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## ISSUE FOCUS

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# LATEST ADVANCES IN CHAMFER HOBBIING

## COMPANY PROFILE

NIDEC MACHINE TOOL AMERICA



# DEBURRING WITH CNC MACHINING

This flexible honing tool is used for a wide range of automated CNC machining applications. (Courtesy: Brush Research Manufacturing)

# Removing burrs with automated machining often can be time-consuming and tedious, but a versatile, flexible honing tool can be used for cross-hole deburring all around the shop.

By JEFF ELLIOTT

**D**elta Machine Company, LLC — based in Huntington Beach, California — is a machine shop specializing in complex, tight tolerance parts made of titanium, nickel alloys, stainless steel, aluminum, plastics, and other exotic alloys. It was recently selected as one of the 10 Best Precision Machine Shops for 2021 by a leading industry trade magazine.

Janos Garaczi, the company's president, still runs manufacturing to ensure everything is working well. He is in a unique position, having started with the company as a machinist and eventually working his way to president and owner. As such, he remains responsible for much of the programming, set-ups, and purchasing.

In the past decade, the machine shop has relied on a flexible, honing tool for a wide range of automated CNC machining applications such as cross-hole deburring, cylindrical honing, surface finishing, edge-blending, and cleaning.

By integrating flexible hones in the machining process, complex parts with cross-drilled holes and other difficult-to-access features can be deburred, honed, surface finished, etc. in-house, at less cost.

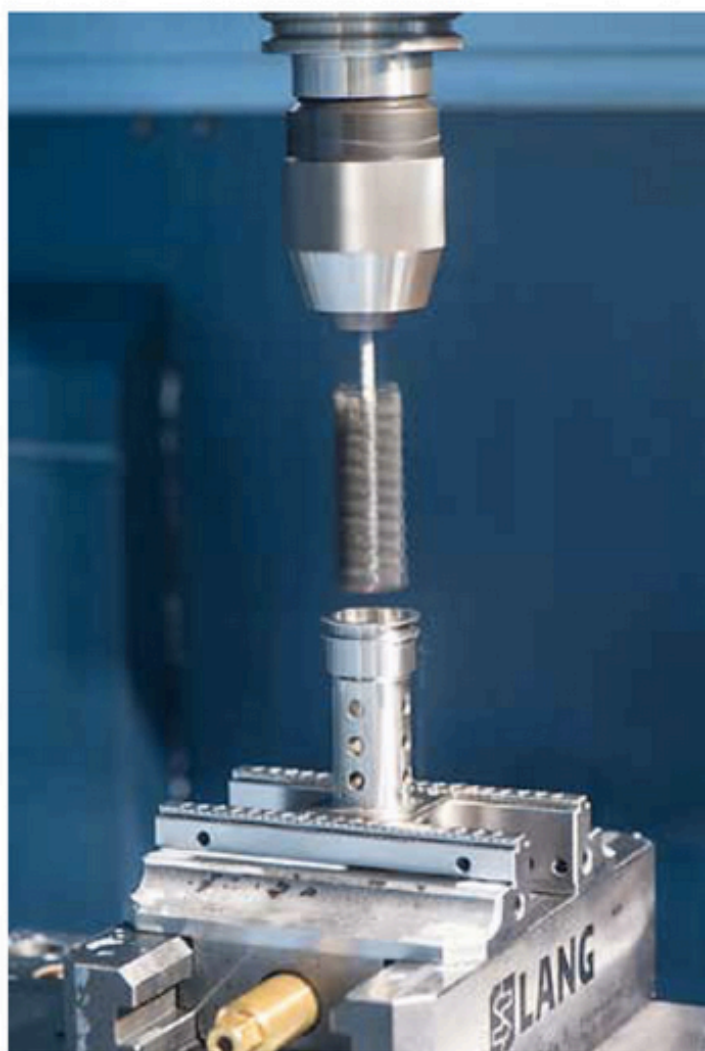
## DEBURRING CHALLENGE

In automated machining, removal of burrs and sharp edges in cross-drilled holes and other difficult-to-access areas such as undercuts, grooves, slots, or internal holes can be tedious and time-consuming. One particular challenge is deburring the intersection of cross-drilled holes frequently found in engine and transmission components.

Despite the challenges, the removal of burrs from the production process is an absolute must for high quality, precision parts. In many applications, cross-drilled holes act as conduits for fluids, lubricants, and gases. Failing to remove burrs can cause blockage of these critical passages or create turbulence in the flow. Burrs can also lead to part misalignments, affect dimensional tolerances, and limit the overall efficiency of machined components.

"Eliminating burrs is critical, because if any loose material gets dislodged during use, there can be serious consequences," Garaczi said.

According to Garaczi, the tool he has selected for such applications is the Flex-Hone from Los Angeles-based Brush Research Manufacturing (BRM). Characterized by the small, abrasive globules perma-



By integrating flexible hones in the machining process, complex parts with cross-drilled holes can be deburred. (Courtesy: Brush Research Manufacturing)

nently mounted to flexible filaments, the product is a flexible, low-cost tool used for sophisticated cross-hole deburring, honing, surfacing, and edge-blending. The hones are available in a variety of abrasive types, sizes, and grit selections.

"For deburring holes and honing when we need to clean up a component, it is the easiest tool to use for us. There is a large variety of grades and sizes, and it is very versatile," Garaczi said.

## COST-EFFECTIVE SOLUTION

In such applications, flexible hones are ideal because the tools are a cost-effective solution to smooth edges and produce a blended radius for cross-hole deburring.

"In terms of accessibility, I haven't found any other tools that can do what a Flex-Hone can, whether for multiple cross holes or internal grooves," Garaczi said.

**Finishing tools release little-to-no abrasive grit during use, and the amount generated is comparable to the metal chips, grinding dust, and tool abrasion created during the machining process itself. Even if minimal fine solids are produced, the filtration requirements for abrasive tools are not much different than for machining.**

“There is really no way to effectively reach those areas with any sort of other tool. Right now, we are making more and more complex parts, especially when it comes to housings with ports all over the part. That is where the hone comes in really handy – for deburring the holes where you drill into it.”

For best results, the deburring tool is typically rotated into the main bore into which the cross holes break. After a few clockwise strokes, the tool is removed and the spindle reversed to rotate and stroke the flexible hone in a counterclockwise direction for a few more strokes. The forward and reverse rotation creates a symmetrical deburring pattern. Coolant should be used to keep metal cuttings and deburred metal in suspension.

### **SUPERALLOY CHALLENGES**

According to Garaczi, removing burrs can be particularly problematic when dealing with machined superalloys, such as titanium, Monel, Inconel, Incoloy, Invar, Rene, and Hasteloy, which are some of the most difficult materials to machine.

“The burrs are one of the biggest problems, particularly when machining superalloys,” he said. “Even during ‘grooving,’ if you cut the material from one side, it just pushes the burr to the edge, and if you approach it from the other side, it just pushes it back. It doesn’t want to break off the material cleanly. As soon as the tool gets a bit

dull, it gets a lot worse. So, sharp tools with the right geometry are key.”

Garaczi noted the Flex-Hone is available with a premium nickel-coated diamond abrasive for use on materials such as carbide, ceramic, and aerospace-steel alloys, as well as a CBN (Cubic Boron Nitride) option that is even harder and is specifically designed for superalloys, which can exhibit high ductility and work hardening that produce a gummy machining behavior if the correct abrasive tool is not used.

According to Garaczi, when deburring superalloys such as titanium or 13-8 stainless alloy, using the Flex-Hone has been very helpful.

“Most of the 13-8 we machine is heat-treated, so it is subject to significant burrs,” he said. “The hone is ideal for removing even the most stubborn burrs.”

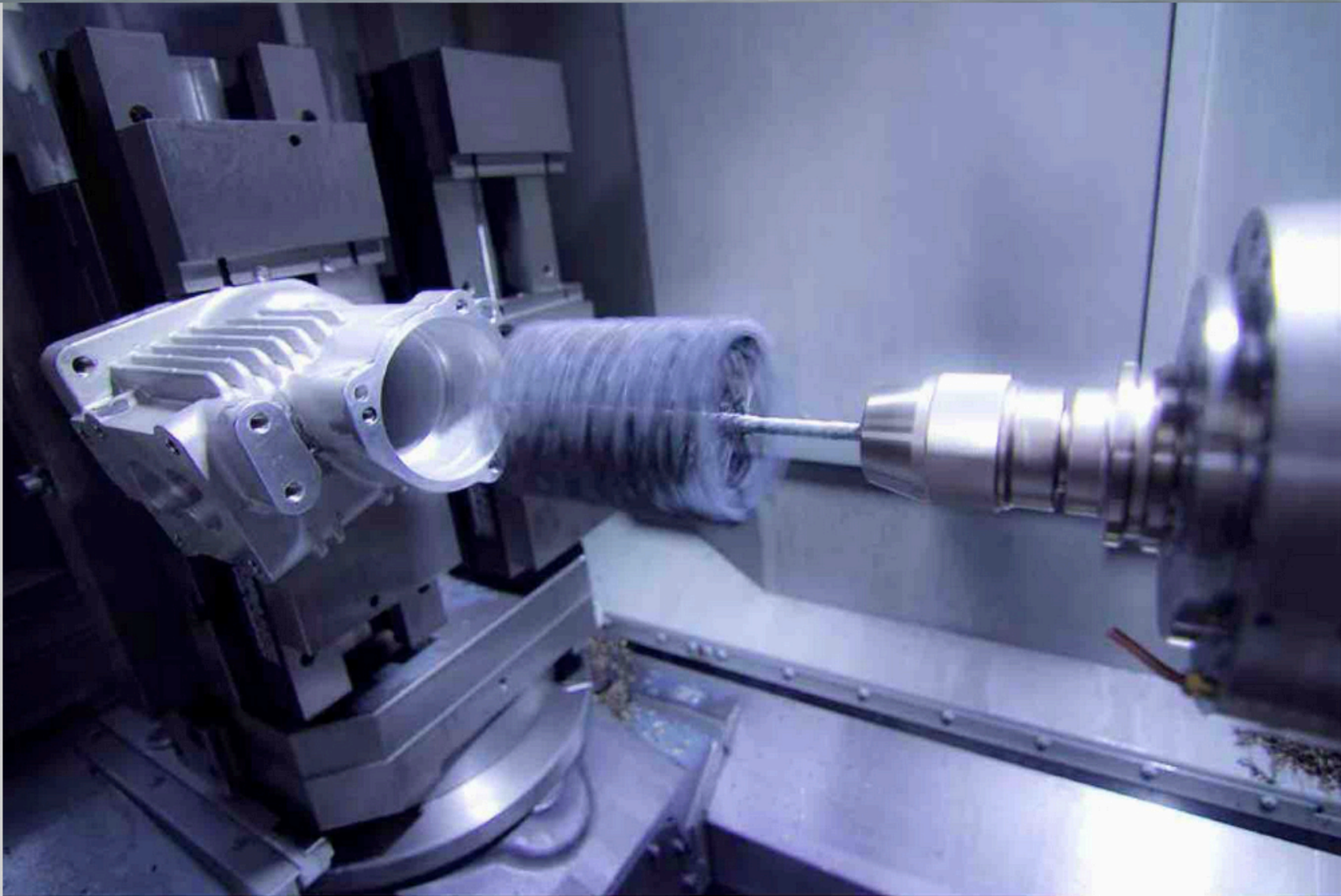
Garaczi pointed out he is installing the flexible hones into CNC equipment to automate the process and reduce the time required to finish superalloys and stainless steels.

### **ABRASIVE DISTINCTION**

Despite the fact that these are abrasive tools, he said even though “abrasives” are often all lumped into the same category, a distinction must be made between abrasives used for aggressive material removal and abrasive finishing tools. Finishing tools release little-to-



**Flex-Hones are ideal because the tools are a cost-effective solution to smooth edges and produce a blended radius for cross hole deburring. (Courtesy: Brush Research Manufacturing)**



Flex-Hone is a flexible, low-cost tool used for sophisticated cross-hole deburring, honing, surfacing, and edge-blending. (Courtesy: Brush Research Manufacturing)

no abrasive grit during use, and the amount generated is comparable to the metal chips, grinding dust, and tool abrasion created during the machining process itself.

Even if minimal fine solids are produced, the filtration requirements for abrasive tools are not much different than for machining. Any particulate can be easily removed using inexpensive bag- or cartridge-filtration systems.

"When you use the Flex-Hone for deburring, all you are doing is removing the burr," Garaczi said. "It doesn't create much dust, so, for me, any grit or dust released is zero concern. It is not like we are grinding inside the machine with powder everywhere — this is not the same at all."

"These are very expensive, very accurate machines," he said. "I wouldn't do anything to jeopardize the accuracy or lifespan of the equipment."

Garaczi said when making decisions about what tools to purchase, it is often on a project-by-project basis. However, if the tool can reduce cycle times versus its cost, it is an easy decision.

"There are definitely scenarios where it would be good to be able to perform surface finishing of this type of material on CNCs," he said. "It would really save a lot of time and extra processing cost."

## COPING WITH COVID-19

According to Garaczi, the use of the hone is even helping his company cope with the demands placed on it by COVID-19 by accommodating more work being done in an automated manner. This not only requires less labor, but it also facilitates social distancing for any workers on the production floor.

"I want to do everything on the CNC machines whenever I can, especially now," he said.

To achieve this, the machine shop incorporates Flex-Hones in a variety of sizes in its tool carousels.

"For a part, we might use two to three different size hones, depending on the number of cross port intersections and different hole sizes," Garaczi said. "However, it is really easy to put a Flex-Hone in a toolholder, give it a simple toolpath cycle, and let it run."

According to Garaczi, automating cross-hole deburring, in particular, eliminates a lot of offline work, since Delta Machine's parts are usually complex with many intersecting holes.

"It is difficult for a person to reliably repeat such work to the level of required quality," he said. "Automating this with the CNC machine usually will produce more consistent results, while enabling greater social distancing among our staff on the production floor." ❧

### ABOUT THE AUTHOR

Jeff Elliott is a Torrance, California-based technical writer. He has researched and written about industrial technologies and issues for the past 15 years. For more information, visit Brush Research Manufacturing's website at: [www.brushresearch.com](http://www.brushresearch.com).