Precise Contours

3D PRINTING CUTS COST OF INSPECTION TEMPLATES BY 96%

"We produce five to 10 jigs or fixtures per month and each one typically saves dozens of hours for each assembly that we produce."

– Daniel Gray / CPI Aero

CASE STUDY

Original metal template

CPI Aero, Inc. (CPI) manufactures structural assemblies for military and commercial aircraft. These assemblies have to be produced to very close tolerances, as most of them directly affect an aircraft's aerodynamic performance.

For example, the height of the barrel-shaped outer skins of a business jet engine inlet assembly needed to be maintained within +/- 0.030 inches of the nominal dimension around the circumference of the inlet. The edge of the panel itself is contoured so the nominal height dimension is different at every point around the circumference. To that end, CPI requires an inspection process to ensure extreme precision, even on complex geometries.

Complexity Added Cost

Finding an inspection process for these structural assembles proved difficult. CPI typically performs final inspection of each assembly using coordinate measuring machine (CMM) instrumentation. But these assemblies required frequent in-process inspections to avoid expensive rework. CMM presents cost and equipment constraints that make this impractical, so mechanical measurements are preferred. Cubic geometry conventional measuring systems like gauge blocks and calipers could perform these in-process inspections. However, most aerospace assemblies are designed with complex contours that require an equally complex template contoured to match the parts being inspected.

3D printed templates inspect contoured panel edges

In the past, CPI subcontracted CNC machine shops to build complex inspection templates to exacting tolerances, often at significant cost. Daniel Gray, program engineer at CPI, said that the company previously purchased metal height check templates from a supplier. The supplier built the templates by cutting pieces out of metal, welding them together and then CNC machining them to meet final dimensional requirements. The templates were built to the low end of the tolerance range so that a feeler gauge could be inserted only if the dimension was greater than the low limit. The inspector inserted a feeler gauge with a thickness of the difference between the high and low limit to determine whether the dimension is acceptable. While these templates worked well, they were expensive and had a long delivery lead time.

Better Design at Less Cost

CPI recently increased its production of these engine inlets and purchased four new assembly fixtures, each of which required a set of eight height check templates. The company had recently purchased a Fortus® 3D Production System and decided to use it to produce the templates. 3D printing made it possible to produce the template at a much lower cost and in much less time. CPI also took advantage of the design flexibility provided by 3D printing to add additional features to the template that inspects additional dimensions, which reduced the time required for the final inspection. This change would have increased the cost of the metal templates but had no effect on the cost of the 3D printed templates. The company printed the templates with polycarbonate because it provided the required strength at a low cost.

“In most cases it is cost-prohibitive for us to purchase jigs and fixtures with complex geometries using CNC machining,” Gray said. “Now we can produce them directly from a CAD file on our 3D printer. We produce five to 10 jigs or fixtures per month and each one typically saves dozens of hours for each assembly that we produce. The end result is that we are improving the efficiency of our manufacturing operations at an acceptable cost.”

METHOD	TIME	COST OF 4 SETS OF 8 TEMPLATES
CNC machining	40 days	$29,541.20
3D printing	3 days	$1,108.36
Savings	37 days 93%	$28,432.84 96%

stratasys

E info@stratasys.com / STRATASYS.COM

HEADQUARTERS
7665 Commerce Way, Eden Prairie, MN 55344
+1 888 480 3548 (US Toll Free)
+1 952 937 3000 (Intl)
+1 952 937 0070 (Fax)

2 Holtzman St., Science Park, PO Box 2496
Rehovot 76124, Israel
+972 74 745-4000
+972 74 745-5000 (Fax)

ISO 9001:2008 Certified