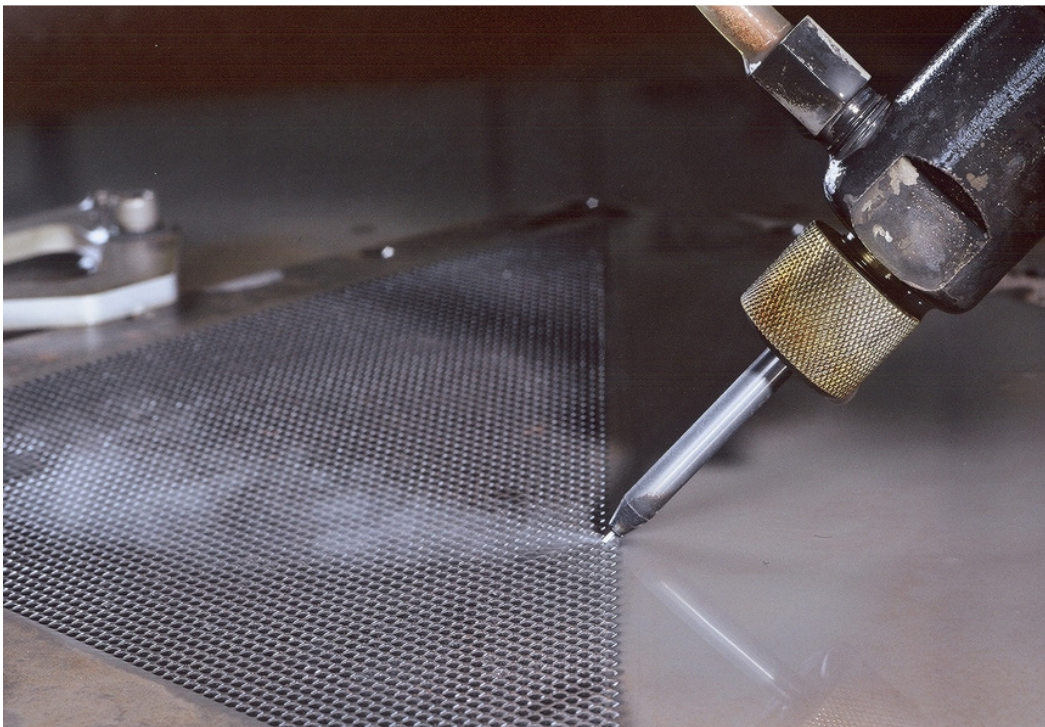


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LAI rides the aerospace waterjet wave



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Patrick Ponticel – Aerospace Engineering & Manufacturing

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LAI International Inc. recently announced an expansion of its Advanced Hole-Drilling Production Center to process turbine component for what it calls the *growth industries* of aerospace and power generation.

The latest phase of the expansion, which has been ongoing for seven years, was completed in June at the Scottsdale, Ariz.-based company's plant in Minneapolis. Among the new installations at the facility, which is a separate unit within the Minneapolis plant, are a high-pressure water system, abrasives delivery and management system, process control equipment, metrology equipment, and a flat-screen video display for

monitoring purposes. The expansion increases production capacity by 25 percent for high-speed waterjet coating removal, drilling, and machining of *shaped* holes.

Compared with regular holes that are round, have parallel sides, and are perpendicular to the material's surface, shaped holes are machined to special geometries that tightly control the flow of air to cool turbine components, according to John Rogers, Vice President of Operations for LAI. They are typically not perpendicular to the surface, may be of irregular shape, and often have shaped entrances or exits needed to accomplish desired airflow characteristics.

"LAI has pioneered development of processing shaped cooling holes using an enhanced abrasive waterjet machining technology that eliminates thermal distortion, recast layers, and the need for secondary operations," said Rogers. "LAI's advanced Drill-to-Flow abrasive waterjet process drills precision-shaped holes to diameters as small as 0.018 inches

and can be performed on components that have already have a thermal barrier coating. This innovative process provides a number of advantages over nontraditional machining methods, including cycle time reduction, superior hole quality, greater design freedom, tighter flow control, improved hole profiles, elimination of recast layers, and lower processing costs.”

The Advanced Hole-Drilling Production Center also features a development laboratory and flow-testing workstations that support drill-to-flow methods to achieve optimum flow performance and precise control in turbine components. The company has incorporated airflow testing as a validation of its hole-drilling processes, Rogers told *AEM*, noting that “typically, waterjet-drilled holes provide improved airflow characteristics compared to holes drilled with alternate technologies such as EDM or laser.”

The latest waterjet workstations and supporting equipment “are specially designed by our engineering group for advanced shaped hole drilling,” said Frank Bailey, Plant Manager at LAI’s Minnesota facility. The company designs and specifies the major components and subassemblies that comprise the Advanced Hole-Drilling Production Center. It purchases or subcontracts the fabrication of these items. Final construction of the workstations is done by LAI. Included in this construction are the integration of the CNC controller, additions of LAI proprietary systems for the monitoring and control of critical process variables, and system calibration.

LAI employs 20 engineers, all with four-year degrees. In addition to developing, designing, and testing LAI’s equipment upgrades and processes, “staff engineers develop specialties relating to structures, hydraulics, motion control, thermodynamics, acoustics and control systems, materials, tooling, and manufacturing systems,” Rogers said.

LAI is a leader in the development of processes for making shaped cooling holes using an abrasive waterjet technology, which LAI has enhanced in the areas of motion control and process variable control “that cannot be realized using commercial, out-of-the-box equipment,” said Rogers. “We did this out of necessity to provide our customers with affordable solutions to their complex product designs. With some

components containing more than 100,000 precision holes, and one defective hole resulting in scrapping the component, enhancements to equipment and processes are absolutely necessary to success.”

Waterjet technology is growing in popularity because of its advantages over other technologies in terms of how a process affects the material being cut or drilled, according to Rogers. For example, laser cutting can raise the temperature to a point where it becomes brittle in the area being processed. Another typical problem associated with some other technologies is that the material in the area being processed can melt and reform in ways that can compromise the part’s integrity or require additional processing.

Among the parts produced by LAI customers, such as GE, are blades, buckets, blisks, shrouds, nozzles, vanes, and impingement plates. In addition to waterjet technology, LAI employs laser, EDM, CNC grinding, and CNC milling technologies for industrial and aerospace gas turbines. Rogers estimates that waterjet technology is used in about half of the company’s revenue-generating activities.

Customers of LAI cross a variety of industries and in the aerospace industry include Boeing, Lockheed Martin, and Northrop Grumman. One of its more significant contracts is a multi-year one to manufacture 21 different highly engineered, precision-machined titanium and aluminum structural panels for the airframe of the Lockheed Martin F-35 Joint Strike Fighter.

“As a contract manufacturer, LAI is involved in the initial product-design phase with the customer,” said Rogers in explaining how the company is more than just a job shop. “Working with our customers’ engineers, we can incorporate the optimization of our processes to achieve the customers’ product performance objectives while delivering the best overall value. Additionally, LAI focuses on managing the entire supply chain required to deliver a finished product to the customer. This includes managing purchased materials, subcontracting, product performance testing, as well as our own in-house manufacturing services.”

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