CENTRAL SCREW PRODUCTS

3D PRINTED CMM FIXTURES TO REDUCE COST

ENGINEERING CASE STUDIES 01

USING ADDITIVE MANUFACTURING TECHNOLOGY TO STREAMLINE QC COMPLEXITY

Manufacturing Mastery Since 1924

Central Screw Products Company (CSP) is a 3rd generation machining company, founded in 1924.

CSP leverages the latest in robotics and automation technology to achieve one of the machining industry's most efficient engineering to production ratios. The result is mastery and control of the manufacturing process, maximum customer value, and unparalleled quality.

We machine Titanium, Inconel, and other hard materials to precise tolerances for the most demanding industries such as defense, medical, aerospace, and automotive.

Our global supply chain provides a reliable single source for diverse secondary operations and value added logistics.

CSP is ISO 9001:2015 Certified, AS 9100 Compliant, ITAR Registered, and a proud recipient of a number of industry and OEM supplier quality awards.

www.centralscrewproducts.com

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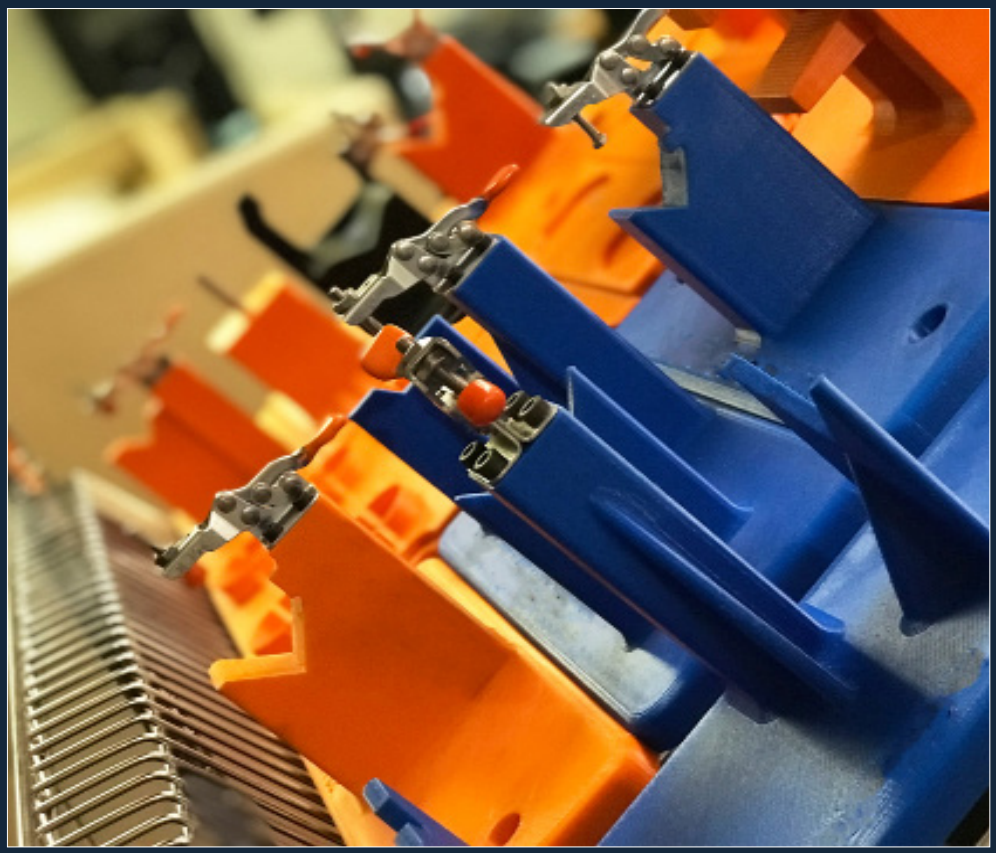


Managing complexity and cost is typically handled with clever estimating, but at Central Screw Products we reduce our customers' total cost by infusing our process with technology. This approach allows customers to streamline their own internal workflows, especially in the critical QC process.

The CMM (Coordinate Measurement Machine) is one of the most powerful tools in manufacturing and quality control, but in a high mix situation reliable CMM workholdings can be difficult and costly to source. This becomes doubly problematic as part complexity increases.

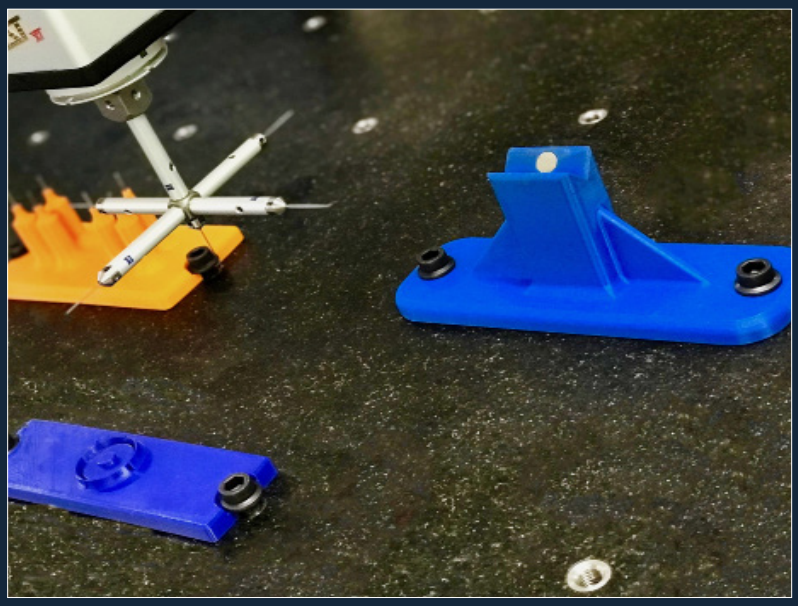
CSP optimize our customers QC and CMM operations by providing duplicate fixtures for each production part using our Stratasys Fortus 3D Printer. This saves time by following a lean, reproducible QC process, and avoids costly bottlenecks with valuable CMM resources.

FIXTURING REQUIREMENTS

Using the base-alignment of our Zeiss Contura G2 CMM, we define the part function precisely according to the data per the customer print. This establishes both the orientation and coordinate system of each part.

CMM fixtures are the most effective method for making this process repeatable for CMM program stability. The fixture itself does not demand accuracy, but rather rigidity and repeatability, for the CMM to scan and create its base alignment before executing measurement cycles.

There are two industry standard options: create dedicated, machined fixtures for long production runs, or use rearrangeable CMM fixture kits (similar to Lego blocks) arranged on a CMM grid plate.



Our alternative to these wasteful and expensive practices is 3D printing. Our Stratasys Fortus 250MC is capable of build volumes of up to 1200 cubic inches and the accuracy of .007" layer thickness. Unlike traditional machining, jobs are typically processed and running within 30 minutes.

UNDERSTANDING COST AND CAPABILITIES

CMM fixture kits typically begin with an expensive 300x300mm grid plate, and a variety of reconfigurable components, with prices starting in the $1500 range. These skyrocket to $3000 if magnetized components are required to reduce set-up time.

Our Zeiss Contura G2 has a working area of 1000mm x1000mm, requiring 9 of these kits, costing between $13,500 and $27,000, if we wanted to utilize only 90% of our entire work area! This does not include the cost of setting up each fixture with a dedicated CMM operator, documenting the set-ups, and troubleshooting the improvisational nature of the configuration.

Fabricating a dedicated fixture is the other industry standard option. For our case study, we looked at 2 fixtures. Fixture A has fewer features and is blocky in its simplicity. Fixture B is more complex to accommodate maximum accessibility for the CMM probes. Using a standard estimating model, these fixtures were quoted at $996.00 and $1875.00, respectively (if we could wait 4 weeks for lead time). Expediting the job would also result in a premium surcharge if we need them faster!

The same Fixture A, quoted prior, would take 17 hours and 18.05 cubic inches of material, while the more complex Fixture B would take 9 hours and 7.51 cubic inches of material. Using the standard posted cost of Stratsys branded material, we have a raw cost of $4.64 per cubic inch.

Our fixtures are now capable of being created in less than 24 hours each, with respective cost of $83.75 and $34.85. Inversely, our more complex fixture actually costs less to 3D print, and this hints at the fundamental benefit of this technology in our process.

A NEW MODEL: REWARDING MATERIAL EFFICIENCY

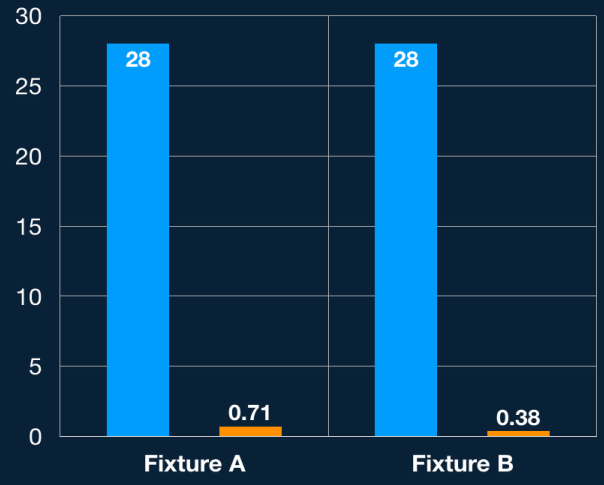
By utilizing our capable engineering team, we break the cost model of traditional machine shop fixturing limitations. Previously, complexity that resulted in greater material removal would drive up cost.

This model is summarized by: (stock volume) – (finished part volume) / (Material Removal Rate) * (work center hourly cost). Cost is then amplified again by tooling requirements such as small holes, long reach, or complex surfaces. This model punishes effective design for maximum capability by an engineering team. Our new model utilizing 3D Printer technology rewards efficient use of material, irrespective of complexity.

In fact, the cost breakdown shows that the more complex Fixture B would cost 53% more than Fixture A if machined, but costs 41.6% less than Fixture A if 3D printed!

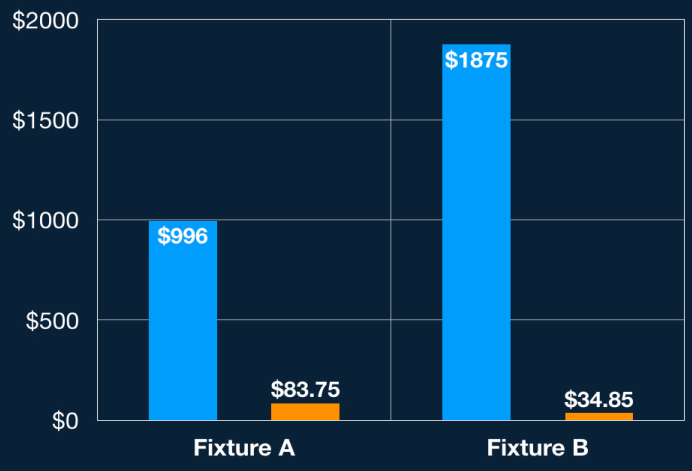
This technology removes us from the typical cost curve of subtractive manufacturing; complexity has no effect on cost and lead time. Material cost is fixed, and labor cost to operate is further reduced because it does not require human oversight while running.

FIXTURE FABRICATION LEAD-TIME IN DAYS



	Fixture A	Fixture B
Machined	28	28
3D Printed	0.71	0.38

FIXTURE FABRICATION COST IN $USD



	Fixture A	Fixture B
Machined	$996	$1875
3D Printed	83.75	34.85

CONCLUSION: HIGHER RESULTS, LOWER COSTS

Our method for CMM fixturing makes us a more efficient and agile shop that can process new jobs at unprecedented speeds. This not only benefits our customer with reduced lead times, but also with our ability to provide expanded services.

Reducing a fixture's cost from $1875 to $34.85 makes it very reasonable to share savings with our customer. We reduce our customer quality control burden, while expediting part approval. Everyone wins, and overall time and costs are reduced.

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RESOURCE LINKS

Stratasys Fortus 250 MC 3D Printer

Zeiss Contura G2 CMM

Solid Works 2018

Renishaw CMM Fixtures

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