Hopping Aboard The 'Jet Stream' For Better CNC

Founded in 1939, Ferrotherm Corporation (Cleveland, OH) is a well-established supplier to the aerospace industry with a heritage of providing quality gas turbine honeycomb seals and shrouds to customers such as GE, Pratt & Whitney, Rolls-Royce, the U.S. Military, and many others. With 121 employees and over 100 various machines, the company is set up to perform most operations and processes on-site at its 78, 000 sq. ft. facility.

This is not a high-production facility; typical batch sizes vary up to 20 pieces, which are manufactured on numerous types of equipment. Ferrotherm uses CNC turning equipment, CNC milling and drilling machines, TIG welding equipment (that can process all metals including nickel and cobalt alloys), and programmable CMMs to ensure consistent quality of accurate components. A high tech-operation, Ferrotherm also has an approved metallurgical laboratory.

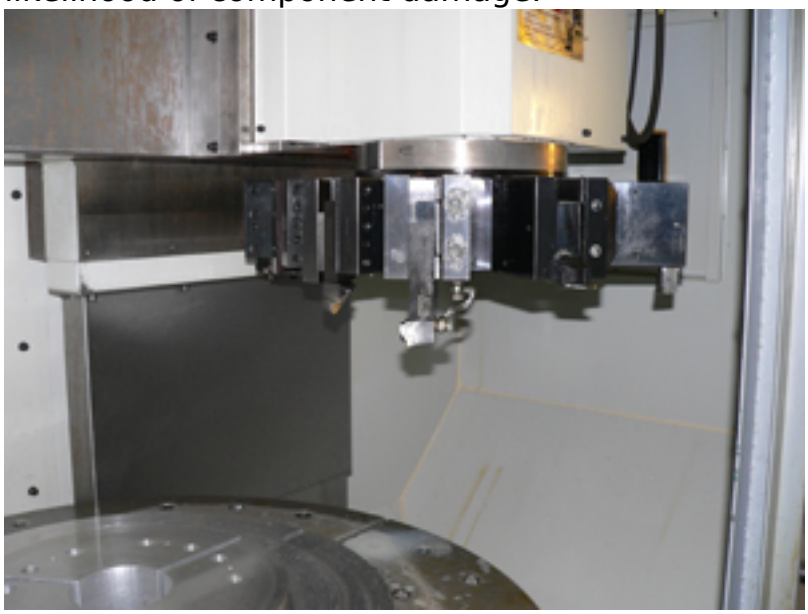
With so many unique components, each requiring multiple machining operations, the need for efficient changeover and set-up methodologies is important. Although the company had been using Seco tooling for over 15 years, events in 2008 brought the companies closer together. First, Jim Owens joined Ferrotherm as an applications engineer. Next, Seco's regional manager Matthew Gluntz began to call on Ferrotherm. Subsequently, Ferrotherm received a "preferred supplier" status from a very large strategic customer, requiring improved throughput while maintaining product quality.

Gluntz was quick to assure Ferrotherm that Seco could provide the tooling and support necessary to help them meet the new and more demanding objectives. Together, the companies developed a structured working format and scheduled regular review meetings to identify key issues and develop action plans.

"As luck would have it," said Gluntz, "Seco was developing an innovative

technology that had potential application to Ferrotherm's operations." While typical turning operations rely upon an insert engaged in a workpiece being flooded with coolant from one or more coolant delivery pipes, the new process — called Jetstream Tooling — offered optimal coolant delivery via a patented coolant inducer. The resulting high velocity "jet stream" targets the precise friction zone between the cutting edge and the workpiece, providing superior lubrication, cooling, and chip removal.

Super alloy materials, which are typically used in aerospace applications, are poor conductors of heat. This not only results in high temperatures at the point of cut, but has a tendency to quickly compromise the cutting edge, increasing the likelihood of component damage.



The first application of Jetstream Tooling was applied to the roughing operation of a ring air seal made of Inconel. A Doosan V740T CNC twin spindle turning lathe was selected for the initial tests, and multi-directional tools (MDT) were selected to rough machine the operation.

The team tested various Seco insert grades to see if they could identify an optimal combination for the new tooling, finally settling on PVD-coated micrograin CP500, which consistently performs in difficult applications. Coolant pressures on the test machine were in the 80-150 PSI range. Because Jetstream Tooling coolant is delivered close to the cutting edge, this PSI was enough to keep the chips cool and move them away from the workpiece.

With the new tooling setup, Ferrotherm adjusted the cutting speed, the spindle speed and the feed rate while depth of cut and length of cut remained constant. This not only resulted in improvements in the metal removal rate (from 0.92 to 1.42 cubic inches per minute), but a 35 percent reduction in machining time. Most importantly, as Ferrotherm applied the tooling to various components, all the initial tests came out positive to typically achieve over a 50 percent increase in surface footage.

After the success of the Jetstream Tooling on the Doosan, the team decided to try the same technology on a You-Ji 1600mm Vertical Turning Lathe, which was already

equipped with high pressure pump capability. With a slight modification of the feed rate, productivity was more than doubled.

Ferrotherm is now in the process of equipping a Doosan 840, which has an advantage over the You-Ji in that it is fully enclosed to contain the mist created by the high pressure jets. Until the new Doosan 840 is up and running, the Doosan 740 and the You-Ji will be kept busy with Jetstream Tooling applications, which has proven to work well on all types of nickel-based alloys and cobalt-based components.

Seco continues to test the Jetstream Tooling process, experimenting on harder super alloys and implementing different grades to help optimize the operation. Given the high speed capability of the You-Ji, Seco's TS2000 grade has been very effective in the area of turning super alloys, enabling higher cutting speeds and increasing productivity while lowering manufacturing costs.

The use of Jetstream Tooling is not only providing a substantial increase of productivity in roughing operations, but new applications will continue to provide numerous cost-saving opportunities for Ferrotherm.

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