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Lockheed cuts F-35 part cost by 30 percent with 5ME cryogenic machining system

Leading aerospace OEM acquires an Okuma horizontal machining center with patented cryogenic machining system and increases cutting speeds by 52 percent with improved surface integrity and part quality, estimates a 30 percent cost reduction for large titanium airframe components.

NOVEMBER 2015 – Lockheed Martin has acquired an Okuma MA-600HII horizontal machining center equipped with 5ME's patented cryogenic machining system to perform roughing and finishing operations on large titanium airframe components for the F-35 program. Test cuts performed on 6AI4V titanium produced a 52-percent increase in cutting speeds (21 hours with 5ME cryogenics vs. 44 hours with coolant), while maintaining equal cutter consumption. The tests, using a 5ME solid carbide cryogenic end mill, also produced improved surface integrity and part quality, as well as reduced white layer. According to Lockheed, cryogenic technology will help lower the cost of large titanium parts by an estimated 30 percent. The new Okuma HMC with liquid nitrogen-based cryogenic system will operate in Lockheed's Dallas/Fort Worth production facility, and represents the collaborative efforts of 5ME, Okuma, Hartwig, and Lockheed Martin.

"The tests we conducted with Lockheed demonstrate the true business advantages of using cryogenic machining for tough-to-cut materials, such as Titanium" said Pete Tecos, Executive Vice President Marketing and Product Strategy, 5ME. "This has a significant impact on cost savings for initiatives like the F-35 program, not only in increased cutting speeds, but also through lower energy consumption, improved worker safety, and the elimination of the infrastructure and disposal required with flood coolants."

5ME's patented liquid nitrogen-based cryogenic technology allows LN2 to flow through the spindle and inside the tool just below the cutting edge, which provides optimum cooling. The reduction of temperature facilitates faster cutting speeds, which makes liquid nitrogen-based cryogenic machining ideal for tough to machine materials. The system is self-pressurized eliminating the need for pumps and other power-consuming assets. Three options for storage include a vacuum container (or "dewar") for individual machines, micro-bulk vessels for machining cells and central/external storage for large-scale installations.

To ensure that critical components are not exposed to cryogenic temperatures, the feed system uses vacuum-jacketed insulated lines between the LN2 source and sub-cooler as well as

to the spindle. The system feeds super-cooled (-321° F) liquid nitrogen at a prescribed pressure and flow rate for the specific tool and/or application. The patented sub-cooler removes pressure-generated heat out of the system and condenses dual phase liquid nitrogen (liquid and gas) back to 100 percent liquid, preventing the formation of gases from downstream heat leaks and pressure drops.

The integral Cryo Controller allows operators to program the flow rate to match requirements of the application. The patented cryogenic machining system is easily retrofitted to almost any OEM spindle, and has a variety of tool interfaces available. 5ME's cryogenic tooling is specifically designed for the system and includes holders, turning and grooving tools, solid carbide mills and drills, indexable mills, drills, and boring tools.

5ME provides asset monitoring and manufacturing efficiency software, cryogenic machining systems for any brand machine tool, application engineering as well as tooling and coolant solutions. Learn more about cryogenic machining at 5me.com/cryogenic-edge. For more information about 5ME, contact Pete Tecos at 586.202.3285 or pete.tecos@5ME.com.

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