

Thread Mill Cuts Aerospace Part Processing

Gentz Industries L.L.C. (Warren, MI) is a world-class provider of complex turbine engine components for the commercial and military marketplace. With over 50 years of manufacturing to its credit, the company's commitment to quality is reflected by its ISO 9001:2000 and AS9100 registrations.

Gentz typically produces low-volume, high-precision parts from expensive and hard-to-machine materials such as Inconel, titanium, and stainless, among others. Due to the high cost of these materials, there is no margin for error due to scrap or waste.

When Belinda Smith, application engineer for Seco Tools Inc. (Warren, MI), approached Mark McWilliams, Gentz purchasing manager, and asked him to consider switching to a 0.156" (3.9-mm) Threadmaster thread mill on a combustor case component made of Inconel 718 heat-treated to R_C 42, she was met with just a bit of skepticism.



Seco's Threadmaster saved two-thirds of the thread milling time on a combustor case component made of Inconel 718 heat-treated to R_C 42 at Gentz Industries.

"We had already tested five competitive 0.156" [3.9-mm] size thread mills on this application, which requires the creation of 52 #10-32 thread holes," explains McWilliams, "All resulted in tool breakage. We weren't real confident when Smith said 'ours is better,'" says McWilliams.

To perform the thread milling operation, Gentz had settled on using a 0.170" (4.3-mm) thread mill, which created undersize holes. Each of the 52 holes then had to be individually hand-tapped for finishing. To perform the entire threading operation required two thread mills making three passes and about 15 taps to hand tap the part. Total time per component clocked in at 154 min of machining time plus another one or two hr for hand

tapping.

Not the most efficient process, but it had proven to be stable, and stability is crucial on high-value components. When the forged combustor ring arrives on Gentz' floor, it is already worth \$14,500 per unit. Then add to that about 14 more hr of machining time before it gets to the final thread milling operation. The Gentz team, understandably, was not very keen about messing with a process that was producing good components.

"We have a long-standing partnership with Seco and enjoy a great relationship," says Jim Stevens, Gentz OEM manufacturing manager. "But experience had taught us that the 0.156" thread mill was just not suited for the job. It took about a year of Belinda confronting us on this process before we finally agreed to give Seco's solid-carbide Threadmaster a whirl," Stevens says.

Part of what makes Threadmaster different from other solid thread mills is a TiCN coating and micrograin structure that provide both toughness and wear-resistance.

Once Gentz agreed to the trial, Curt Hassan, Seco regional manager, then insisted that Gentz more than double its feed rate from 78 to 194 ipm (1.9–4.9 m/min). Additionally, he wanted to run the OKK KCH500 four-axis twin pallet machining center from OKK USA Corp. (Glendale Hts, IL) to its 5000-rpm capacity; over three times the 1500 rpm Gentz had been using.

"We were very skittish about speeding up," says Stevens. "I couldn't imagine the thread mill doing anything but falling apart on the Inconel."

It's because of Mark and Jim's support along with the rest of the Gentz team—Paul Jones for programming and machine operators Mike Namel and Simon Street—that we were able to try and run the Threadmaster at this speed and feed," says Hassan. "Our numbers were so much higher that it just scared everyone."



Using its Productivity Cost Analysis program, Seco is now studying the other operations performed on the combustor case including turning, rough milling, debossing, heat treating, and finish milling.

The new Seco Threadmaster 0.156" was able to complete the thread milling operation in 53 min with only two passes, saving an hour in machining time and one complete pass. Additionally, the hand tapping time was reduced from 90 min average per component to 30 min. And, this is only done to check and see if any of the threads are snug.

Programming parameters were modified with Seco's Thread Milling Wizard software to help compensate for the increased feed and speed. With the Wizard, the operator need only enter the type of thread, diam, depth, and material group they are working in. The software then generates the machine code, greatly reducing setup time and creating a perfect thread from the very first cut.

Gentz also switched from the current hydraulic chuck system to a shrink-fit thermal toolholding system offered by Seco. "This helped us achieve less runout, better tool life, and more even tool wear," adds Stevens. "The machining center is really humming at 5000 rpm and the rigidity of the thermal toolholder helped us achieve better tool balance." An added bonus is that the shrink-fit system has worked so well, that Gentz is now going to apply it to other applications.

Hassan is modest about the success of this thread milling application, although the two hr/part savings equates to 44 hr/month that can be spent manufacturing other hardware. "The Threadmaster 0.156" is providing a great cost-savings to Gentz and increasing throughput," says Hassan, "but, I think we are only in the infancy of gaining efficiencies in the machining of this part, which spends about 16 hr on the Gentz shop floor."

"Just eliminating the hand-tap time was worth the change in this process," emphasizes Gentz COO Roger Bartolomei. "Most of the hand labor is gone and now we are threading to size, which improves quality. And, you can't scoff at almost \$62,000/year in savings."

Seco is currently studying the other operations performed on this component—turning, rough milling, deburring, heat treating, and finish milling—using its Productivity Cost Analysis (PCA) program. PCA measures a process or workpiece as it moves through production with the software manipulated to achieve the stated objective, whether it is reduced cost or increased output. With PCA, Seco can evaluate a single-machine tool process or the complete path that a workpiece takes on its journey through the shop floor.

Seco and Gentz, along with distributor E&R Industrial, have opened a monthly forum during which the group reviews what has been accomplished on the Gentz shop floor and develops action items that need to be addressed. "We've really seen a lot of good things come out of this forum," says McWilliams.

"Through these meetings, we help Gentz to identify their hot spots... the areas where they need help. This helps us focus on what is important to them," says Seco Tools' Hassan.

"We are a fast-growing company, so it is critical for us to work with suppliers that know how to help us improve efficiencies," concludes Bartolomei. "One thing I know for sure, Seco understands the meaning of partnership."