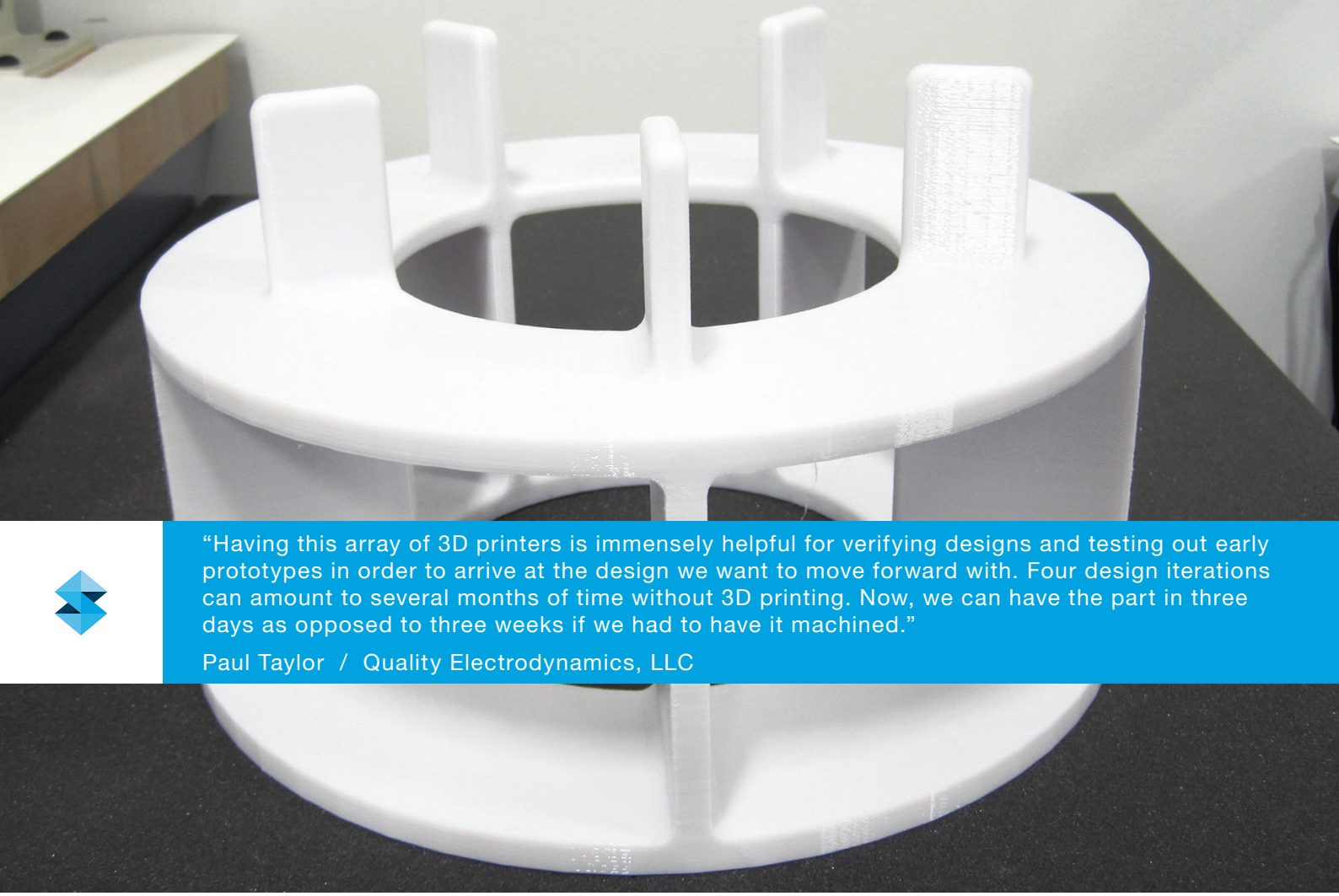


> “Having this array of 3D printers is immensely helpful for verifying designs and testing out early prototypes in order to arrive at the design we want to move forward with. Four design iterations can amount to several months of time without 3D printing. Now, we can have the part in three days as opposed to three weeks if we had to have it machined.”
>
> Paul Taylor / Quality Electrodynamics, LLC

A knee coil assembly fixture used in coil assembly and test.

CASE STUDY

MRI’s Reimagined

EXPEDITED DESIGN ITERATION FOR QED

COMPLEX IMAGING

Medical imaging has been relevant since its inception and its usage so pervasive it would be difficult to imagine modern medicine without the technology. Magnetic Resonance Imaging (MRI) in particular, reveals tissue unable to be seen in X-ray, ultrasound or CT scans, but avoids the harmful radiation exposure present in many other scans. The process works by creating images of the human body using magnetic fields and radio waves that produce a detailed image of the body’s soft tissue and bones. Intrigued by the technology which rests at the confluence of physics, engineering, mathematics, chemistry, biology and medicine, Dr. Hiroyuki Fujita, started Quality Electrodynamics, LLC (QED), a business focused on the design and manufacture of MRI radiofrequency (RF) coil technology for equipment manufacturers, in 2006.

Fujita's first product was designing custom MRI coil housings and he needed a way to create rapid prototypes to test his design ideas. After being introduced to 3D technology, he purchased a Stratasys Fortus 400mc™ printer, knowing the additive technology would allow him to speed his products to market. QED quickly landed Toshiba, the electronics giant, as its first customer. Since then, the global developer, manufacturer and supplier of advanced medical equipment electronics has also added Siemens and GE to its customer-base, and QED's business has grown to include coils for both clinical as well as research MRI scanners, including ultra-high field systems.

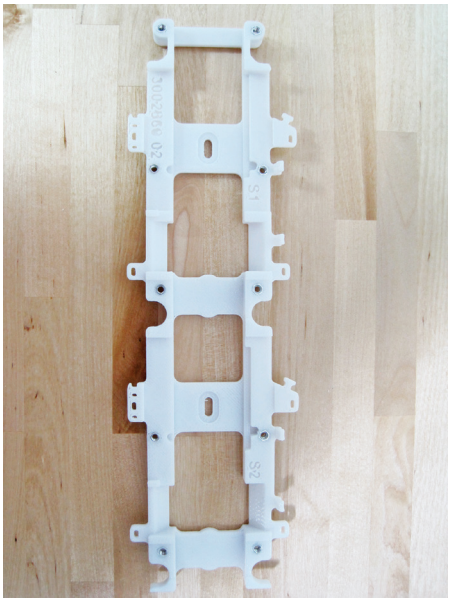
Expanding the Vision

While initially focused on 3D printing MRI coil housings, QED rapidly expanded the use of 3D printing to create the mechanical structures within the coils. These parts provide a way to hold the electronics in precise positions. "They're the internal mounting fixtures inside the housing," said Peter Byrnes, purchasing team leader at QED. "Think of a post of a C-clamp you would put on the edge of something and screw it down to hold it in place to be used as a guide so that the wires travel a certain path."

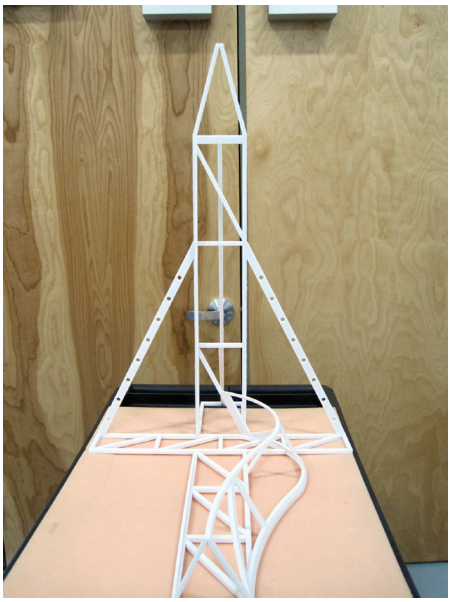
QED also 3D prints production fixtures, or the traveling trays that carry and protect assemblies as they are moved around the department. "We have 81 different production fixtures we print in-house," Byrnes said. "Instead of going outside to buy plastics, and ones not tailored to our needs, we can design and print them in-house." Iterative capabilities are not the only benefit, says Byrnes. "Going back and looking over costs, we see a 15-75% cost savings with 3D printing in our MRI cover prototyping and fixtures. It's an extraordinary amount of savings and they'd be cost-prohibitive if we couldn't print them in-house."

QED continues to 3D print MRI coil housings, but its focus now is on unique needs and designs. "Our one-off research coils for specific customers often require only a single unit," said Byrnes. "Having to tool that would be incredibly expensive." Inside these custom covers there is also the need for custom fixtures and it often takes a few tries to get these just right. "With 3D printing, design to part takes a couple of days as opposed to a week for a quote to go through, and another week to manufacture the part," said Byrnes. Also, with the high-use MRI equipment, there is sometimes a need for replacement covers and "being able to print these off when they are returned is very helpful."

Currently, QED has six Fortus 400mc printers and one Fortus 900mc™ printer in-house. "Having this array of 3D printers is immensely helpful for verifying designs and testing out early prototypes in order to arrive at the design we want to move forward with," said Paul Taylor, design engineer. "Four design iterations can amount to several months of time without 3D printing. Now, we can have the part in maybe three days as opposed to three weeks if we had to have it machined."



An internal rail channel spine coil bottom.



An FDM validation design.

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