

Machine to keep up with the stringent AS-9100 quality standards and maintain an efficient facility. Owned by George McNab and hosting between 50 and 55 employees, MAC Machine manufactures radar assemblies, air and fuel handling components, and in-the-airstream lighting components, as well as other parts for the aerospace industry. As it has for more than 30 years, the MAC Machine prides itself in tackling difficult aerospace work that most shops pass by.

## FACING THE CHALLENGE

MAC Machine often accepts contracts for parts without straight edges or diameters that can effectively be fixtured. These types of parts must be machined with the latest technology in order to avoid runout and chatter.

"It's not unusual for us to have an extended holder with a 1/4" ball mill that's sticking 2" out of the holder," says Randy Barbe, head programmer at MAC. "That's the kind of application where using a side-lock holder results in chatter even at the slowest feedrates."

Radar assemblies in particular have very tight tolerances, especially in the areas where they mount the optics. The optics are mounted to in-line bores for rotational purposes, leaving no room for mistakes or runout. These assemblies are everyday work for MAC.

On the other hand, a five-piece weldment unit that the company produces doesn't have such tight tolerances, relatively speaking; it's the geometry of the unit that makes it one of the most challenging parts. The manufacturing process involves machining the part with a qualifying operation, then mounting a base to the aluminum block and bolting up through the base, mounting it to a 5-axis machine and machining all of the features. At the very end, it's connected to a spud by a thin rail, and the manufacturer cuts tabs through it and then saws off the tabs and hand-works what was connected to blend the part.

The order was placed for only 11 parts, but the machining is extremely complex. The 18"-long unit is completed in one operation with very quick turnaround, thanks to the implementation of a REGO-FIX powRgrip system.

"Using the REGO-FIX holders really helped me to get past the difficult-to-machine areas of the part that would normally need to be broken down into several more

toolpaths using tools of varying lengths and holder types. These toolholders can really take a lot," Barbe says.

## PARTNERING WITH INNOVATION

The MAC team first laid eyes on the REGO-FIX powRgrip system at the South-Tec show in October, 2007. Ironically, they were unaware of its existence up until then. REGO-FIX employees informed them that they have a test-drive program that would allow MAC to test the product in-house.

The following week, the system was in their shop and set up. Tim McCall of E&R Industrial, a distributor of REGO-FIX products, helped MAC conduct shopfloor tests of the powRgrip system.

"We got a few tools in place and by November, we were ordering more tools," Barbe says. "We were so impressed with them that we've been placing orders ever since."

MAC purchased the latest version of the



A five-piece weldment part that MAC Machine produces is difficult to machine because of the complex geometries of the unit.



## The powRgrip System

The powRgrip system uses a slightly tapered collet with a built-in setscrew for tool height adjustment. The tool and collet are pressed into the toolholder with up to nine tons of force by means of a bench-top hydraulic press. To unclamp the tool, the compression cycle is simply reversed. The clamping and unclamping cycles are very short, taking approximately 7 to 8 seconds per cycle. After the tool is inserted and the clamping cycle is complete, the tool is ready to use. Unlike shrink systems, no cool-down period is necessary. PowRgrip provides a high-precision gripping solution for high-speed, high-performance cutting technology.

The powRgrip holders and collets have an extremely high life expectancy. Under normal operating conditions, more than 20,000 clamping cycles are guaranteed. Furthermore, powRgrip is balanceable for high-speed applications by using the optional REGO-FIX balancing ring system.

powRgrip system, the PGU9000, on December 4, 2007. They currently buy 10 to 20 tools at a time as needed.

"We take advantage of simultaneous 5-axis machining for many of these parts because of the exotic shapes and hard-to-reach features," Barbe explains. "REGO-FIX helps us not only in the high-speed machining, but we found out that the holders have tremendous rigidity and vibration-dampening that reduces our surface chatter in situations where we have to use an extension mounted inside of a holder, or situations where we have high vertical walls meeting contoured surfaces with small corner radius callouts."

The biggest improvement in productivity that MAC has experienced is the ability to buy high-performance carbide cutting tools and use them to their full potential, according to Barbe. The combination of the powRgrip system plus the carbide cutting tools is highly beneficial when machining materials such as aluminum and tungsten. With blanks starting out extremely large and ending up only a few pounds, the roughing aspect of what they do is very time consuming.

"With this combination, we have metal coming off the parts so fast that you can barely follow it with your eye," Barbe says. "We've used it on tungsten and gotten much better results. Tungsten can really rattle a machine, and we changed the tools over to REGO-FIX holders and it drastically reduces the vibration of the machine, as well as improved surface finishes and tool life. It's a much more rigid system."

## TAKING OFF IN AEROSPACE

MAC Machine is now thinking of implementing a matrix style of tooling solely for roughing tools in each of their machines. The matrix would consist of all REGO-FIX holders with all high-performance carbide mills, with the same tool line up in every machine.

"We've found that even our old machines, with only 8,000rpm to 10,000rpm spindles, have greatly increased performance level using the REGO-FIX combination with the high-quality carbide mills," Barbe notes. "And of course, it also makes for ease-of-programming when you know what tool configuration you can use with each machine, as well as reduced setup time."

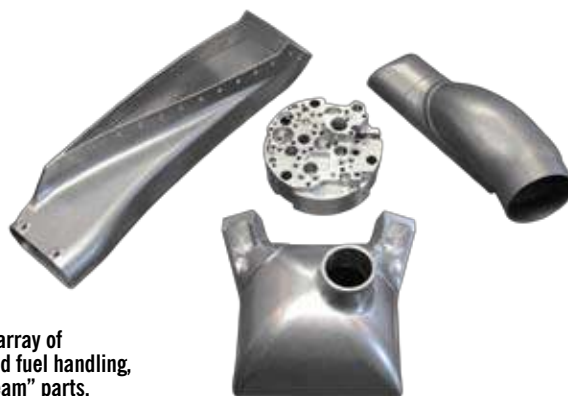
Due to the results with applications to date, MAC is expanding the use of powRgrip to more processes throughout their plant. **A**

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### THE DIFFERENCE: powRgrip v. SHRINK FIT

Shrink fit	powRgrip
Buy a holder for a specific size, can only be used for that size tool	Uses collets, so one holder can hold multiple tool sizes
Time consuming with heating and cooling of the toolholder	Less time consuming – 7 second setup time
Dangerous, high temperatures	Does not generate heat
Hazardous EMF (electromagnetic fields) radiation associated with many high-voltage shrink-fit systems	Strictly mechanical and does not emit dangerous radiation
Low runout	Runout <0.003mm (0.000 12") at a distance of approximately four times the diameter of the tool
Problems exist in maintaining consistent Z-axis height repeatability	Precise tool presetting – repeatable to less than 10μ (0.0004")



MAC Machine manufactures a wide array of aerospace products including air and fuel handling, radar assemblies and "in the airstream" parts.

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