



## 3D PRINTED WORKHOLDINGS

### ENGINEERING CASE STUDIES 07

#### USING HIGH-PRECISION SLS (SELECTIVE LASER SINTERING) TO REDUCE LEAD TIMES AND COST

##### 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.

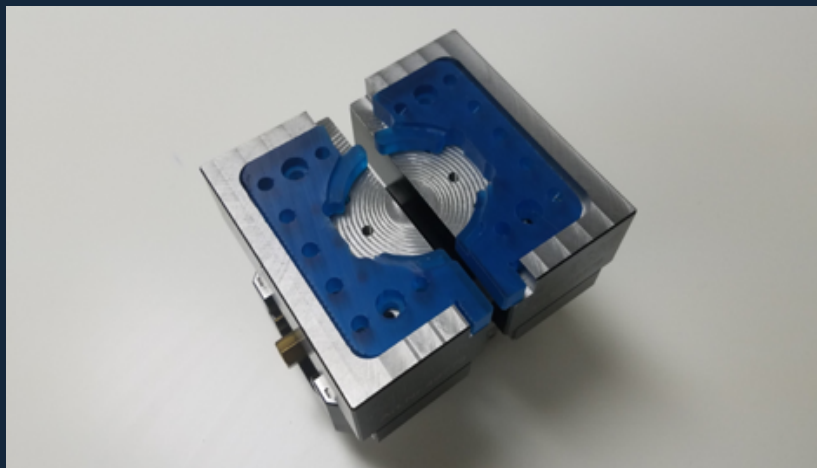
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Modern manufacturing continues to exert pressure to be ever more data-centric while delivering more precise parts in less time. Bespoke or prototype components represent a specific challenge due to the limited production numbers and cost expended for ancillary items like workholding.

Central Screw Products has been counteracting the typically high cost of one-off custom components through a workholding recipe that includes 3D printing soft jaws among other custom workholding solutions. This system has allowed us to keep costs low, with shorter lead-times and no reduction to overall quality.



CSP prides itself on being at the forefront of technology in modern manufacturing. We have used 3D printers shop-wide to automate QC inspections and provide set-up jigs and fixtures for our Fanuc Robotic arms. 3D printed workholdings pose new challenges while opening new opportunities to engage with lower volume customers.

We chose FormLabs to build our new competency with 3D printed workholdings for several reasons. Firstly, the technology is fundamentally different from a typical 3D printer like a MakerBot. Traditional 3D printers use Fused-Deposition Modeling to slice the desired form into multiple layers, then print them with a plastic extruder in successive layers. These layers usually contain a partially hollow interior that varies in density. FormLabs is unique by using a laser beam that selectively sinters engineered resins into a homogeneous, solid form. The parts from this system are cured and virtually indistinguishable from a solid piece of engineered material. Our FormLabs printer can create workholding in a variety of materials with distinct mechanical properties, including glass-filled polymers for rigidity and flexible rubber-like polymers for conformance.

CSP has successfully implemented the SLS process to various applications on our shop floor. To date, we have 3D printed grippers for our Fanuc Robotic arms, soft-jaws for durable conformance to in-process parts, and rigid plates for aggressive material removal rates. Typically the jobs where we are actively using this technology are targeted specifically towards cost reduction with one-off or low production components.

***On average, we have seen a reduction in material cost by 74% and reduction in labor hours by 70%!***

For comparison, we will reference a typical example of in-process work holding: a clamshell set of jaws for a Lang Profilo vise. We estimate 8 hours are required to produce such workholding. This timeframe includes designing and drawing the workholding, sourcing/purchasing material, programming and verification, assembling tools and machining the stock, inspection for conformance, logging results in the Quality System, and lastly, functional testing. Quite simply, this meta-process is burdensome, costly, and represents no value to the final customer. The material cost is only \$119, but the cost of the human resources and machine time is closer to \$350-\$500 depending on machine time and base HR rates.

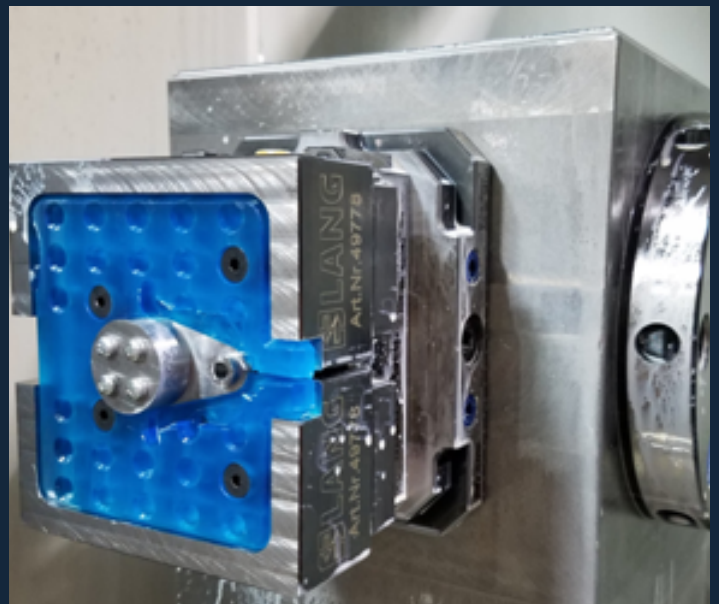
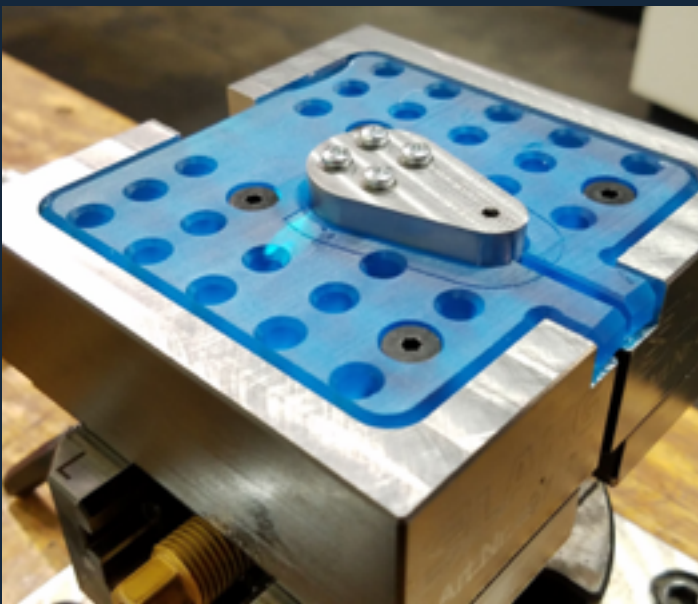
By contrast, the FormLabs workflow requires significantly less material cost and human resources.

Workholding Type	Material Cost	Labor Hours
Machined Jaws	\$119.00 (Lang Technovation)	8
Printed Jaws 1	\$18.33 (78.33 Millilitres)	2
Printed Jaws 2	\$16.07 (68.7 Millilitres)	2
Printed Jaws 3	\$9.24 (39.5 Millilitres)	2
Printed Bolt Down plate 1	\$26.75 (114.33 Millilitres)	3
Printed Bolt Down plate 1	\$25.78 (110.12 Millilitres)	3

Although we still use CAD to design the workholding, all the shop floor tasks and machine time is replaced using a desktop device. With no wear items, the Formlabs printer retains accuracy over time and requires significantly fewer checks before using the resulting workholding. On average, we have seen a reduction in material cost by 74% and reduction in labor hours by 70%!



At CSP we traditionally use precision components from Lang Technovation as the basis of our workholding recipe. The addition of our Formlabs machine has allowed us to build upon this foundation in new and exciting ways. For example, we have produced a series of standardized jaws that accept any 3D printed insert, allowing for infinite variation within a controlled framework. Additional workholdings have focused on creating simple plates that enable us to rigidly locate and bolt-down in-process parts. This approach holds our parts in compression with the 3D printed material and withstands higher tooling forces. This process is simplified with 3D printed fixtures because we can easily place threaded components wherever we choose in the engineering print and eliminate sourcing concerns, broken taps or stripped threads. The inserts, nuts, and bolts can all be removed and replaced as needed.



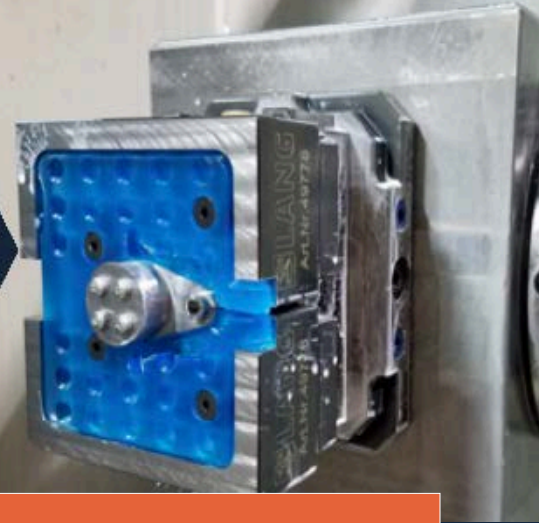
## CONCLUSION: 3D PRINTED WORKHOLDINGS INCREASE PRODUCTIVITY AND REDUCE COSTS

CSP is committed to manufacturing the most challenging parts in shorter lead times. We use cutting-edge precision technology to keep our costs low and have expanded our portfolio to include laser-sintered engineered resins with our Formlabs 3D printer.

We are actively using 3D printed workholdings to deliver precision one-offs to the entertainment and animatronics industry, as well as prototypes for mil-spec and aerospace customers. Please contact us to learn more about how we use today's best technology to rewrite the rules of manufacturing.



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