THE WHIRLPOOL CORPORATION

Additive Manufacturing for Production Tooling

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Whirlpool Corporation is the world's leading major home appliance company, with approximately $21 billion in annual sales, 92,000 employees, and 70 manufacturing and technology research centers. The Global Advanced Manufacturing Engineering (GAME) Department works at the forefront of Whirlpool's innovation initiatives identifying and integrating state-of-the-art process technologies in manufacturing operations. As part of their Industry 4.0 efforts, the GAME Department recognized additive manufacturing as a potential means to increase manufacturing productivity and reduce operating costs associated with production tooling.

Whirlpool's current process for production tooling applications, including robot end-effectors, fixtures, jigs, and hand tools, required multiple setups and substantial labor with conventional manufacturing methods. Furthermore, manufacturing engineers routed complex and unique production tooling designs to their plant's tool and maintenance shops, adding to the workload of machinists primarily focused on maintaining production operations. The GAME Department forecasted these production tooling applications to grow with the expansion of automation projects and the rollout of Whirlpool's World Class Manufacturing program across the globe.

To support Whirlpool's automation and process improvement initiatives, Whirlpool requested that the Tauber team develop a strategy to achieve cost savings over conventional manufacturing by using additive manufacturing for production tooling. The team first researched additive manufacturing technologies, materials, vendors, and potential use cases. Next, the team collected computer-aided design files for production tooling across several plants, and analyzed the performance of conventional and additive manufacturing methods for these designs. The team then built a decision support tool to help engineers identify designs that could leverage the strengths and savings of additive manufacturing. The Tauber team tested and refined this decision support tool across four pilot experiments with different collaborative robot end-effectors at three plants. Further, the team conducted extensive interviews with technicians, engineers, tool shop managers, and engineering managers to gauge the applicability of additive manufacturing to future projects. Finally, the Tauber team generated a roadmap for implementation and delivered a technical bulletin to share additive manufacturing knowledge across Whirlpool's engineering network.

The team's analysis showed a potential reduction in the cost of robot end-effectors and manufacturing aids by 56-92% and lead time by 60-76% with additive manufacturing. Moreover, the team predicts that over 500 production tooling projects per year could utilize additive manufacturing with increasing quantities as the World Class Manufacturing program spreads across the enterprise. With adoption of the Tauber team's recommendations for additive manufacturing, the team estimated that Whirlpool will save over $3M across the next three years as a result of production cost savings, lead time savings, and other savings related to production tooling projects.