

An Overview of Metal Additive Manufacturing in Aerospace and Space Exploration Applications

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ABSTRACT

The Aerospace and Space Exploration (Aerospace) industries have been early adopters of Metal Additive Manufacturing (AM) or Metal 3D Printing technology, for both commercial and military applications.

Metal Additive Manufacturing technology has some great attributes that make it a great fit for aerospace applications, such as: designing of complex components; allowing incorporation of multiple components into a single additive manufacturing part; shortening product development cycles via rapid prototyping with scalability to low-volume production; extending product life by providing a route to produce obsolete spare parts; and creating a robust supply chain with ability to produce new components and spare parts on-demand.

The aerospace industry is utilizing or evaluating a range of AM-grade metal powders and additive manufacturing technologies. Additive manufacturing materials of interest include: stainless steel, nickel alloys, cobalt alloys, titanium alloys, superalloys, and aluminum alloys. Additive manufacturing technologies adopted or being explored by these industries include: laser powder bed fusion, direct energy deposition, binder jetting, fused deposition, and friction-stir technology.

With recent advances in Metal Additive Manufacturing technology, improved build quality, robust supply of metal powders, material reuse, ease of scalability, larger build size, and creation & adoption of industry standards are anticipated to result in faster and wider adoption of technology by the aerospace industry.

INTRODUCTION

Additive manufacturing, also referred to as “3D Printing”, has broken the mold both figuratively and literally. The concept of building a part, layer by layer, allows components to be manufactured that were not previously possible by traditional manufacturing techniques.