Additive Manufacturing: An Exposé on the Diversity of Industrial Use
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Executive Summary From its earliest days as a method of rapid prototyping to its latest evolution in support of end-use parts, Additive Manufacturing (AM) has been a true enabler for its users such as the designer (performance validation), marketer (concept realization) and customer (end-use products). As materials and processes have matured there has been an increase in industry acceptance and diversity in part deployments. This presentation will highlight some of the common requirements that have been gathered from industry as well as demonstrations of parts (both graphically and in-person). The pervasiveness of this manufacturing technology is affecting a multitude of industries from fashion to defense and challenging the design community to fully realize additive techniques' capabilities. This presentation's intent is to increase awareness of the additive industry, its customers and where industrial users would like to see it go.

Figure 2 Aerospace Component (Morris Technologies, Inc.)

Figure 1 Medical Implant (Oxford Performance Materials)

Industrial Requirements ASTM International has categorized and defined AM techniques into seven additive manufacturing processes. While this presentation is not intended to expound on applications possible per each process, it will review some common industrial requirements that have been met by several of these processes. As requirements vary between components, assemblies and operational environments, it is beneficial to periodically benchmark AM processes against such requirements. This presentation will highlight processes currently meeting such industrial requirements and will show how process advancements are enabling increases in AM acceptance and usage.

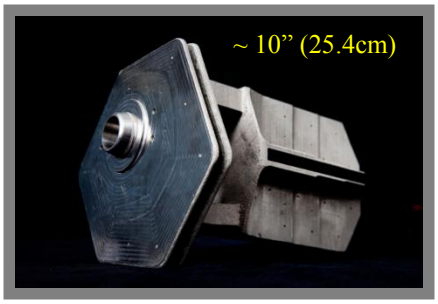

Figure 3 Deep Space Component (CalRam, Inc.)

Industrial Application It is often difficult to shed old habits. Applying "prototyping" to additive techniques is a prime example. How is industry maturing from solely prototype-based application to a more robust use of additive technologies? This presentation will discuss the use-cases from industries such as aerospace and medical and how companies are positioning to meet current and expected customer demand. An interesting measure of viability within a given technology is the pervasiveness of a solution where I define *pervasiveness* as the number of heterogeneous opportunities realized by a given solution; in this case additive technology. In other words, is additive manufacturing only found in a particular firm, in a particular

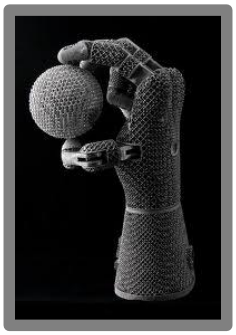

Figure 4 Robotic Arm (Oak Ridge National Lab)

industry? This presentation will delve into the breadth of industrial AM applications and help to focus on both current and emerging areas of insertion. The presentation will also look high potential areas to provide even more products to even more industries.

Challenges / Opportunities From an industrial perspective many current and prospective adopters agree that improved reliability, broader offerings of materials, increased access to material design data and increased robustness in the supply chain would increase industrial adoption. While the "what" may be better defined than the "how," the US has taken a Fraunhofer-like approach to create necessary conditions to promote investment for such advancements within additive technology. The National Additive Manufacturing Innovation Institute (NAMII) is currently underway and the first round of projects has been awarded. This presentation will provide a snap-shot of the NAMII technology roadmap that identifies such challenges and opportunities to advance the adoption of additive technologies.

Figure 5 WWW.NAMII.ORG