



# Creative Tooling

3D PRINTED PUNCH SPEEDS PRODUCTION OF SPECIALTY XEROX PRINTER

*“If you can imagine it and draw it in CAD, you can build it in FDM.”*

*– Duane Byerley, Xerox*

## CASE STUDY



The white FDM piece supported each connector during punching.

With sales of \$22 billion, Xerox is the world's leading business process- and document-management enterprise. The company recently introduced a low-volume printer to serve a specialized market that needs features not found in high-volume printers. The printer requires a longer cable with a new connector to accommodate its additional features.

The connector manufacturer needed a minimum order of 1 million units to retool for the new connector. Projected volume of the new printer was significantly less than the minimum order.

“We found another cable that was long enough but the connectors did not fit the new printer,” said Duane Byerley, senior model maker for Xerox.

“Then we noticed that if we flipped the connector 180 degrees it came close to fitting. All that we needed to do was remove the ribs, a tab and a clip. I pulled out an X-Acto knife and in about 20 minutes was able to cut away the extraneous geometry and make the connector work. But this approach was too slow, expensive and imprecise to make more than a few parts.”

### A Fast Punch

Xerox needed 350 connectors modified immediately for testing. “We have used FDM to make many different types of tooling, so I started thinking of how I could utilize FDM to make tooling to modify the connectors,” Byerley said.

The first requirement was supporting the surface to be cut. Using the CAD file, Byerley created the negative of the existing connector geometry as the basis for an FDM piece that fits like a glove.

The next step was building a punch. Byerley designed a two-piece FDM blade holder to carry four X-Acto blades in the U shape needed to punch out the extraneous geometry. He designed tapped holes into one of the FDM pieces so that two screws could be used to hold the assembly together. Then he designed a guide body to hold the connector and support and provide rails for the blade holder to slide on.

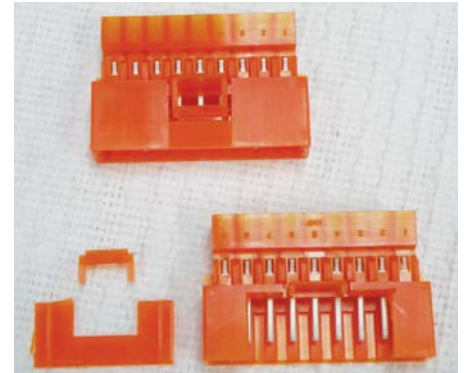
“I assembled the punch, inserted it into a toggle press and began making connectors only four and half hours from the time I began working on the problem,” Byerley said.

An operator punched out the 350 pieces that were needed immediately in about an hour. Another operator installed them into prototype printers as quickly as they came off the press.

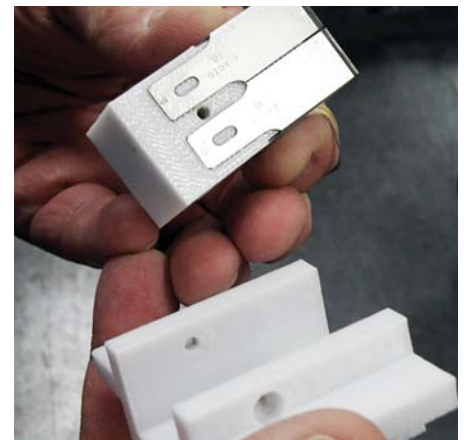
### Broad Applications

It would have taken about three weeks to produce the prototype parts by hand or a total of five weeks for a contractor to make a steel rule die and attach it to the press. The time savings made it possible to get the printer to market and begin generating revenue weeks faster. After validating the concept of modifying the connector with the FDM punch, Xerox ordered steel rule dies and used them to produce the production parts.

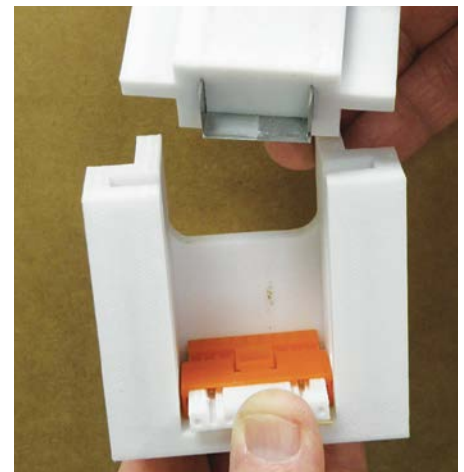
“We use both SLA and SLS, and each of these technologies has its niche,” Byerley said. “But FDM has a much broader application range. It works well in 90 percent of what we do, including making prototype parts, fixtures, tooling, injection molds and production parts. If you can imagine it and draw it in CAD, you can build it in FDM.”



The connector (top) as it came from the supplier and (bottom) after removal of geometry to fit the specialty printer.



The two-piece FDM blade holder was designed with holes to accept screws.



Completed punch with blade holder, guide, connector and support



An operator modified 350 connectors in about an hour on this toggle press.

How did FDM compare with traditional tooling methods for Xerox?

METHOD (TO MAKE 350 PARTS)	COST	LEAD TIME
<b>Building by hand</b>	\$7,200	120 hours
<b>Punching with steel rule dies</b>	\$11,450	200 hours
<b>Punching with FDM tooling</b>	\$268	5.5 hours
<b>Savings</b>	\$11,182 (98%)	194.5 hrs (97%)

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