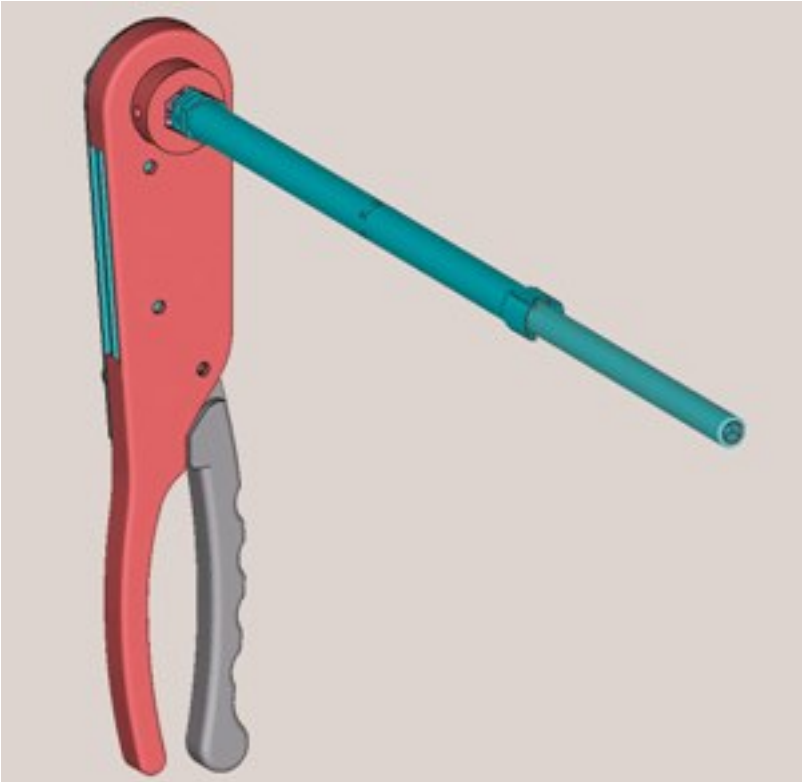
Make Two Models and Call Me in the Morning

Joe Hiemenz, Technical Communications Manager, Stratasys Inc.

The Project: *A prototype lab is tasked with inventing solutions to design challenges presented to them by surgeons with medical device ideas.*

The Solution: *Utilizing a fused-deposition modeling machine and design software, engineers are able to create physical prototypes of medical devices that are able to be put through functional testing.*



Doctors make house calls, but there are no patients to see at Medtronic's Sofamor Danek prototype lab. Instead they come to see their ideas for new surgical instruments become working prototypes with the help of FDM prototyping. With locations in Memphis, Tenn. and Rossi, France, Sofamor Danek is the world leader in spinal and cranial medical technologies.

"We often see one or two VIP surgeons per day," says design engineer Richard Franks. "They come in with a problem to solve in the morning. They explain their need to an engineer, the engineer will model a solution on ProEngineer, and then make a prototype. Often, by the next morning, we'll have a prototype in their hands. Sometimes, we even deliver the same day. Having the Stratasys machine in-house really makes it easy for us to design products."

Medtronic uses a Fortus brand additive manufacturing machine, manufactured by Stratasys [1], which uses the FDM (fused deposition modeling) process to produce parts.

Sofamor Danek engineers recently designed a ratcheting counter-torque instrument that surgeons use to fasten set-screws to a corrective implant on a patient's vertebrae. After the screws are fixed in place, the tool shears off the screw heads at a pre-set torque level. The existing method required surgeons to use separate tools, working them in opposing directions, using both hands. The result was often a violent impulse that occurred at the moment the screw head sheared off, and the surgeons wanted to eliminate that.

"The tool we developed combines the two existing tools into a single unit," says Franks. "As the surgeon squeezes two handle pieces together, the ratchet tightens the screws." The engineers produced a working polycarbonate ratchet strong enough to withstand testing on stainless steel set-screws and durable enough to survive an autoclave. In addition, says senior engineering manager Troy McDonald, "Surgeons are really rough on these prototypes while trying them out, so we have got to have tough material. FDM gave us the strength and durability we needed."

Medical technologists advancing surgical technique appreciate the impact of FDM technology, according to McDonald. "FDM turned out to be an important tool for us," he says. "The benefits of functional prototypes extend to communication too," he says, "Being able to use the rapid prototypes has really cut down on miscommunication." After sending the counter-torque ratchet out to three hospitals, Sofamor Danek learned that the tool design could be improved by rotating its handle 90 degrees—information it might not have learned without working prototypes.

The financial advantages of including FDM technology in the prototype lab are evident to McDonald. "Now we can refine our designs more before we start cutting metal, which is where the dollars start going up exponentially."

He sees savings mount as more prototypes are made inhouse. "We have several

divisions and each one has its own dedicated engineering staff that comes to our RP lab with modeling requests. Except for display items, almost everything that comes off the FDM machine is for functional evaluation. That saves the company a lot of money. The cost of sending out work versus doing it in-house is easy to capture and we can justify owning the [Fortus] FDM system via reducing that cost alone. But the intangibles like timing issues, communication, and the value-added services are where we see the greatest benefits."

"At Medtronic - Sofamor Danek, cutting-edge medical technology takes new shape, thanks in part to FDM prototyping technology," says rapid prototyping designer David Freeman. "Forward-looking companies seek forward-thinking partners."

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