



## Mastering One-and-Done with 5-Axis Machining

By Evan Grose

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.

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.



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

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.



**Machinist 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



### **Evan Grose**

Evan has worked at Gray Manufacturing for nearly a decade over two different stints. He returned to the company in 2017 as a manufacturing engineer and rose to quality engineer shortly thereafter. In July 2021, Evan received another promotion to Operations Manager.

He has nearly two decades of experience working as an engineer designer and CNC programmer. While earning his two-year mechanical engineering degree, Evan graduated first in his class at Catawba County Community College.