

NASA's In-Space Manufacturing Project: Materials and Manufacturing Process Development Update

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The mission of NASA's In-Space Manufacturing (ISM) project is to identify, design, and implement on-demand, sustainable manufacturing solutions for fabrication, maintenance and repair during exploration missions. ISM has undertaken a phased strategy of incrementally increasing manufacturing capabilities to achieve this goal. The ISM project began with the development of the first 3D printer for the International Space Station. To date, the printer has completed two phases of flight operations. Results from phase I specimens indicated some differences in material properties between ground-processed and ISS-processed specimens, but results of follow-on analyses of these parts and a ground-based study with an equivalent printer strongly indicate that this variability is likely attributable to differences in manufacturing process settings between the ground and flight prints rather than microgravity effects on the fused deposition modeling (FDM) process. Analysis of phase II specimens from the 3D Printing in Zero G tech demo, which shed further light on the sources of material variability, will be presented. The ISM project has also developed a materials characterization plan for the Additive Manufacturing Facility, the follow-on commercial multimaterial 3D printing facility developed for ISS by Made in Space. This work will yield a suite of characteristic property values that can inform use of AMF by space system designers. Other project activities include development of an integrated 3D printer and recycler, known as the Refabricator, by Tethers Unlimited, which will be operational on ISS in 2018. The project also recently issued a broad area announcement for a multimaterial fabrication laboratory, which may include in-space manufacturing capabilities for metals, electronics, and polymeric materials, to be deployed on ISS in the 2022 timeframe.