

*Proceedings of the
Thirty-Third
Turbomachinery Symposium*

Sponsored by the
Turbomachinery Laboratory
Texas Engineering Experiment Station
The Texas A&M University System

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with assistance from
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and
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JAMES R. (JIM) PARTRIDGE
1935 - 2004

Dedication

Jim Partridge spent his whole career dealing with gears. I had the pleasure of knowing Jim for many of those years. Over the years I had some “run-ins” with high-speed gears and I learned to give them much respect and attention. Of course I also learned to respect those few people in the world that really knew gears, and Jim was one of those people. I learned a lot about gears from Jim, both one on one and through reading the technical papers he wrote. His paper in the 6th Turbomachinery Symposium Proceeding from 1977 is still an excellent resource. I had the pleasure of coordinating many gear discussion groups for the Turbomachinery Symposium with Jim, and I was always impressed with his eagerness to share the lessons he had learned over the years to help people with their gear problems.

I remember early in my career when I was involved with a gear problem on a large propylene compressor train in an ethylene plant. The gear manufacturer was no longer involved with industrial gears so we turned to other gear manufacturers for help. Most of those manufacturers said they could build us a new gear just like the old one. When we met with Jim and others at Lufkin, they reviewed the design and told us that even though this would be a large gear for them (at the time), they would help us out. Jim then proceeded to tell us all the things he felt were wrong with the current design and how Lufkin would make us a better gear. We trusted in Jim and we never had a problem with that gear he helped design. — *Terryl Matthews, Bechtel Corporation, Turbomachinery Symposium Advisory Committee Member*

James Robert (Jim) Partridge was a member of Texas A&M University’s Mechanical Engineering class of 1958. In 1994, Jim became a member of the Academy of Distinguished Graduates of the Department of Mechanical Engineering at Texas A&M. From the beginning of the Turbomachinery Symposium, Jim played a key role. He was often a discussion leader and contributed many ideas to the planning efforts through the years.

Along with his many honors, Jim served as President of the American Gear Manufacturers’ Association and chaired several standards committees. Jim also worked closely with the American Petroleum Institute on gear standards. He served his country in the United States Army and the National Guard.

Jim spent his entire career with Lufkin Industries, joining the company in 1958 as a design engineer. From the beginning, Jim developed a fascination for gears. Over the next 40 years, Jim would become an internationally recognized authority on gear design. During that time, his work helped establish Lufkin Industries as the leader in the design and manufacture of precision, high-speed gears. Jim’s career path led to the position of Chief Engineer for Lufkin Industries and, later, he was named Vice President of Lufkin’s Machinery Division. Near the end of his career, Jim accepted the challenge of launching Lufkin’s entry into Europe. He moved to Amsterdam in 1992 and established EuroLufkin. The same qualities that had won him the respect of peers and customers in the U.S.A. proved successful in Europe. Jim’s willingness to listen, together with his ingenuity for simple, workable design solutions created many opportunities. Perhaps the most challenging was the 100,000 horsepower load gears he sold and helped design as he neared retirement.

Jim was a demanding leader who insisted on quality, commitment, and hard work. For those who shared those values, Jim was a great mentor. If a man is measured by those he mentors, Jim is a giant. Jim could be blunt, quick witted, acerbic, stubborn, and uncompromising. All virtues for someone who is committed to ensuring quality and reliability in a product, while at the same time pushing the design envelope into uncharted territory. Jim could tell it like it is, even when the audience may not have wanted to hear how it was. But that was one of his strengths, and those who listened learned and developed a greater understanding.

Jim leaves behind many friends who will miss him greatly. He also leaves behind a family. Jim’s children: Jayme, Janece, and Traci, Aggies all, are a fitting tribute to a man who worked diligently to expand the horizons of his profession and those who followed in his footsteps. — *Authored by Lufkin Coworkers*

Preface

These Proceedings contain papers from the lectures for the Thirty-Third Turbomachinery Symposium, held in Houston, Texas, September 20-23, 2004. The Symposium is sponsored by the Turbomachinery Laboratory, of the Texas Engineering Experiment Station, The Texas A&M University System.

The Turbomachinery Symposium was established as a forum for users and manufacturers of industrial turbomachinery. Because of many overlapping areas of interest, the symposia are directed primarily to commercial users with the utility and petrochemical industries.

The Advisory Committee for the Thirty-Third Turbomachinery Symposium and past symposia have had a continuing influence on the content and direction of the symposia. The committee is composed of recognized leaders in the commercial turbomachinery field from users and manufacturers. Based on their experience and knowledge of the field, papers are solicited and selected to address contemporary problems of interest. Their continued assistance is wholeheartedly appreciated.

Essential elements of the symposia that are not entirely covered by this proceedings include six short courses that preceded the symposium, 11 case studies, 17 discussion groups, and a product exhibit show. The short courses are: Turbomachinery Alignment Overview; The Lubrication of Power Generating Turbines; Auxiliary Lubrication and Fluid Seal Systems—Design, Component Selection, and Predictive Maintenance Guidelines; Combined Cycle Gas Turbines; Review of API RP 684—The API Standard Paragraphs Covering Rotordynamics and Balancing; and Reciprocating Compressor Performance Measurement and Condition Analysis.

This symposium includes a “case study” format. Presentations are made of a problem, its resolution, and the lessons learned. Persons attending the case studies receive a CD-ROM containing copies of the presentations.

The discussion groups are led by engineers with a great deal of experience in the subject areas, and they facilitate discussion from the floor. Attendees actively participate in the discussion groups, and many use this forum to get sound advice from their peers on problems of immediate importance. The discussion groups facilitate a quick transfer of information across industry boundaries.

The product exhibit show has more than 200 companies and features new products, accessories, and analysis tools. This aspect of the symposium has continued to improve over the past several years in the quality and range of products exhibited.

Again, the vigorous support of the Advisory Committee is appreciated. My very considerable thanks are also extended to lecture authors, short course speakers, tutorial leaders, case study presenters, and discussion leaders. Both personally, and on behalf of the Advisory Committee, a special “thank you” is extended to the exhibiting companies and their representatives.

Finally, the efforts of the Turbomachinery Laboratory staff in seeing through the detailed execution of the symposium are greatly appreciated, with particular thanks extended to Stephen Phillips. With regard to this proceedings, my personal thanks is extended to Joanne Burnett for her excellent work in editing, preparation, and organization.

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