BUCKEYE shapeform

case study

aerospace & defense industry

the summary

Some customers ask for products that are so mission-critical that failure is not an option. The liners that are used in compressed natural gas containers in buses, vans and light trucks can never fail. The aluminum liners inside a breathing apparatus used by a miner or a firefighter must always be dependable. And, so too, must the missile skins that surround a weapon that the military will use in battle.

A company that supplies equipment to the United States government for military purposes contracted with Buckeye Shapeform to use its deep-draw technology, machining capabilities and 3-D scanning technology to produce missile housings for the tube-launched, optically tracked, wireless-guided (TOW®) weapon system. The TOW missiles are used widely throughout the world for NATO, coalition, United Nations and peacekeeping operations.

customer profile

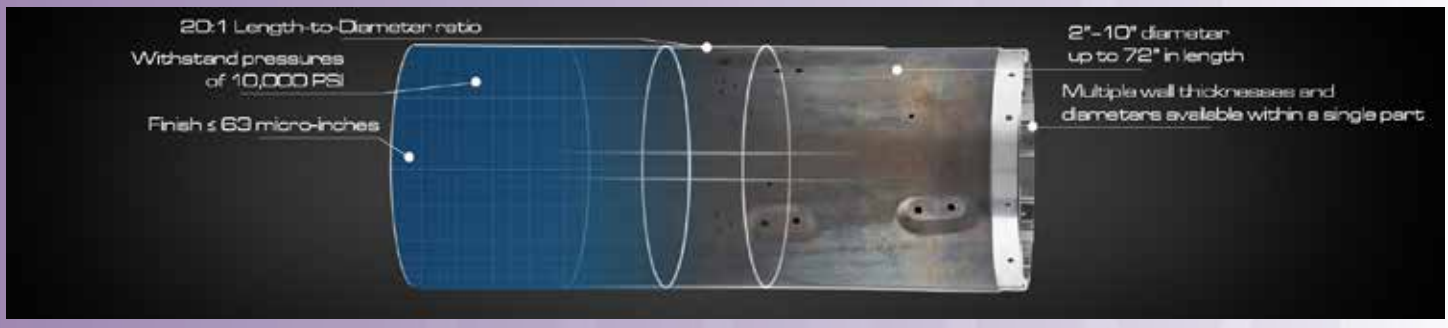
The customer, a tier-2 supplier to the U.S. military, was familiar with Buckeye Shapeform's work. But Buckeye Shapeform still had to prove its capability in order to be added to the supply chain for military parts. Buckeye Shapeform has a long history of using its deep draw technology to produce mission-critical parts that never fail. Previously, Buckeye Shapeform had designed and produced a skin for Hellfire missiles. Using the company's deep draw technology, Buckeye Shapeform's engineers designed a single-piece part with multiple wall thicknesses, a design far superior to the original concept because it did not require welds.

After demonstrating that the same process could be used to produce the skins for the TOW missiles, Buckeye Shapeform was awarded a contract to produce 5,400 missile skins, all due in 2016. The missile that these skins are being produced for, however, is forecast to be produced for years to come and is expected to be procured well into the future.

the challenge

The challenges with this project are two-fold: Buckeye Shapeform first had to prove its capabilities to handle the project and deliver a product on time, on budget and to specifications. Secondly, Buckeye Shapeform had to develop in-depth engineering analyses to ensure that the product, and its mission-critical features, met the military's tight requirements. To accomplish that, Buckeye Shapeform invested in tooling, machining capabilities and 3-D scanning technology that would ensure as precise an outcome as possible. The skins that Buckeye Shapeform is producing for this client have more than 400 critical features that have to be as close to exact as possible to meet the military's tight specifications since the mission outcome is critical.

Prior to Buckeye Shapeform's contract, a previous supplier had been producing this part. However, that supplier had great difficulty meeting the production specifications, holding tolerances and meeting its delivery commitments. Buckeye Shapeform, which had been working for five years to re-establish its relationship with this customer, had positioned itself to take advantage of the opportunity.





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"Because of the critical nature of the product, meeting the customer's demands for tight specifications is a requirement, and part of what makes this work challenging," said Carl Estock, project manager at Buckeye Shapeform. "Precision is crucial when making this part because it is only one piece of a very complex missile design and has to mate perfectly to all other components. Buckeye Shapeform's precision manufacturing process is able to achieve geometric positional tolerances of three-thousandths of an inch."

In addition to the 400 unique features of the part, the housing also has varying wall thicknesses, ranging from three-eighths inch to four-hundredths of an inch thickness over a seamless length of 14 inches. Many of the enclosures that Buckeye Shapeform produces do not require such a tight tolerance because the components being designed into the enclosure have room to accommodate the dimension of the unit. But when it comes to military applications, the engineers and technicians at Buckeye Shapeform understand that the military components they are producing are part of an assembly in which all mating parts must match up exactly. A single failure could prove fatal for a soldier, and Buckeye Shapeform understands that there is no room for error in the development and manufacture of weapons.

the solution

Buckeye Shapeform's deep draw technology and five-axis machining with live tooling, combined with the latest 3-D scanning technology, are the perfect applications to manufacture the housings for the TOW missiles. Deep draw technology is used to create small, medium and large cylindrical shells, tube and other shapes that require close tolerances.

Buckeye Shapeform's deep draw process, however, is a reverse draw. Material is first pulled, or drawn, through a ring, forming a cup-shaped cylinder with uniform wall thickness. The cylinder is simultaneously turned inside out, or reversed, combining two draws in one operation, which saves time and money. Buckeye Shapeform also irons the part during the deep draw process, which allows sections of the material to be ironed to different wall thicknesses. Once the part is drawn or shaped, Buckeye Shapeform begins the necking and expanding process to create multiple diameters in a form that more exactly matches the product engineer's specifications. This series of drawing and ironing steps controls the flow of metal to deliver the desired configuration within the required tolerances.

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> **Carl Estock**
> **project manager, Buckeye Shapeform**

Buckeye Shapeform's deep draw technology differs from other traditional processes, such as impact or spinning. Those traditional processes cannot delivery consistent, reliable results, and they also use more raw materials, increasing the overall cost and weight of the product. Buckeye Shapeform's deep draw process, however, results in a seamless, one-piece part with multiple wall thicknesses and diameters created through minimal operations.

In addition, Buckeye Shapeform invested in the latest 3-D scanning technology to scan the part and verify the correct placement of all the critical features. This scanning technology allows quick quality checks to be made on a part that has hundreds of critical features. The process saves time and money because the 3-D scanner can measure the placement of the features much more quickly and accurately than if the checking were done manually.

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In this step, Buckeye Shapeform uses a 3-D scanner to scan the part—in this case the missile skin—and then create a 3-D model that is matched up to the dimensional engineering CAD model of the original product design. Buckeye Shapeform engineers are able to look at how the two models line up to see if the part they have manufactured is matching up within the tight specifications to the original CAD model. The features that match up perfectly show in green, and those that don't match up show up in red. Engineers can then make adjustments in the manufacturing and correct the errors in a much faster, precise fashion.

the results

Buckeye Shapeform began delivering the first shipments of TOW missile skins in February. The company's technology and investment in the latest 3-D scanning technology has resulted in a finished product that is precise and rugged, qualities required of a product that is being delivered for use in the military industry.

Buckeye Shapeform's deep draw technology has enabled Buckeye Shapeform to produce a part that contains multiple wall thicknesses and is absent of any seams or welding, which eliminates potential weaknesses in the part. Through its investment in the latest 3-D scanning technology, Buckeye Shapeform has been able to ensure that it is delivering a part that has zero defects and meets the customer's required tight specifications.

Buckeye Shapeform understands that precision is critical when it makes a difference on whether or not someone comes home safely from battle. With that in mind, Buckeye Shapeform is providing an unmatched product through its engineering expertise and meticulous attention to detail.

To learn more about how Buckeye Shapeform products will work for you, visit our website at **buckeyeshapeform.com**, or call (614) 445-8433 or 1-877-728-0776 (toll free).

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