



HIGHLIGHTS OF A FORUM

Convened by the Comptroller
General of the United States

June 2015

Why GAO Convened This Forum

Additive manufacturing has the potential to fundamentally change the production and distribution of goods. Unlike conventional or subtractive manufacturing processes, such as drilling, which create a part by cutting away material, additive manufacturing builds a part using a layer-by-layer process. Additive manufacturing has been used as a design and prototyping tool, but the focus of additive manufacturing is now shifting to the direct production of functional parts—parts that accomplish one or more functions, such as medical implants or aircraft engine parts—that are ready for distribution and sale.

On October 15-16, 2014, GAO, with the assistance of the National Academies, convened a forum to discuss the use of additive manufacturing to directly produce functional parts, including its (1) opportunities, (2) key challenges, and (3) key considerations for any policy actions that could affect its future use.

Forum participants included officials from government, business, academia, and nongovernmental organizations that were selected to represent a range of viewpoints and backgrounds. This report summarizes the ideas and themes that emerged during the forum and the collective discussions of the forum participants. This report does not necessarily represent the views of the organizations whose representatives participated in the forum, including GAO. Participants were given the opportunity to comment on a draft of this report and their technical comments were incorporated, as appropriate.

3D Printing

Opportunities, Challenges, and Policy Implications of Additive Manufacturing

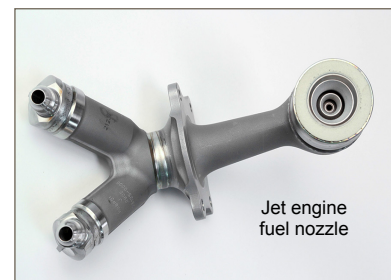
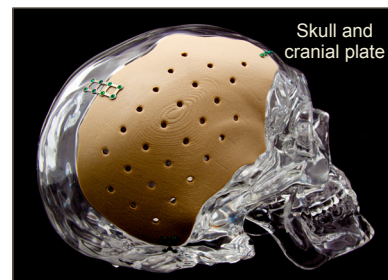
What Participants Said

Forum participants identified many opportunities for using additive manufacturing—also known as three-dimensional (3D) printing—to produce functional parts and discussed benefits that have been realized in the medical, aerospace, and defense sectors. For example, they said that the medical industry is using additive manufacturing to produce customized prosthetics and implants, including cranial implants (see fig.). Because it is made specifically for a patient, the part results in a better fit, which leads to a better medical outcome. In the aerospace industry, participants said additive manufacturing was used to design and produce a complex jet engine fuel nozzle as a single part, which will reduce assembly time and costs for the engine (see fig.). Participants identified some future applications of additive manufacturing including enhancing supply chain management. Overall, participants concluded that additive manufacturing will not replace conventional manufacturing, but rather it will be an additional tool for manufacturers to use when it is appropriate from a cost-benefit perspective.

Forum participants identified three broad groups of challenges in using additive manufacturing to produce functional parts: (1) ensuring product quality, (2) limited design tools and workforce skills, and (3) supporting increased production of functional parts. First, they identified challenges related to building quality parts, such as the need to improve the quality control of the additive manufacturing process. Second, they said that existing design and analytical tools combined with an insufficiently skilled workforce could limit the use of additive manufacturing and its ability to reach its potential for greater innovation. Finally, participants identified challenges that affect the increased production of functional parts, such as the need for an improved industrial infrastructure, including more robust supply chains of machines and materials.

Forum participants identified key considerations for potential federal policy actions that could affect the future use of additive manufacturing, including industry challenges, areas affected by additive manufacturing growth, and trade-offs. Although there was no consensus on specific policy actions needed and many participants suggested caution on potential government action, participants discussed several areas of potential government involvement, such as coordinating standards setting, considering risks for infringement of intellectual property rights with regard to additive manufacturing products, and encouraging a national dialogue about the government's role and its goals.

Examples of Additively Manufactured Parts



Sources: Oxford Performance Materials, Inc. (left) and General Electric (right). | GAO-15-505SP