

FEDERAL PROGRAMS THAT SUPPORT MAKERS

Agency/Bureau: In-Space Manufacturing (ISM) Initiative, NASA

- *Why is making important to your agency? Describe your targeted goals and outputs.*

NASA's ISM Initiative is focused on developing the technologies, skills, and processes required to provide affordable, sustainable on-demand manufacturing, recycling, and repair during long-duration space missions.

- *Brief overview on how your organization/program(s) supports Making?*

In order for NASA to have these capabilities in place to support Exploration missions, ISM is leveraging the rapidly-evolving technology development underway within industry and academia in this arena. This involves innovative collaboration across everything from maker spaces to crowdsourcing to National Space Grants to Broad Agency Announcements (BAAs) and Small Business Innovation Research (SBIR) awards.

- *Identify customers/stakeholders, resources (funding levels, equipment), and federal partners.*

Grants/awards range from hundreds to millions of dollars, and are made to universities, small and large industry, and even individuals via crowdsourcing challenges.

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- *Identify challenges that inhibit the impacts of your work.*

Establishing quick, agile collaborative mechanisms that reach traditional, as well as non-traditional, proposers. NASA also provides consultants/advisors, when applicable, to limit the amount of 'NASA-ease' required to develop space systems.

- *Identify opportunities to enhance or scale your current services to makers.*

Given that the core needs for on-demand manufacturing (i.e. technologies, material development, digital threads, certification processes and standards, etc.) are common across multiple government sectors (DoD, NASA, etc.), it would be incredibly advantageous for a virtual collaboration platform to be established that would permit controlled sharing of data, designs, processes, and even encourage joint solicitations with pooled funding, etc.

- *Identify one way that the Making IAWG can support, promote, or amplify your work.*

Help increase awareness of NASA's desire to work with non-traditional government proposers to develop these novel capabilities and establish a collaborative virtual forum that allows day-to-day, working-level interaction across government sectors in this arena.

SUCCESS STORY

Agency/Bureau: In-Space Manufacturing (ISM) Initiative, NASA

Project: Future Engineers National Stem Program

Goal: Workforce development for 3D design skills.

Tools: The Future Engineers website (www.futureengineers.org) serves as an engaging, one-stop-shop for students, parents, teachers, etc. for creating 3D designs. The website hosts regular national, K-12 challenges and includes free 3D design tutorials for every age and skillset.

Challenge/Opportunity: Future Engineers is an online platform that develops, hosts, and administers student challenges with an emphasis on K-12 STEM education. Future Engineers' issues national challenges, inviting students across the country to simultaneously participate in design competitions, whether individually at-home or via teacher facilitation in the classroom.

Results/Impact: Via a SAA between NASA and ASME, Future Engineers has successfully conducted five national challenges to date with student participation from 45 states. The program has received national recognition for the first student-designed part to be 3D printed in space, as well as multiple awards including the Five Years of Excellence in Federal Challenge & Prize Competition Best Student Challenge Award (2015), the Popular Mechanics Breakthrough Award (2015), and the ASME Summit Award. Lastly, the Future Engineers Director has been awarded Phase I and II DoE SBIR awards to grow this platform across multiple subjects and sectors.

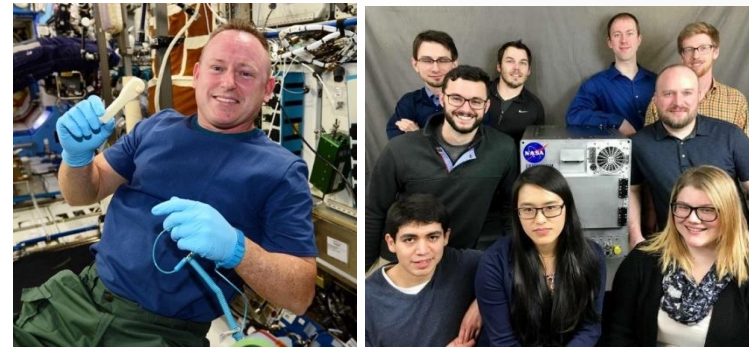


Making Makers: The grand prize for the first Future Engineers Challenge was for the winning design to be the first student designed part to be 3D Printed in space. RJ Hillian was the national winner and was invited to the NASA Payload Operations Center (top) to talk to the astronauts on the International Space Station (ISS) about his design of the Multipurpose Precision Maintenance Tool (bottom). RJ contributed his decision to major in Aerospace Engineering to his experience with Future Engineers and he hopes to work for NASA in the future.

SUCCESS STORY

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- **Project:** In-Space Manufacturing (ISM) SBIR Awards resulting in spaceflight projects
- **Goal:** The NASA ISM Initiative leverages industry and academia to develop the technologies needed to enable on-demand manufacturing, recycling and repair during space missions.
- **Tools:** NASA SBIR Program , including Phases 1-3, as well as SBIR Enhancements.
- **Results:** In four short years, ISM has awarded 24 SBIRs (Fourteen Ph. 1, Six Ph. 2, Two Ph. 2X, Two Ph. 3) resulting in three ISS first-time technology demonstrations, including the first 3D Printer in space and the first integrated 3D Printer and Recycler.
- **Solutions:** Three of the awarded SBIRs have resulted in first-time technology demonstrations on the International Space Station (ISS) including the first 3D Printer in space, the first commercial 3D Printer in space, and the first integrated 3D Printer/Recycler. Additionally, the awardees have developed multiple patents and novel terrestrial capabilities.



Left: Commander Butch Wilmore holds a wrench manufactured on the first 3D Printer in Space which was developed under a NASA SBIR contract with Made in Space, Inc. (MIS)
Right: Members of the Tethers Unlimited, Inc. (TUI) team posing with the Refabricator Engineering Test Unit (ETU) developed under a NASA SBIR contract. The Refabricator is the first integrated 3D Printer/Recycler and will be launching to ISS in Spring 2018.