



Space Tools On Demand: 3D Printing in Zero G

Fall 2014



The Made In Space 3D Printer launched to the International Space Station on the fourth installment of the SpaceX Cargo Resupply Service mission.

Today, astronauts aboard the International Space Station depend on cargo resupply missions to ferry parts and tools from Earth, sometimes waiting weeks or months for critical maintenance supplies. As we venture farther into the solar system, these cargo resupply missions will become more costly and complex, compelling NASA to consider alternate options for spacecraft supplies.

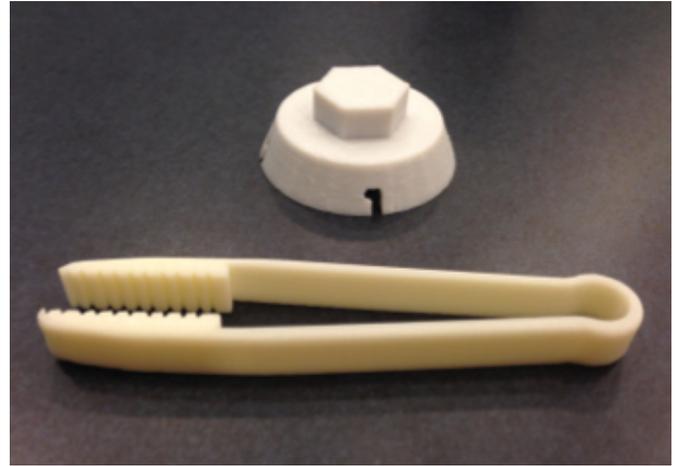
The 3D Print experiment will demonstrate additive manufacturing technology aboard the International Space Station. Additive manufacturing is a way of printing three-dimensional (3D) components from a digital model. If you think of a common office printer, it uses a 2D file to print images and text on a sheet of paper. A 3D printer uses a 3D file to deposit thin layers of material on top of each other, creating a 3D product.

This technology demonstration is the first step toward realizing a microgravity 3D print-on-demand “machine shop” for long-duration space missions—a vital component for sustainable, deep-space human exploration, where there is extremely limited availability of Earth-based logistics support.

To prepare for a future when parts can be printed on-demand in space, NASA’s Marshall Space Flight Center in Huntsville, Ala., and Made in Space of Mountain View, Calif., have partnered to develop and launch the first 3D printing experiment to the International Space Station. The first 3D printer in space uses extrusion additive manufacturing, which builds objects layer by layer out of Acrylonitrile Butadiene Styrene (ABS) plastic (the same material that is used to manufacture a Lego® brick) and other materials. More than 20 parts will be printed from computer-aided design files loaded onto the printer, with the ability to uplink additional files from Earth.

NASAfacts

For this mission, NASA awarded Made in Space a Phase III Small Business Innovation and Research Contract. The Small Business Innovation Research (SBIR) program is a highly competitive program that encourages domestic small businesses to engage in federal research and development that has the potential for commercialization. Through a competitive awards-based program, SBIR enables small businesses to explore their technological potential and provides the incentive to profit from its commercialization. By including qualified small businesses in the nation's research and development arena, high-tech innovation is stimulated and the United States gains entrepreneurial spirit as it meets its research and development needs.



The plastic tools above were printed with the Made In Space 3D printer and are representative of tools used by the space station crew.

The ability to 3D print parts and tools on demand will dramatically reduce the time it takes to get parts to orbit and increase the reliability and safety of space missions, while dropping costs. Current space missions take months to years to get parts to orbit. With 3D printing, parts can be built within minutes to hours. The 3D print hardware launched to the space station in Fall 2014.



Astronauts who pioneer the solar system and Mars will use additive manufacturing to print 3D supplies such as tools and equipment.

Student Space Station 3D Print Challenges

NASA and the American Society of Mechanical Engineers Foundation have issued a “Future Engineers” printing challenges for the first 3D printer aboard the International Space Station. Open to K-12 school students, the challenge calls on students to design items for 3D printing on the space station. The winning student will watch from NASA's Payload Operations Center with the mission control team as the item is printed in space.

To sign up for more information on the challenge, visit: <http://www.futureengineers.org>

More about the 3D printer:
<http://go.nasa.gov/QFDI60>

More about Made in Space:
<http://www.madeinspace.us>

More on the SBIR Program:
<http://sbir.nasa.gov>

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