CASE STUDY

Scaling Innovation at The Toro Company Through Automated FDM Support Removal from PostProcess

OVERVIEW

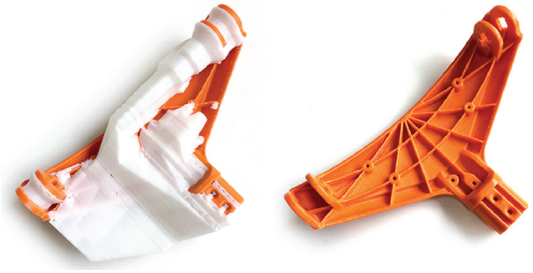
The Toro Company is a global leader in solutions for the outdoor environment, with more than a century of innovation and a presence in over 125 countries worldwide. To support rapid product development and meet growing internal demand, Toro has been leveraging Fused Deposition Modeling (FDM) technology since 2012, steadily expanding its fleet of printers to produce a wider range of prototype and production-scale parts.

As additive manufacturing adoption grew, manual support removal emerged as a critical bottleneck - slowing turnaround times, increasing labor requirements, and limiting overall throughput. To overcome these challenges and scale its additive workflow, Toro implemented the PostProcess® BASE™ automated support removal solution, enabling faster post-processing, improved consistency, and a more efficient path from print to finished part.

SCALE-UP STORY: GROWING PAINS OF ADDITIVE POST-PRINTING

Becoming a leader in any industry requires continuous innovation to meet evolving customer needs while staying ahead of the curve - and The Toro Company has done exactly that for more than a century. Founded in Minneapolis, Minnesota in 1914, Toro has grown into a global organization serving 125 countries and is now one of the most recognized brands in outdoor maintenance solutions, including turf maintenance, snow management, landscaping, rental, and specialty construction equipment.

Toro implemented their first Fused Deposition Modeling (FDM) printer in 2012. Though they initially only employed the print technology for smaller prototype components, they soon invested in a total of six FDM printers to better serve their customers and develop a more diverse range of build sizes and parts for product groups. Before long, Toro realized how cost-effective it was to print larger parts piece-by-piece, then later fuse them together. This opportunity opened up an entirely new playing field for Toro's additive potential. However,



Example FDM Part with Support Material

as print volumes rapidly increased, it became clear that this growth would be slowed by FDM support removal bottlenecks. Their Minneapolis facility supplies prototype components for over 300 designers, and even with printers running 24/7, there's always room for increased efficiency.

Toro's post-printing bottlenecks became evident as support removal times grew to twice the length of build times - a three-day build time would take six days to clean. The cleaning and support removal process itself was also highly manual, requiring techniciains to dedicate significant time to rinsing, soaking and physically removing support material, which often caused production delays. In addition to manual labor, the post-printing process had a costliness associated with it as well, accounting for 25% of a part's total cost. Though Toro had evolved to be able to develop entire product bodies with additive manufacturing, they were held back by the time and cost of their post-printing processes.

ENABLING SCALABILITY: A SOFTWARE-AUTOMATED SOLUTION

After facing these issues, Toro decided that it was time for a change in their post-printing process in order to match throughput to demand. In 2019, Toro brought new precision and efficiency to its additive workflow with the **PostProcess® BASE™ FDM Support Removal Solution**. With advanced software, hardware, and chemistry, the BASE provides improved levels of consistency from part to part, fewer warped or damaged parts, and increased efficiency.

PostProcess BASE FDM Support Removal Solution

What once demanded significant time and labor has been reduced to just about two hours per week, spent loading, unloading, and rinsing parts from the BASE. The software capabilities of the BASE enable users to store temperature and pressure settings as "recipes", so their post-printing process is as simple as "press play and walk away."

"With the software control over temperature, pressure, agitation, and duration that the BASE provides, our technicians barely have to think about support removal anymore," said Rob McArdell, Product Development Supervisor of Engineering Technical Services at Toro.

In respect to return on their investment, the BASE has brought Toro closer than ever to achieving their ultimate "build time = lead time" goal. "It's integrated very well into our value stream. We went from spending two times the build time to clean parts to spending only 4% of the build time on average. That's a tremendous improvement. Now, it's very rare that something takes us more than a couple of hours to clean and remove all of the support from," stated McArdell.

Plus, between an average **89% decrease in post-printing process times** and over a **90% decrease in operator labor**, the workflow efficiencies that the BASE has opened up haven't just saved Toro resources, it's allowed them to redefine their product offerings, as well.

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Thanks to the breakthrough productivity levels that the BASE achieved, Toro has been able to rapidly manufacture high-quality parts in a shorter amount of time than ever before. With these innovations, Toro has brought the past back to life, while continuing to trailblaze the future of lawn care. The extra time that the BASE allotted to the team meant that they could begin restoring old vintage equipment for the company's museum. Simultaneously, the level of part quality enabled by the BASE opened up new promotional opportunities for Toro.

With a timeline of only twelve days until the world's largest golf show, it would've previously been impossible to get a high-quality product from design to market under those restraints. However, thanks to the rapid support removal efficiencies of the BASE, Toro pulled it off with a day to spare. They were able to debut their autonomous fairway mower at the world's largest golf show, giving it invaluable exposure in their most significant industry.

Regarding these achievements, McArdell said, "Without that rapid support removal, we would've never had time to do this…. the BASE, being a robust machine tool as well as something that's integrated with some very intelligent, user-friendly software, really helped to make this possible."

About The Toro Company

The Toro Company (NYSE: TTC) is a leading worldwide provider of innovative solutions for the outdoor environment including turf and landscape maintenance, snow and ice management, underground utility construction, rental and specialty construction, and irrigation and outdoor lighting solutions. With sales of $2.6 billion in fiscal 2018, The Toro Company's global presence extends to more than 125 countries through a family of brands that includes Toro, Ditch Witch, Exmark, BOSS Snowplow, American Augers, Subsite Electronics, HammerHead, Trencor, Unique Lighting Systems, Irritrol, Hayter, Pope, Lawn-Boy, MTI Equipment and Radius HDD. Through constant innovation and caring relationships built on trust and integrity, The Toro Company and its family of brands have built a legacy of excellence by helping customers care for golf courses, sports fields, construction sites, public green spaces, commercial and residential properties, and agricultural operations.

About PostProcess Technologies

PostProcess is the leader in automated and intelligent post-printing solutions for 3D printed and additive manufactured parts. Founded in 2014 and headquartered in Buffalo, NY, USA, with international operations in Mougins, France, PostProcess removes the bottleneck in the final stage of the 3D printing workflow, post-processing, through a combination of patent-pending software, hardware, and chemistry technologies. The company's solutions automate industrial 3D printing's most common post-printing processes including support, resin, and surface finishing, enabling customer-ready 3D printed parts at scale. The PostProcess portfolio has been proven across all major industrial 3D printing technologies and is in use daily in every imaginable manufacturing sector. Learn more at postprocess.com.