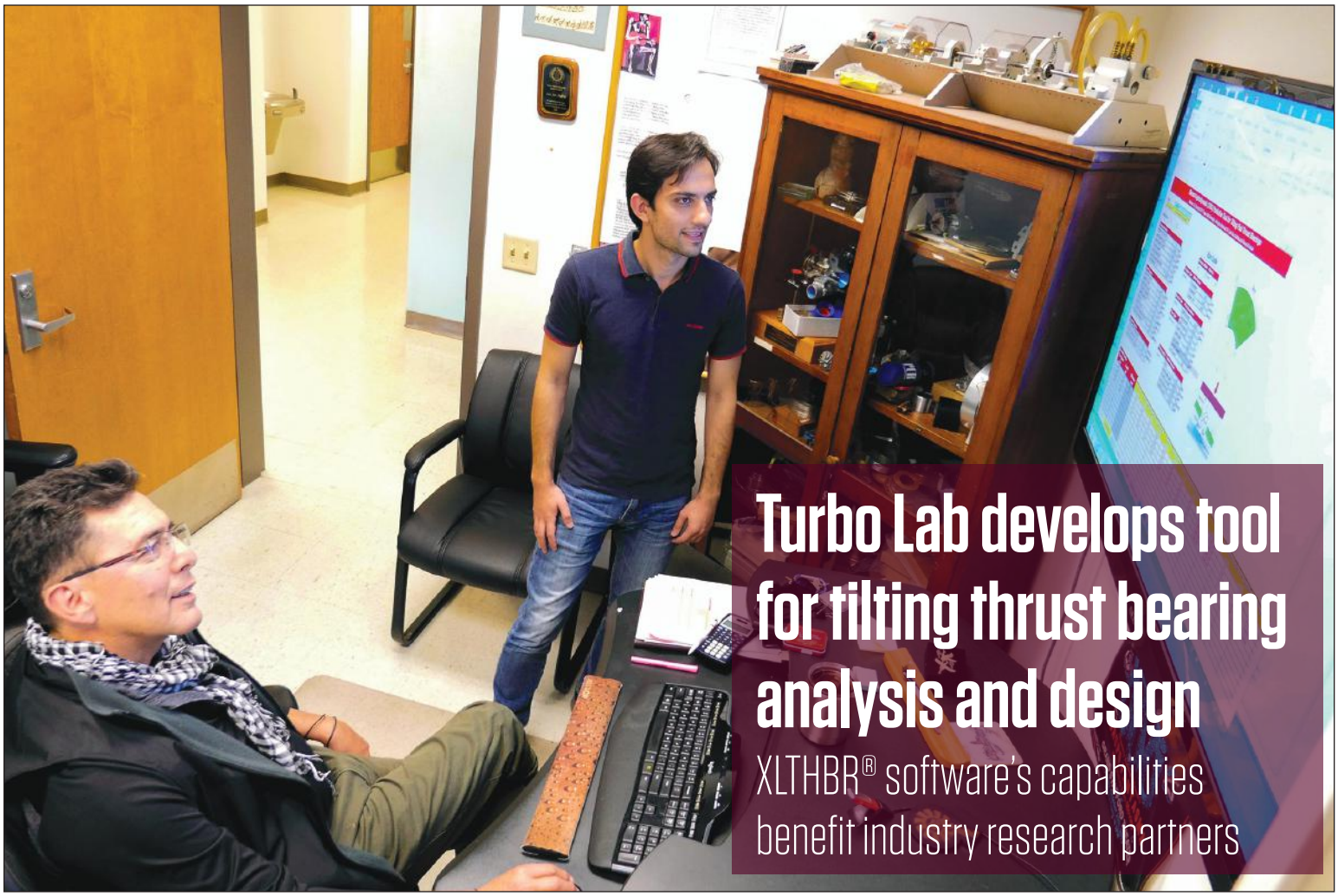
Machinery Vibration and Rotordynamics
January 9-13, | Houston, Texas | Instructors: Dr. Dara W. Childs, Dr. Luis San Andrés, Burga Ertas, Dr. Brian T. Murphy, Fouad Y. Zeidan

2018 Extended Short Courses

Machinery Vibration and Rotordynamics
January 22-26 | Houston, Texas | Instructors: Dr. Dara W. Childs, Dr. Luis San Andrés, Dr. Fouad Zeidan, Dr. Burga Ertas, Dr. Adolfo Delgado

Centrifugal Compressor Operations for 21st Century Users (CCOPS)
March 20-23 | Houston, Texas | Instructors: Jim Sorokes, Mark Sandberg, Jeff Moore, Jigger Jumonville

Rotordynamics
March 20-23 | Houston, Texas | Instructors: Malcolm Leader



Turbo Lab develops tool for tilting thrust bearing analysis and design

XLTHBR® software's capabilities benefit industry research partners

The Turbomachinery Laboratory at Texas A&M University announced in the fall of 2017 that it had developed a fast and accurate computational design tool for tilting pad thrust bearings.

The new tool, XLTHBR®, surpasses the capabilities of competitors' technology and adds value for current and future industry research partners.

XLTHBR® facilitates rapid modeling of thrust bearings over a wide range of operating conditions, including surface speed, load and fluid types. Version 1 of XLTHBR®, released this fall, allows the user to design, evaluate and troubleshoot the performance of tilting pad thrust bearings, which control rotor position in rotating machinery. Tilting pad thrust bearings consume less drag power and produce lesser temperature rises in the fluid film and pads when compared to rigid surface fluid film bearings.

Dr. Luis San Andrés was the lead faculty researcher on the project and was aided by doctoral student Rasool Koosha. Koosha gave a presentation about the software's benefits on the Turbo Stage at the Turbomachinery & Pump Symposia in December.

XLTHBR® closes a gap for members of the Turbo Lab's Turbomachinery Research Consortium (TRC), an exclusive organization of major turbomachinery developers and end-users who join with the Lab to answer important questions about performance and reliability of rotating machinery through research. TRC members have exclusive access to XLTRC software, a suite of fast, experimentally verified codes for executing complete lateral and torsional rotordynamic analyses of rotating machinery. Until recently, the XLTRC software suite was missing an important component: thrust bearings.

"This analysis tool is more advanced than any other tool of its kind," San Andrés said. "Our TRC members do not have to join another research consortium to get what they need. We have the top-notch technology to keep our members and recruit new ones."

Koosha and San Andrés have secured funding for at least one more year of research on XLTHBR® through the TRC. The pair will enhance the tool by including elastic deformations in the tilting pads from mechanical pressure and thermal effects, as well as fluid inertia and turbulent flow effects.

Learn more about this and other TRC projects at turbolab.tamu.edu/trc

MORRISON CAPS INFLUENTIAL CAREER

Turbo Lab professor who helped build program retires after 40-plus years at A&M

The Turbomachinery Laboratory at Texas A&M boasts one of the nation's top degree programs and research facilities.

But, when Dr. Gerald Morrison arrived in College Station to teach in 1977, the Turbo Lab was housed in an old World War II airplane hangar with a leaky roof and no heating at what is now A&M's RELLIS campus. Morrison retired on July 31, 2017. During his more than 40 years with the school, he helped get the program out of that leaky hangar and into a top-of-the-line research facility, while also helping build the Turbo Lab's graduate program from scratch.

"We all worked our backsides off getting the Lab together," Morrison said. "It was difficult to get going, and we sacrificed a lot — a lot of time and effort, but it's totally different now."

During his career at A&M, Morrison brought in more than $12 million for research projects, published 67 refereed journal articles, 140 conference papers, received the American Society of Mechanical Engineers' Worthington Medal in 2014 and led the development of the Fluids Lab. Morrison said that the accomplishment that he is most proud of, though, are the 100-plus graduate students he has been able to graduate.

"To me, what it's always been about is education and the students first," Morrison said. "I came here to be a teacher. I didn't come here to be a researcher. I did it because they asked me to and I was capable, but it's always about the students first."

Former Turbo Lab director Dr. Dara W. Childs said that Morrison's absence will be felt throughout the program. Childs praised Morrison's integrity and contributions to growing the Turbo Lab program.

"Dr. Morrison was always the best engineer and mechanic in the facility," Childs said. "He could make and design stuff and it worked and he could do it all himself. I always needed a support engineer for my projects, but he didn't."

Morrison's goal with his students was to produce well-rounded engineers who were ready to make contributions in the industry. His students took the lead on research projects and he made sure they knew the ins and outs of how things worked. Morrison said because of that, there is an industry demand for his students.

Morrison has never been one to "mail-it-in." Despite his continued love of teaching, Morrison said his health has forced him to consider how much time and effort he can put into his lectures and research.

"I always swore to myself that I would not be one of those old farts who came in and mumbled in the room and walked off, gave you take-home tests, didn't care and gave you a grade," Morrison said. "You never learn anything from that."

"I'm going out while I am still on the top as far as my teaching goes."

REMEMBERING DR. MEHERWAN BOYCE

Original Turbo Lab director helped found Turbomachinery Symposium

Dr. Meherwan P. Boyce, a founding member the Turbomachinery Symposium and first director of the Turbomachinery Laboratory, then known as the Gas Turbine Laboratories, died Thursday, Dec. 21, 2017. He was 75 years old.

He is survived by his wife, Zarine, son, Phiroz, and daughter, Anita.

Boyce received a bachelor's degree in mechanical engineering from South Dakota School of Mines in 1962, a master's degree in mechanical engineering from the State University of New York at Buffalo in 1964 and a doctorate degree in mechanical engineering from the University of Oklahoma in 1969.

After earning his doctorate degree, Boyce joined the Mechanical Engineering Department of Texas A&M University. He founded the Gas Turbine Laboratories at Texas A&M and was appointed as the first director of the Turbomachinery Symposium in 1972. Boyce left Texas A&M to found Boyce Engineering, Intl. in 1979.

Boyce authored three best-selling engineering books and more than 150 technical papers and reports on gas turbines, compressors pumps, fluid mechanics, and turbomachinery.

Boyce is Past Chairman of the Plant Engineering & Maintenance Division of ASME, and Chairman of the Electric Utilities Committee of the of ASME's International Gas Turbine Institute and Chairman of the ASME Conferences Committee. He is the recipient of the ASME award for Excellence in Aerodynamics and the Ralph Teetor Award of SAE for enhancement in research and teaching.

Boyce is recognized as a founding member of the Turbomachinery Symposium and served on the Turbomachinery Advisory Committee since 1972. He attended his final Turbomachinery & Pump Symposia in December.

'ORIGINS OF THE TURBOJET REVOLUTION'

Bechtel Engineering Fellow Meher-Homji delivers 2017 Distinguished Lecture

Understanding the past can help formulate solutions in the future.

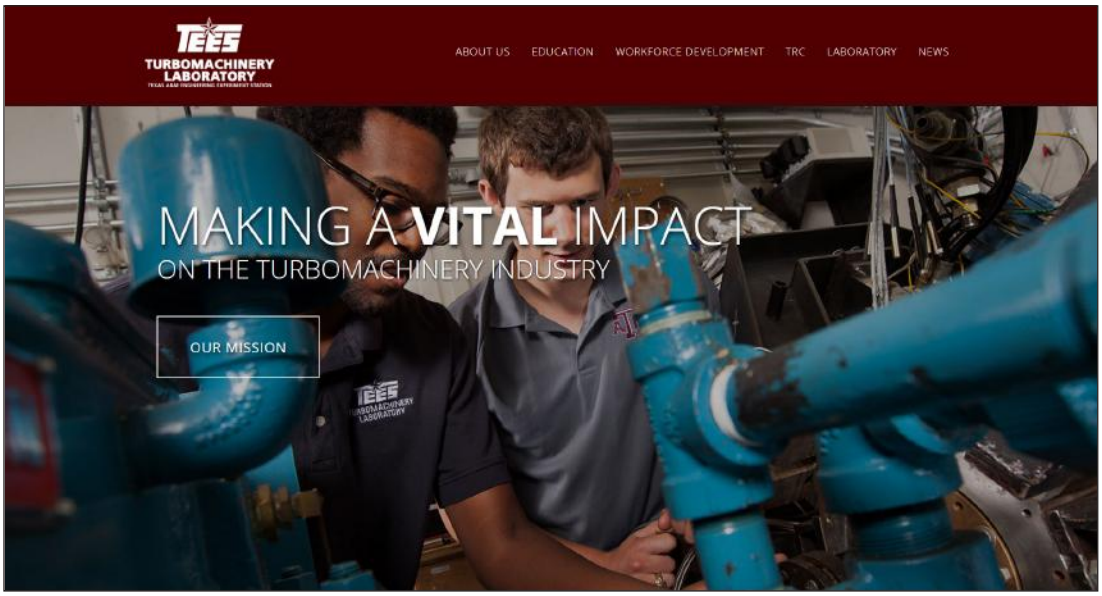
This was one of the messages Cyrus Meher-Homji conveyed as he presented The Origins of the Turbojet Revolution for the fourth-annual Turbomachinery Distinguished Lecture in November 2017 at Texas A&M University.

Meher-Homji, an Engineering Fellow and Turbomachinery Technology Manager at Bechtel Corporation, spoke to a room of about 100 students and faculty about the advancements that have taken reciprocating engines from what was used on the Wright Flyer to the machines we use today.

"If you understand how things develop, technological challenges, what the early inventors had to go through, that culminated in a modern engine, that's a valuable thing for students — as valuable as math and science and physics," Meher-Homji said.

"I would hope that the main thing that they would take away is to realize how people interact with each other and the importance of interacting in teams in order to develop big projects, complex initiatives."

Meher-Homji graduated with his degree in Mechanical Engineering from Texas A&M in 1978. He serves on the Turbomachinery Advisory Committee (TAC) — a group of academics and industry professionals who select the technical program for the annual Turbomachinery & Pump Symposia, which is organized by the Turbomachinery Laboratory.



TURBO LAB SITES GET FRESH LOOK

Digital facelifts aim to improve user experience, usefulness

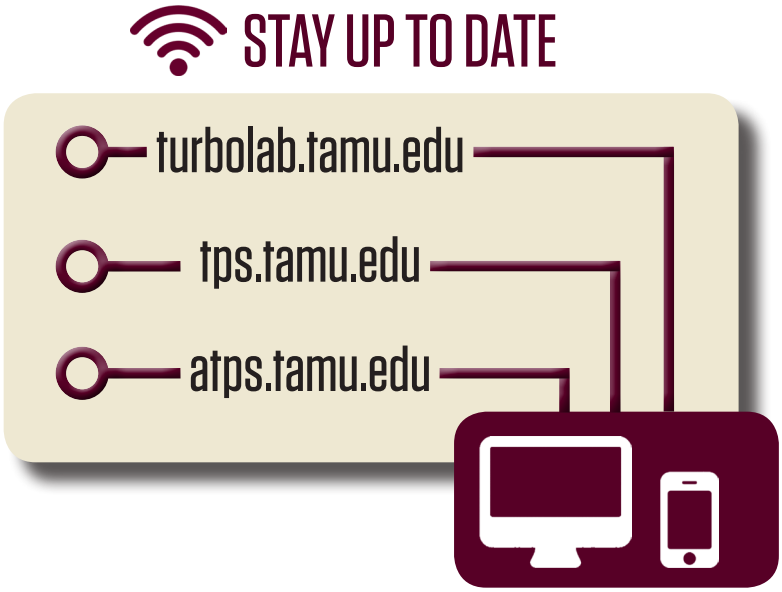
Over the course of 2017, the Turbomachinery Laboratory saw upgrades to its three websites in both aesthetic and functionality.

Upgraded websites for the Turbomachinery & Pump Symposia (TPS) and Asia Turbomachinery & Pump Symposium (ATPS) launched in the spring and allowed users to more easily find the information the information they were looking for and better pathways to directly communicate with the lab and staff.

The Turbomachinery Laboratory's main website launched in the fall and included more robust information on the lab's many facets and functions, as well as easy-to-find links to the lab's photo galleries and social media.

One of the most valued assets on the Turbo Lab site is its repository of proceedings — technical content from TPS and ATPS. The Proceedings are easy to access from the main menu.

Several upgrades came on the Turbomachinery Research Consortium (TRC) page. Current and past projects are now listed with a section highlighting some ongoing projects.



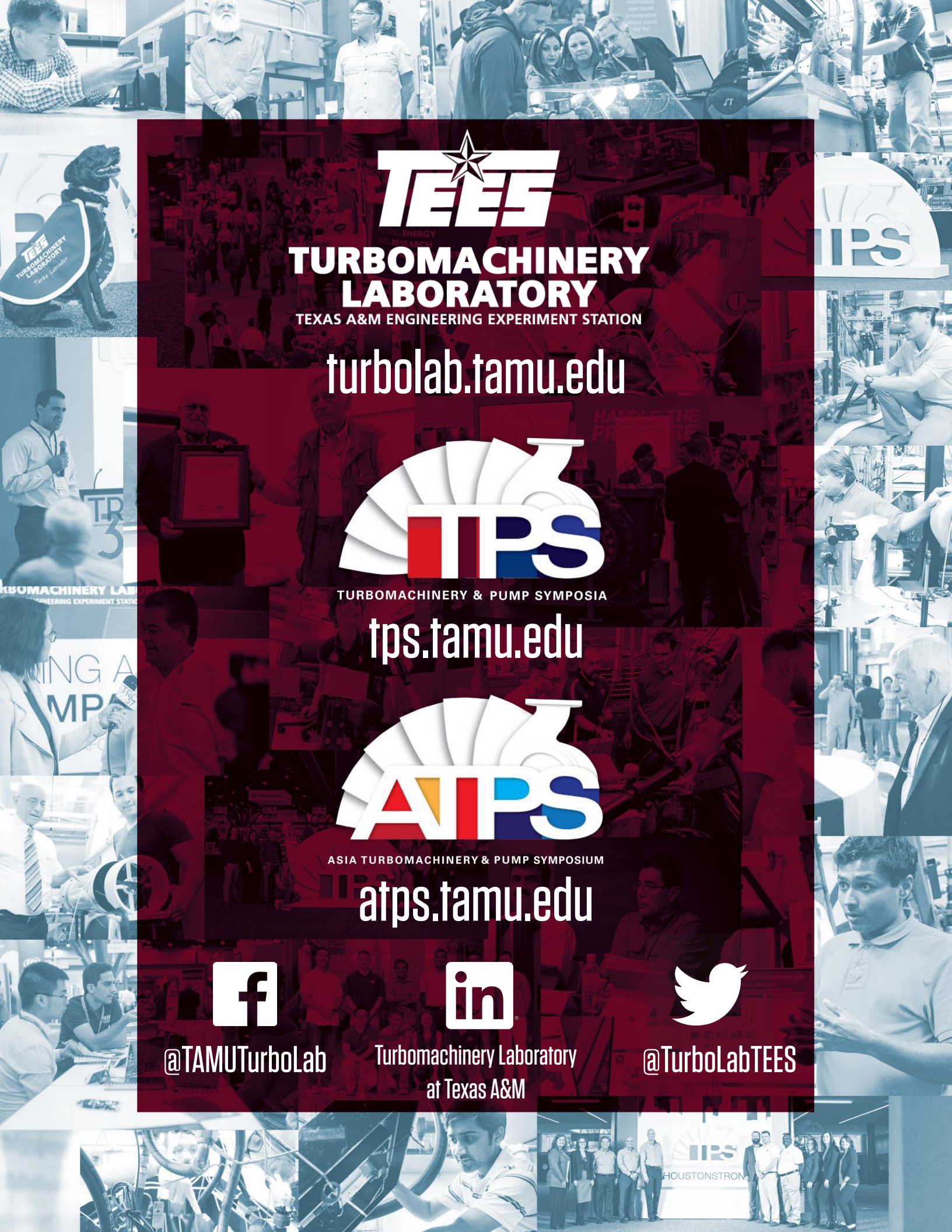
SYMPOSIA LENDS SUPPORT FOR THRIVING LAB

Each year, financial support for research endeavors and graduate student education at the Turbomachinery Laboratory at Texas A&M University is generated primarily through exhibitor and delegate registration at the Turbomachinery & Pump Symposia (TPS). Funds from TPS 2016 supported Turbo Lab initiatives in 2017.

In fiscal year 2017 (September 2016 through August 2017), the Turbo Lab appropriated more than $700,000 to back turbomachinery faculty and researchers operating in the 12 test cells located at the Turbo Lab research facility in College Station. Income from TPS also goes toward ongoing lab maintenance and operating expenses that range from $150,000-200,000 annually.

The Turbo Lab is equipped with high-end computer servers and software for advanced CFD analyses, a battery of electrical heaters producing hot air to test seals for gas and steam turbines, flow/mixer systems, and high-speed cameras and sensors used to acquire measurements in dedicated test rigs serving industrial needs.

The Turbo Lab's capabilities have expanded with the acquisition of a supercritical CO2 loop and instrumentation. This gives turbomachinery faculty unique facilities to pursue external funding in emerging areas such as concentrated solar power and waste-heat energy, as well as subsea multiple-phase pumping.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