# LIFE-SAVING INNOVATION


## Designing Tools for the Super Hero

*"[Because of the concept models] we didn't have to guess if the customer would like the T3 – we knew from the very beginning."*

— Eric Bielefeld, Bullard Senior Industrial Designer

*An image of an unconcious victim as seen through the T3 thermal imager..*

In the line of duty, fire fighters rush into burning buildings to rescue trapped or unconscious victims. In doing so, these heroes risk their lives, demonstrating know-how and the height of courage. But how do they keep up the search when their sight is blocked by black smoke? What transforms a hero into a super-hero? Super Man had his x-ray vision. And a company named Bullard brings high-tech vision to rescuers, lending them super powers.

Bullard Co., Cynthiana, Ky., makes fire and rescue equipment including hand-held thermal- imaging systems. Using infra-red technology, these devices let fire fighters maneuver through buildings to locate people by detecting their body heat. The thermal-imaging system can't remove all dangers for rescue workers, but it does improve their success rate and save lives. For Bullard, maintaining its position as an industry leader means being among the first to bring to market new products with leading-edge technology. The company's T3 thermal-imaging device was developed after Bullard identified a need among fire fighters for an affordable unit that was portable and lightweight.

Bullard brought the T3 model to market in record time using in-house rapid prototyping. With it, the company's design-cycle time dropped significantly. "More importantly," says CAD/CAE Administrator Bonnie Davis, "the lower cost of prototyping in-house enabled Bullard to build more models and lock in the right design early in the process." And the result is better products. This achievement required visualization of product concepts early in the design cycle, checking designs through snap-fits of components, quick modification of design concepts, and building many design iterations in a short time. During the development of the T3, Bullard brought tighter control to its development process and eliminated the high cost of outsourcing by installing a Fused Deposition Modeling (FDM) system from Stratasys. With the help of FDM, the company reduced modeling costs by over 80%.

### Everything but the Screws

When designing a ground-breaking project, it's never immediately clear which direction to go. To help narrow the path, Bullard modeled several concepts of the T3 thermal imager. "Once we settled on a few designs, we modeled nearly every part of each, including a mockup of the internal electrical components," says Senior Industrial Designer Eric Bielefeld.
Aside from simple off-the-shelf items, such as screws, everything was modeled. "We ran everything, from the main housings to the battery cages to rubber gaskets, rubber buttons and the rear boot – even the buckles that hold the T3's straps. From

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early concept models to the final design, we modeled 251 components in all. Then we sanded, primed, and painted the models to look like production units. These models were invaluable as discussion tools with our Marketing department and even a customer – a group of actual fire fighters. Our design team received solid feedback from the fire fighter group on what they liked and disliked about the concepts. We knew which concept they wanted, and we knew exactly how to improve it in a way we felt would make it an industry-leading product. We didn't have to guess if the customer would like the T3 – we knew from the very beginning."

*Bullard's T3 "sees" through darkness and smoke to help fire fighters rescue victims.*

Bullard uses FDM throughout the development process. In early development, designers build rough concept models to check their idea for potential. These models are examined for aesthetics and ergonomics. The designers, marketing team, and sales personnel all give input. Bullard's manufacturing department, as well as its vendors, are also asked for feedback. During engineering development, form, fit, and function of final CAD models are verified. Even many of the machined and sheet metal components are modeled and evaluated for form and fit in the assembly before metal parts are requested for functional testing. All injection-molded parts are modeled before hard tooling is ordered. The durability of FDM parts even allowed Bullard to create manufacturing fixtures for the T3 assembly using a CAD model designed in SolidWorks. Bullard made fixtures by creating a base and cutting the necessary shape, using SolidWorks' core-and-cavity tools and sending the file to the FDM system. "Fixtures can be made for approximately one quarter the cost of having them built by an outside vendor," Davis says. "And because of the tight integration with the CAD model, the fit is maximized."


*An early concept moldel molded from ABS plastic.*

## From Functional Tests to the Field

Parts made with the Stratasys FDM Process won't warp, shrink, or absorb moisture. The ABS plastic models are 70 to 80% as strong as an injection molded ABS part. So they're robust enough to survive repeated functional tests that play a key role in Bullard's development process. "FDM parts are so durable that Bullard assembles some working prototypes and uses them as field models, testing them at real fires," says Davis. "When we first purchased the machine, we expected it to meet about 70 percent of our model-building needs. But since then, the only things we have sent out to a service bureau were large items that had to be built in one piece, and one item that needed highly flexible SLA 8110 material. Other than that, the FDM process has handled all of our needs."
"We typically make 40 to 50 prototypes per month. And the parts are a fraction of what it costs to get them from a service bureau. For about $300 in materials, we make large parts that would cost as much as $2,700. And we can have them in a matter of hours. In an average month, we spend $650 on material to make parts that would cost about $5,800 from a service bureau. Our machine paid for itself in less than 12 months. The machine is so maintenance-free, it's almost unbelievable."



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