TIMKEN

aerospace

A TIMKEN COMPANY SUBSIDIARY

Timken design and manufacturing

excellence yields comprehensive

aerospace solutions.

Timken is **innovative.**

Timken is **collaborative.**

Timken is **responsive.**

innovative

For more than 100 years, The Timken Company has revolutionized industries with innovative products and unique services. Our success is grounded in technology and research, supported by industry-leading manufacturing and enriched through customer-focused relationships.

The Timken aerospace business offers a comprehensive product line, known for consistent, critical performance and backed by the most stringent quality standards in the world. Our products are found in engines, gearboxes, helicopter transmissions, auxiliary power units, landing wheels, instrumentation and airframes.

Founded more than 100 years ago, The Timken Company quickly established an international presence and has long been recognized as a leader in globalization. Timken maintains 90 manufacturing plants and 10 technical centers in 29 countries on six continents. Timken Aerospace's Lebanon, N.H., plant, a dedicated aerospace facility, has been in continuous operation for more than 75 years. Our Asheboro, N.C., location recently was recognized in the industry as the most modern bearing plant in the world. No matter where Timken bearings are made, you are assured outstanding products that carry a distinguished mark of excellence.

Timken engine, gear-box, aircraft-control and landing-wheel bearings are featured on planes piloted by the Blue Angels, the elite U.S. flying squadron.

foundations in research

Timken has invested more than $500 million over the last 10 years into technological advancements at research and technical centers in the United States, Europe and Asia. Customers rely on our engineers' knowledge and experience to enhance product performance and life in today's rapidly changing aerospace designs. This value is recognized by our aerospace customers – one recently named Timken Research the best research and development organization in the bearing industry.

In Timken laboratories, engineers create product simulations that mirror the atmospheres of actual applications. These tests prove how design variations – such as advanced materials, engineered surfaces and internal geometry – affect system performance. The result: nearly 1,000 registered patents for bearings and related products.

Timken Research in Canton, Ohio, was named the best research and development organization in the bearing industry by a leading aerospace manufacturer.

Timken Research offers an array of services focused on problem solving and performance enhancement. Technical services include:

- **Application Testing –** analysis of rotational/oscillatory/static performance under simulated or actual application conditions and environments
- **Material Development and Testing –** supply experimental materials, mechanical testing, material/failure analyses and consultation on materials and thermal treatment processes
- **Metrology and Measurement –** emphasis on precision measurement and surface characterization
- **Advanced Modeling and Simulation –** engineering analysis, including finite element analysis, statistical analysis and bearing system analysis (considers bearings, shafts, gears and housings)
- **Tribology and Lubrication –** evaluation of lubricants and characterization of their properties, which also encompasses rolling/sliding contact evaluation of friction, wear, damage and durability of these surfaces

Timken has the largest aerospace product offering in the world.

technical breakthroughs

Technical innovations have resulted in enhanced performance and breakthroughs in material development, engineered surfaces and sensors. Timken Aerospace has the distinct advantage of being the only aerospace bearing manufacturer that develops and produces aerospace steel. Timken has been producing and developing new bearing steels for more than 80 years and we can internally supply more than 90 percent of our requirements for aerospace steels.

Timken Research engineers spend as much time on steel as they do bearings and other related components, knowing that clean steel and metallurgical composition play critical roles in aerospace products. Timken also leads the industry in development of engineered surfaces which are improving performance in extreme environments by applying a variety of coatings and surface finishes to select components. The leadership continues in sensor technology, which can be applied to a variety of applications to increase system life or improve performance.

responsive

manufacturing excellence

Customer satisfaction drives our manufacturing processes. Timken maintains renowned manufacturing facilities that have won awards for excellence and innovative process techniques. Timken Aerospace has led the company in its implementation of Lean Six Sigma manufacturing techniques that heighten quality and streamline production. Today, more than 75 percent of Timken Aerospace's technical resources are trained in Six Sigma operations.

Timken integrated the best of Lean Manufacturing and Six Sigma programs into one unified program, Lean Six Sigma. These programs complement each other to provide a strong, total-process improvement program and the metrics to compare different parts of the company consistently. This is a natural evolution of our ongoing continuous improvement initiative.

Six Sigma applies statistical tools to minimize process variation. Lean Manufacturing uses tools such as setup reduction to eliminate waste and inefficiency. Timken Aerospace associates embrace continuous improvement initiatives, and their ideas and tactics have helped the organization enhance quality while delivering products faster. Timken Aerospace recognizes the importance of continuous improvement to ensure that we remain a leader in aerospace-quality performance, delivery and service while providing the best total value to customers.

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proud heritage

Timken bearings were integrated into some of the world's first military and commercial planes. The Timken heritage now encompasses the traditions established by Torrington and Fafnir. These three powerful names provided innovative technology that has become foundational designs for today's modern aircraft.

During the 1930s, Fafnir was a leader in aircraft control bearings, while Lockheed relied on Torrington bearings for the first known follower-flap application. The U.S. Department of Defense developed military standards based on Torrington/Fafnir airframe bearing designs.

Among the classic aircraft that featured Timken products were the 1939 Boeing 307 Stratoliner, which introduced cabin pressurization. Timken bearings also were included in the Lockheed L-649 Constellation. Designed for military, the L-649 was a final step in piston-engined, propeller-driven planes.

During World War II, Torrington needle bearings found many new applications – more than 2,000 were integrated into each B-29 Super Fortress. In 1943, all war planes in production featured Fafnir bearings.

Timken continues to pioneer technological advancements today. Torrington experience and Timken Aerospace product development have joined forces to create new products, including aerospace spherical bearings, and enhance parts that affect speed, handling, safety, power, landing and other flight operations.

The Martin Mars, the largest flying boat to ever achieve operational status, featured 232 Timken bearings. This unusual aircraft, launched in 1941, featured a 61-meter (200 feet) wingspan, 36-meter (117 feet) length and weighed 34.3 tonnes (75,573 pounds) empty.

Six of these grand planes were built for the U.S. Navy, where they were used primarily as cargo transports.

collaborative

customer collaboration and service

Every design, every production phase, every service call is driven by one thing: exceeding the expectations of our customers. Timken Aerospace is committed to remaining the leading supplier of bearings to the aerospace industry. Our future is bright. We continue to grow outside of bearings into related parts, sub-assemblies and services to bring greater value to our customers.

To provide the best service in the industry, we assign customer support teams – comprised of product engineers, quality specialists and customer service liaisons – to each customer. These cross-functional teams ensure that all aspects of customer satisfaction, from product integrity to delivery to modified designs, are managed appropriately. These support teams also provide a small group of contacts for our customers, ensuring rapid, consistent, personal communication.

Timken Aerospace is much more than a source for products; we are your resource for comprehensive aerospace solutions and the best service available. We deliver value at every turn. To learn more about how Timken Aerospace can fuel your company's performance, call Timken Aerospace U.S. at 603.448.3000 or Timken Aerospace Europe at (44)1902.719300.

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND STEEL