

# Casting Conversion Successes

From part reductions to lightweighting to increases in strength, changing the manufacturing method to metalcasting—and the accompanying redesign—paid dividends for these pieces.

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## Stress Test Says Yes

The original part for this farming application was made of many individual steel parts welded together. With ductile iron, the team of customer and foundry (AFS Corporate Member Waupaca Foundry – Tell City, Indiana) was able to create a component in one continuous cast that added strength and reduced machining costs. This also reduced inventory costs and simplified assembly for the customer. The original welded design had a series of necessary pockets that added weight and mass to the piece. If that same design had been used for the cast version, the part price would be needlessly high. During the redesign to ductile iron casting, the number of support ribs was decreased to reduce weight and cost. A stress analysis test confirmed the casting was durable with less metal. Reducing material also decreased the solidification time of the casting, which aided the avoidance of porosity. The final design weighed 43.1 lbs. compared to the original 66 lbs.





## Optimized Design

A manufacturer of tillage equipment had converted a number of forgings to castings, so tackling the redesign of a trunnion bracket and bracket guard to cast iron components was not far-fetched. The original bracket was machined from carbon steel barstock, and the guard included two steel ears welded to a piece of bar steel. One trunnion bracket was mounted to the implement, and a mating trunnion bracket was assembled to a guard with four fasteners that surround a bearing. The team chose ADI for the single-part cast version to improve wear resistance. Engineers optimized the design for casting by minimizing section size and reducing the need for expensive alloying. The final cast part (produced and austempered by AFS Corporate Members Urick Ductile Iron and Applied Process) reduced costs by 43% and reduced downtime by integrating the guard into the component.



## 15 Pieces to One

The shank pivot mount here, cast by AFS Corporate Member Dotson Iron Castings, attaches to the implement tool bar and carries the main load of a tillage system. As the shank is pulled through the ground, the shank pivot mount takes on the driving force, causing high stress. The original version—a welded steel fabrication—showed early signs of wear in this application. Alignment accuracy also showed room for improvement. The 15-piece part was redesigned as an engineered cast component in austempered ductile iron (ADI). In the redesign process, material was moved from the outer portion of the part to the center line, eliminating cores, and profile ribs added strength while also serving as paths for liquid metal to flow to the three bosses. The ADI casting was twice as strong as the steel weldment, 9 lbs. lighter and 26% less costly.



## 100 Hours Welding Saved

A startup company building a device for municipalities to break up ice on roadways needed to find a cheaper solution to the star-shaped steel weldments that clawed away at frozen streets. Converting to ductile iron castings slashed more than \$300 from the cost of the wheel. The final 16-in. casting weighed 33 lbs., 3.5 lbs. less than the weldment, and saved 100 hours of welding time per machine. The casting supplier—AFS Corporate Member Farrar Corporation—also cast the wheel's teeth, which are then roll-pinned onto the wheel. The cast teeth are comparable in price to the forged steel teeth sourced from a low-cost country and provide a better, more precise fit.



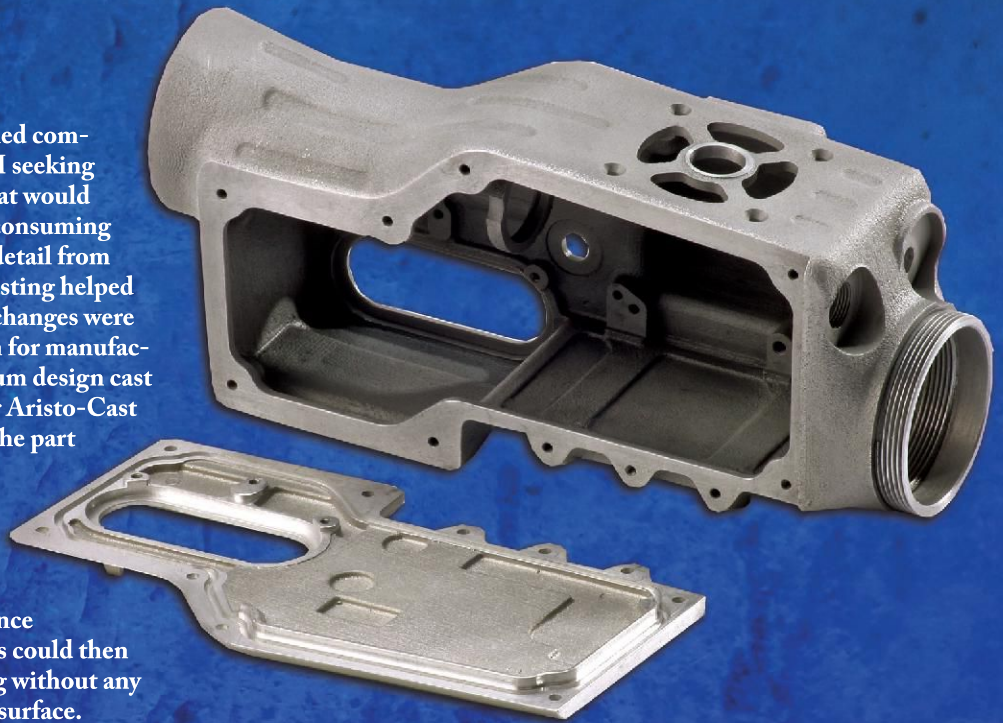
## Mining for Savings

When a fabricated part for an electric mining shovel kept failing in the field—generating huge repair costs—it was time to rethink the part. The new cast steel version produced by Spokane Industries features locks for the retaining pin that do not allow the axle to back out—eliminating the cause for failure. Plus it was offered as an upgrade to existing equipment and as standard on new shovels. The overall cost savings per part was \$535. At 16 pieces used in each shovel, the company saved \$8,560 per shovel.



## Keeping Tabs

An ultra-complex, detailed component design had an OEM seeking a manufacturing process that would be less expensive and time consuming than machining the entire detail from a solid piece. Investment casting helped meet the goal once several changes were made to improve the design for manufacturability. The final aluminum design cast by AFS Corporate Member Aristo-Cast Inc. reduced the weight of the part by reducing the overall wall thickness to 1 mm. Machine holding tabs were added to the exterior to help simplify the machining fixture for a tight tolerance machining process. The tabs could then be removed after machining without any visible signs on the casting surface.



## Taking Flight

A 354-lb. aluminum casting solution for an aerospace component was selected to achieve cost savings over alternative manufacturing processes. The team at AFS Corporate Member foundry Denison Industries worked closely with the customer to establish unique processing capable of repeatedly ensuring the quality of the casting dimensionally, radiographically (AMS-STD-2157 requirement Class 1 Grade B), and metallurgically (AMS-A-21180 requirement 40ksi/50ksi/5%El from excised specimens) resulting in a casting that is truly one-of-a-kind. Requiring over 60,000 lbs. of sand and hundreds of unique form chills, this casting expands the boundary of what can be accomplished with premium aluminum casting foundry practices. **CS**

