Empirical evidence

Laboratory takes test specimens to rough finish in minutes instead of hours with waterjet technology

BY LYNN STANLEY

We all do it. Each time we step on an airplane, drive a car, cross a bridge or enter a building, we take it for granted that the airplane will stay airborne, the car will run, the bridge won't fail and the building will stand. For the metals industry, the success or failure in the performance of materials and parts used in these and other critical applications can mean the difference between life and death, which makes stringent testing a must.

Metal alloys tailored to specific applications, for example, routinely undergo tensile testing to verify properties like strength and ductility. Nondestructive testing is typically reserved for parts or material prior to service or manufacturing. Destructive analysis tests materials or parts to the point of failure to evaluate structural performance and material behavior under a combination of live and dead loads.

These methods and many other inspection and analysis services are all in a day's work for Laboratory Testing Inc. (LTI). Family owned, the Hatfield, Pennsylvania, company is one of the largest independent testing laboratories in the industry. Co-owners Robert McVaugh Sr. and Frank Carson started it up in 1976 as the nondestructive division of Carson Helicopter. In 1984 McVaugh Sr. purchased his partner's share and changed the name. When McVaugh Sr. died 10 years later, his son Mike took over as president. The business has added services, capabilities, certifications, employees and floor space at a brisk pace over the past 20 years.

Who's who

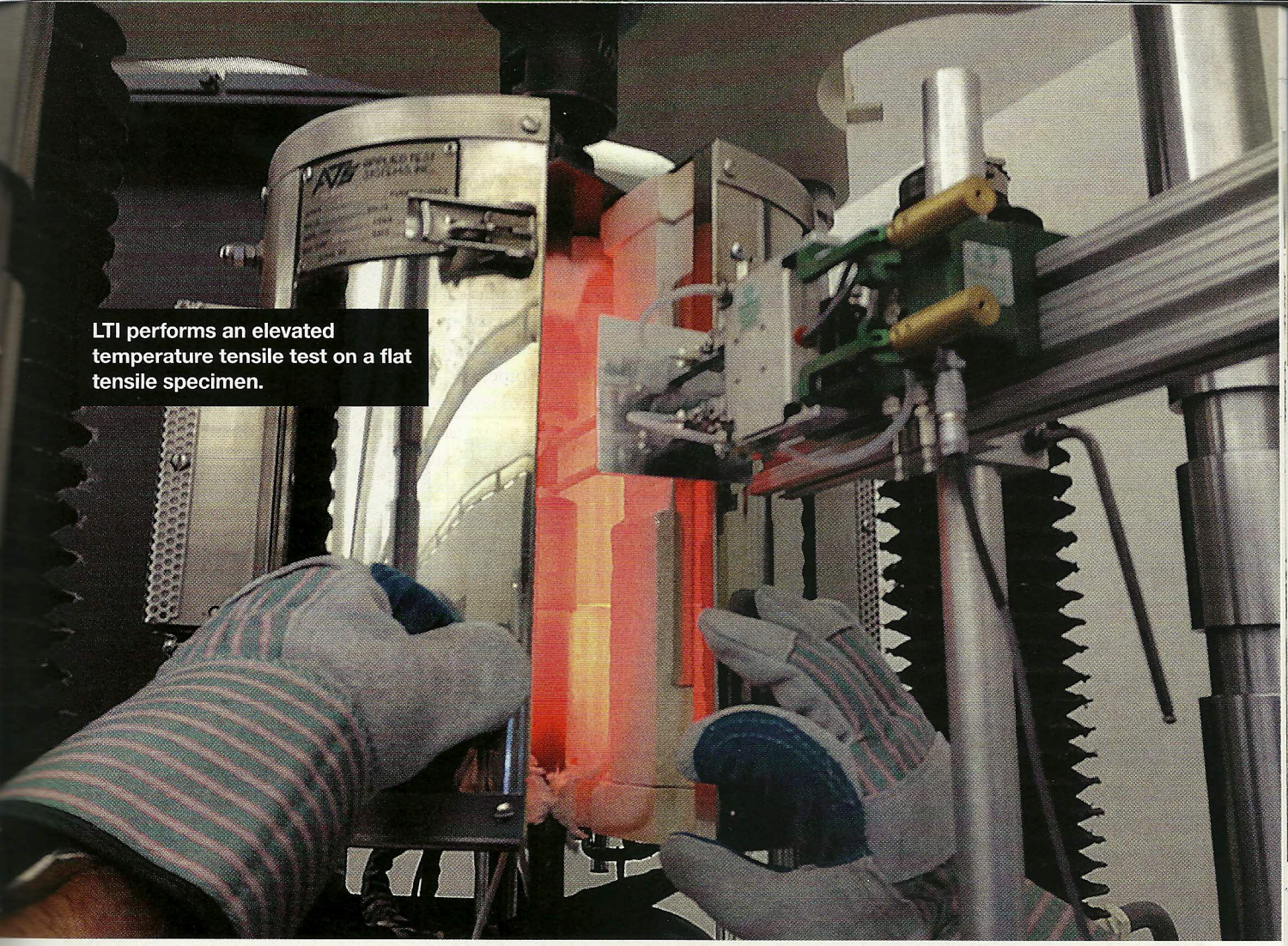
Today, two generations of the McVaugh family manage the firm with the help of 160 employees. Three buildings totaling 100,000 square feet house materials, nondestructive, metal, polymer, fastener and weld testing; failure analysis; specimen machining; and metrology and calibration services.

Machinist Bryan Cass uses Maxiem Intelli-MAX software to program part dimension and generate a cutting path for the waterjet.

The industries LTI serves are equally diverse ranging from aerospace, power generation and defense, to the medical, automotive and commercial markets. The laboratory is Nadcap and A2LA accredited and ISO 17025 certified. Its customer approval list reads a little like a "Who's Who" of such companies as Lockheed Martin, Northrop Grumman, Rolls Royce, Duke Power, Exxon and Westinghouse.

Rapid results

"Providing validated test reports certifying that materials meet specifications is critical for manufacturers," says Brandon McVaugh, mechanical test and machining manager for the lab. Approximately 95 percent of LTI's customers are subtier suppliers with a large portion of work coming from the aerospace industry. Design trends in aerospace continue to call for high performance aircraft parts that are lighter weight. For designers and manufacturers it means these components must carry very high loads in relation to their material strength—a situation that holds the potential for tiny flaws to grow and lead to part failure. As aircraft are subjected to multiple takeoffs and landings, many components become susceptible to fatigue cracking over time. LTI performs fatigue tests as well as nondestructive testing on site for parts and components or starting material prior to manufacturing. Tubes, for example, are exposed to ultrasonic testing while finished bolts undergo magnetic particle or liquid penetrant testing. LTI also takes its nondestructive testing skills into the field for a few of its aerospace customers.



LTI performs an elevated temperature tensile test on a flat tensile specimen.

Regardless of the industry, the common denominator, Brandon McVaugh explains, is that "LTI customers want test results fast. It's all about speed," he says of the work pace at LTI. "The quality side of the equation is expected. Our average turnaround time on tensile testing and most other jobs is three business days. If a customer needs accurate testing performed quickly we can provide same-day service."

Even with this abundance of credentials, McVaugh says the lab is continually looking for ways it can improve. "Although test methods haven't changed much," he notes, "the types of tests have changed, requiring us to manufacture specimens differently, especially for methods like fracture toughness and fatigue testing. This also prompted us to look at new equipment that could support those changes."

Cass sets up a ⅛-inch-thick stainless steel sheet from which to cut near net shape specimens on the Maxiem 1515 abrasive waterjet system.

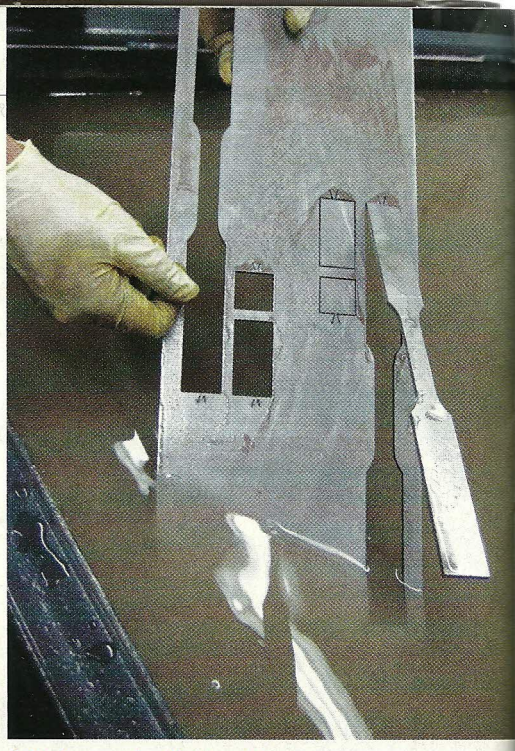
Specimens vary

LTI engineers test all types of materials from aluminum to copper, steel, super alloys, Inconel and Hastelloy. Test specimens prepared in LTI's machine shop range in size from 1.25-inch long by 0.25-inch round up to 3.25-inch long by 6 inches round. Flat specimens can be produced as thin as 0.002 inch up to 6 inches thick in varying lengths. LTI also offers a wide array of other test specimens—all of which are used to support mechanical, corrosion and destructive analysis.

To keep pace with demand, LTI's ma-

chine shop runs two shifts during a five-day work week. Customer specifications tend to represent a mixed bag of test requirements with many inter-related methods. Each test depends on the material or part's application and industry.

"Analysis of basic material properties using round tensile or flat specimens is really the genesis for all other tests," McVaugh says. LTI produces approximately 75,000 specimens annually for use internally or to be sold to customers for their own testing purposes. To prepare specimens, machine shop personnel take raw stock and rough finish to size with a saw. Depending on the material, the process could take up to four hours.



A flat sample that undergoes chemistry and hardness testing can be cut faster and more cleanly on a waterjet machine.

Time crunch

"We were losing too much time with secondary operations," McVaugh notes. "In looking for a solution we had to carefully consider our equipment choices to avoid processing that might create heat-affected zones in the specimen or change its properties."

McVaugh and Andy Giordano, machine shop supervisor for first shift, conducted research and then attended the 2013 IMTS Show to watch a demonstration of Omax Corp.'s Maxiem 1515 abrasive waterjet system. "It was modestly priced but provided a lot of capability," says McVaugh.

LTI installed the Maxiem in May 2015. "Instead of three to four hours to take a specimen to rough finish with a saw, we can accomplish the same process in 45 minutes on the Maxiem," he says. "The waterjet's cold cutting process is cleaner; we don't have to worry about modifying the chemistry of our specimens or introducing heat."

Apart from trimming processing times, LTI is saving money on consumables costs. "Carbide saw blades cost about $250 a piece so the savings on those and other supplies like carbide cutting inserts has been considerable."

The waterjet gives LTI a cutting area of

4 feet by 4 feet with a total workable area of 5 feet by 5 feet compared to the 20-inch cutting area the saws provide. "It has increased our capability to handle larger parts," says Tim Pettine, machine shop supervisor for LTI's second shift.

Machine shop personnel also find the Maxiem makes processing materials like Inconel 718, Waspoly and Hastelloy easier. "Customers using these materials typically ask us for tensile, rupture, hardness, fatigue and chemistry tests.

"These materials are challenging to machine because stock comes to us aged or heat treated and hardened," Pettine explains. However, the waterjet allows LTI to hold a tight tolerance of ± 0.005 inches. "It also gives us an advantage from a throughput perspective because we're able to provide near-net-shape specimens to other departments for the next steps in that material's certification procedure," McVaugh adds.

There have been a couple unexpected value-adds as well. "The waterjet gives our employees the opportunity to learn new skills and, because we can set it up for automated cutting to run unattended, it frees up our employees to focus on other mission essential tasks." ■

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