Unlock the Potential of 3D Printing

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Tech analysts and media pundits perceive 3D printing as transformative technology, while critics are skeptical of the overstatement of benefits brought by 3D printing. However, companies that adopt the technology challenge the orthodox thinking and quickly discover several solutions to unlocking the potential. This article traces three barriers—material limitations, CAD file acquisition, and cost—and examines the rewards realized by companies that tackle these challenges.

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3D printed mold affixed to injection molding machine base

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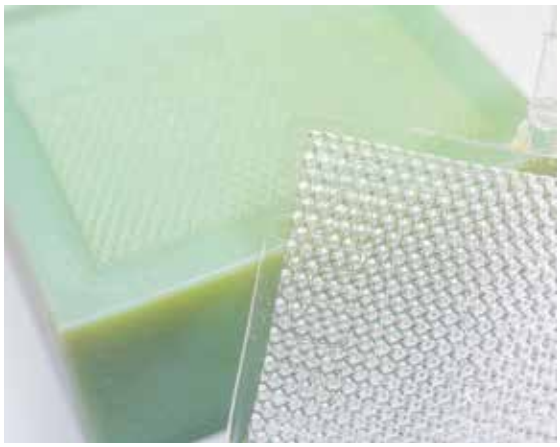
As versatile as they are, 3D printed molds have been misperceived for their limitations in withstanding the constant heat and pressure of long production runs. Even though these molds are not replacements for metal injection molds in mass production, 3D printing unlocked new potential for Japan-based Swany. The President, Yoshihiro Hashizume, encourages his engineers to use their Connex 3D printer to explore new concepts -- “Without new ideas, we cannot compete.” 3D printing has enabled Swany to rapidly print injection molds for concept modelling and functional prototyping, resulting in new contracts and jobs at Swany that were previously lost to locations in Asia with lower labor costs. Variations of a design are now produced for different evaluations and assessments. Engineers are able to revise design iteration easily and efficiently, resulting in better products and faster time-to-market.



Injection molded prototype of LED headlight reflector that will be applied to metal backing to form finished piece

Unlock the Potential of 3D Printing

ULA will 3D print flight-ready components

Material limitations are diminishing as new materials designed for 3D printing become available. Few organizations have higher material standards than United Launch Alliance (ULA), a joint venture of Lockheed Martin Space Systems and Boeing Defense, Space & Security that builds launch systems capable of rocketing past the troposphere, stratosphere and even beyond the 3D printing hype-sphere. Kyle Whitlow, a ULA structural engineer, explains that “innovations through additive manufacturing are really pushing ULA to be leaner, more cost-effective, more efficient, and enabling us to implement new, innovative technologies into our design process and flight structures in a way that hasn’t been done in the past.” A new initiative at ULA will replace the existing design for the rocket’s Environmental Control System (ECS) ducts to a Fused Deposition Modeling (FDM) thermoplastic.

ULA was concerned that the extreme operating conditions during a launch would preclude the use of 3D printing. Those concerns disappeared thanks to a material released in recent years: "ULTEM 9085 has great strength properties over a wide temperature range," said Greg Arend, Program Manager for Additive Manufacturing at ULA. "We have done testing to show that it is very capable of withstanding temperatures from cryogenic all the way up to extreme heat. And it's tough enough to handle the vibration and stress of lift off and flight. We are very satisfied with its performance." ULA slashed production costs for the ECS by 57% and reduced the assembly from over 140 production parts to just 16.

3D printed ECS duct with ULTEM 9085 material for its ability to withstand a wide range of extreme temperatures

Unlock the Potential of 3D Printing

3D printed prototypes of the fan next to their finished counterparts

Such progress is only possible when companies reimagine a part from the ground up. Reducing the number of parts in an assembly requires CAD files designed for 3D printing's unique capabilities. Omer Krieger, General Manager of Stratasys Asia Pacific and Japan, notes that "You need to think entirely different, in order to design for something that you want to manufacture by additive manufacturing." 3D printers are capable of creating complex geometries difficult to duplicate with traditional manufacturing. Thus, how to create CAD files that can be 3D printed presents a key challenge.

Professor Kwok-sui Leung at the Prince of Wales Hospital in Hong Kong recognized that he could use the digital data captured by medical imaging to boost the success and accuracy of surgeries. "Patients' 3D printed bone models are used to test different positions of stabilizing plates or screws," said Leung. "3D printing allows in-depth assessment and pre-surgical rehearsal, resulting in a smooth operation process in which implants are more accurately fitted to the curvature of the patient's bone." Through this repeatable procedure for creating plastic guides based on an individual's unique anatomy, the risk of bleeding and subsequent infection is reduced. With the right digital models, 3D printers can save lives.

Despite dramatic benefits, many organizations say they have yet to adopt 3D printing due to the perceived cost of the technology. Chimei Group, a consumer product company based in Taiwan, used to outsource prototype production. A single prototype could cost as much as US$700 and take six to ten days to produce. By bringing a 3D printer in-house, prototype production has been reduced to a couple hours and the cost has been lowered by 10-20 percent per part. "Quick turnaround time and accurate models are critical to optimize our design validation process, thereby shortening time to market and ultimately, sustaining our competitive advantage," said the design manager of Chimei.

Chimei used 3D printing to quickly and cost-efficiently verify the function of its remote-controlled fan

Unlock the Potential of 3D Printing

3D printing has helped propel Triple Eight Race Engineering to multiple motor racing championships

Australian motor racing team Triple Eight realized similar benefits from in-housing 3D printing. The team reduced prototyping time by nearly 70 percent and cut costs by 90 percent by replacing a third-party service bureau with their own Dimension 3D printer. “Producing close to 20 different parts with complex geometries on a regular basis for testing would have been nearly impossible without 3D printing solutions,” said Craig Johnstone, Machine Shop Manager of Triple Eight. He added that “the accuracy and level of customization allows us to detect any flaws and effortlessly repeat production till perfection.”

Some barriers such as cost, speed, and materials; can be overcome simply by adopting appropriate machines, material choice and learn from best practices. Others, like the challenge of creating the requisite CAD files, necessitate clever thinking to leverage existing data as much as possible. In both cases, companies that overcome these barriers see lower costs, shorter lead times, reduced assembly work, new business, and even the potential to save a life.

3D printed seat mount prototype compared to the final end-use part

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