



Mastering One-and-Done with 5-Axis Machining

By Jerry Soots

Five-axis machining is such a complex and expensive process that it is not at all typical for a startup company to initially invest in it. For instance, it took Advanced Machining & Tooling, one of the three original operating companies of Compass Precision, LLC, a couple decades to begin diving into 5-axis machining.



Mikron 5-axis machining center with seven pallets to support extensive unattended operation at Gray; company has four 5-axis Mikron machines; nearby sister division, Advanced Machining, has three more

But at Gray Manufacturing Technologies, the fourth operating company Compass acquired, 5-axis machining has always been its livelihood. Mastering the “one-and-done” process was not a luxury for Gray to add onto its capabilities but rather its main focus and has propelled the company into great success in the aerospace & defense and space markets.

The 5-axis machining process is often referred to as “one-and-done” or “done-in-one” because it can be performed in a single setup. With a 5-axis machine, the cutting tool and the part move along five different axes simultaneously, thus eliminating the need to stop the machine to manually shift the workpiece. This brings a higher level of efficiency -- lead times and cost can often

be reduced by more than half -- while accuracy increases because the likelihood of human error drops.

To standardize all the 5-axis equipment at the company, Gray installed Mastercam CAD/CAM software more than five years ago. This software maximizes each setup's potential, reducing human interference as much as possible and ensuring each part is as perfect as it can be.



Gray's DMG 5-axis machining center in unattended operation manufacturing complicated titanium component for space customer

But that isn't where the advantages of 5-axis machining end. The process can create intricate shapes and contours that aren't available through other CNC machining. Furthermore, 5-axis machining can cut difficult-to-work-with materials such as titanium.

A vast majority of the parts Gray produces are made from titanium. Conventionally, titanium is difficult to machine at high speeds and leads to quick wear on cutting tools, slowing down the process because of the need to replace them.

However, with the technology established at Gray, the operating company can machine titanium at a faster pace than usual and receive more life out of its tooling. This reduces the cycle time and improves profitability because of the lower cost to customers.

The highly-sophisticated machining at Gray produces parts for rocket engines, launch vehicles, spacecraft, satellites, fighter jets and other military or commercial aircraft.

Gray has invested in eight 5-axis machines -- each highly regarded Mikron, Mazak, or DMG units -- an extraordinary amount for a company with only 16 employees. All of them come equipped with multiple pallets and pallet changers, enabling unattended, lights-out production, which further eliminates lead time. In addition, Gray possesses a Mazak multi-tasking mill/turn machine, also with 5-axis milling capabilities.



Jerry checking operation of Gray's DMG 5-axis machining center, with one of company's three Mazak 5-axis machining centers running unattended in background.

Despite possessing the latest technology, Gray still places a major emphasis on carefully selecting its employees based on experience and ability to manufacture “mission critical” parts. There is no margin for error, making Gray Manufacturing Technologies, and thus Compass Precision, one of the small handful of American CNC machining companies trusted to create complex components from difficult-to-work-with materials.

About the Author



Jerry Soots

Jerry helped found Gray Manufacturing Technologies in 2013 and became President of the company following the Compass acquisition in Aug. 2020. He has been instrumental in concentrating Gray's highly irregular efforts of focusing the start-up company on 5-axis machining. Additionally, he is a highly-accomplished 5-axis programmer in his own right as well as a teacher and mentor of other programmers at Gray.

Prior to Gray, Jerry gained extensive CNC machining experience and built connections in the industry, a lot of which became some of Gray's original employees, while working at Curtis-Wright Corporation and Penske Racing.

He graduated from Western Carolina University with a bachelor's degree in engineering technology.