



## Use Case – Metal Forming Die

### Customer Profile

Graco Inc. supplies technology and expertise for the management of fluids and coatings in both industrial and commercial applications. It designs, manufactures and markets systems and equipment to move, measure, control, dispense and spray fluid and powder materials.

### Challenge

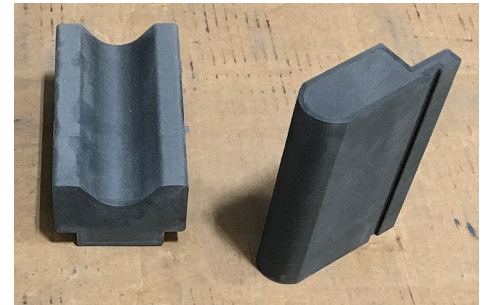
The fabrication of prototype sheet metal brackets for a gasoline-powered motor required the use of standard sheet metal forming dies. However, the dies would need to be machined internally or outsourced, and both solutions would incur excessive lead times (approximately four weeks), jeopardizing the ability to meet the production timeline.

### Solution

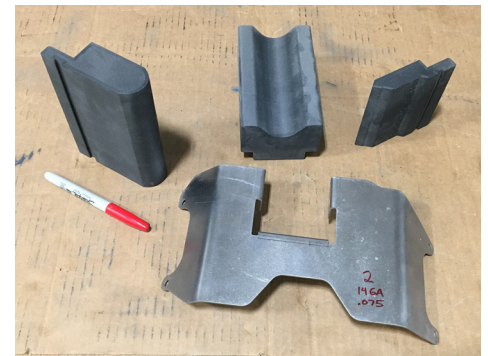
In place of using standard metal tools, Graco engineers 3D printed forming dies on an F370<sup>®</sup>CR composite printer using FDM<sup>®</sup> Nylon-CF10, a carbon-filled thermoplastic material. The die set was printed solid and used to form the brackets out of 14-gauge (0.075 in. thick) carbon steel using 0.8 tons of pressure. The chopped carbon fibers in Nylon-CF10 add stiffness and rigidity to the base nylon polymer, giving it sufficient toughness for metal-forming operations. The inherent smoothness of the as-printed material also reduces friction on the sliding surfaces between the 3D printed tool and the formed sheet metal.

### Impact

3D printed metal forming dies allowed Graco to manufacture all required prototype brackets on time and significantly reduced tooling cost and procurement lead time. The total cost to 3D print the tools was \$400, a \$1600 savings from the \$2000 cost to outsource. The lead time was reduced from approximately one month to three days, a 90% time savings vs. outsourced tooling. Additionally, one set of 3D printed tools withstood 40 cycles of forming operation with no tool degradation or deformation.



The metal forming die set 3D printed with Nylon-CF10 material.



The 3D printed tools shown with one of the formed sheet metal brackets.

**Time Savings**



**90%**

**Cost Reduction**



**80%**