

Additive Manufacturing Reduces Tooling Cost and Lead Time to Produce Composite Aerospace Parts

“Moving from traditional methods involving CNC machining to producing composite tooling with FDM has helped us substantially improve our competitive position.”

— Bruce Anning, owner, ACS

Advanced Composite Structures (ACS) repairs helicopter rotor blades and other composite structures for fixed-wing and rotary-wing aircraft. The company also produces low-volume production composite parts for the aerospace industry.

Both offerings require tooling. On the repair side, the company normally uses a mold with a contoured surface to guide the repair. It creates most production components by applying composite laminate strips onto layup tools. Many jobs also require fixtures to locate secondary operations such as drilling.

Old Methods

In the past, ACS typically produced layup tools, drill fixtures and consumable core patterns on CNC machines. Another option was producing a model using a CNC machine or power tools and using it to mold a composite layup mandrel. It typically cost around \$2,000 to hire a machine shop to produce a metal composite mold. Producing a model and molding a composite layup tool cost about the same. In both cases, lead times were eight to ten weeks.

Initial tooling design sometimes presented problems. In these cases, ACS incurred substantial additional expenses and the project was delayed while the tooling was repaired or rebuilt from scratch.

New Efficiencies

More recently, ACS has switched to producing nearly all of its tools using additive manufacturing on a Fortus Fused Deposition Modeling (FDM®) machine. FDM technology is an additive manufacturing process that builds plastic parts layer by layer, using data from CAD files. A typical FDM layup tool takes only about \$400 and 24 hours to produce. This low cost and short lead time means ACS can easily remake tools that are found to have problems on the manufacturing floor.

For example, ACS recently produced a camera fairing used to install a forward-looking infrared camera on a military aircraft. The Fortus machine built the layup tool directly from a CAD drawing. In another example, the geometry of a vertical fin assembly for a helicopter is so simple that a layup mandrel was not needed. However, the Fortus machine produced a drill fixture to accurately locate a series of holes.



This FDM layup tool produced the aircraft camera fairings above.



ACS used this FDM fixture as a guide to drill holes in a helicopter fin.

How does FDM compare with traditional tooling for ACS?

Method	Cost (for a typical component)	Time
CNC machining	\$2,000	45 days
FDM Technology	\$400	2 days
SAVINGS	\$1,600 (80%)	43 days (96%)

ACS also used FDM-built tooling to fabricate a capsule component for a remotely piloted vehicle. The company built a consumable core, core co-bond tool, cover layup tool, cover trim tool and cover drill with the FDM material ABS-M30 thermoplastic. The traditional approach to producing hollow composite parts is to use CNC machines to make patterns from polyurethane boards that are then used to mold clamshell tools. The FDM method offered substantial time and cost savings.

“Tools produced with FDM cost only about 20 percent as much as CNC-produced tooling,” said Bruce Anning, owner of ACS. “FDM tooling can be produced in a single day compared to several weeks for CNC tooling. For the repairs and short-volume production work that we specialize in, tooling often constitutes a major portion of the overall cost. Moving from traditional methods to producing composite tooling with FDM has helped us substantially improve our competitive position.”

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