NASA SBIR 2015 Phase I Solicitation

H14.03 Recycling/Reclamation of 3-D Printer Plastic Including Transformation of Launch Package Solutions into 3-D Printed Parts

Lead Center: MSFC

Participating Center(s): ARC, JSC, KSC

The National Aeronautics and Space Administration (NASA) has a long-term strategy to fabricate components and equipment on-demand for crew exploration missions. The greater the distance from Earth and the longer the mission duration, the more difficult resupply becomes; thus requiring a significant change from the current space travel supply chain model. The ISS is an ideal platform to begin testing and transitioning from the current model for resupply and repair to one that is more suitable for exploration missions. 3-D Printing, more formally known as Additive Manufacturing, is the method of building parts/objects/tools layer-by-layer. 3-D Printers on-board ISS will use extrusion-based additive manufacturing, which involves building an object out of plastic deposited by a wire-feed via an extruder head. While this process does provide on-demand capability for printing parts, to truly develop a self-sustaining, closed-loop on-orbit manufacturing process that will result in meaningfully less mass to launch and enabling space exploration, a means of recycling/reclaiming readily available materials will ultimately be required.

NASA seeks launch packing solutions that can be composed of materials suitable for recyclable processing into 1.75mm filament and subsequently 3-D printed parts. This capability will significantly decrease current waste and substantially increase sustainability. The solution may be obtained using a variety of approaches, such as:Â

- Converting commonly used 3-D printing feedstocks into packing solutions, including but not limited foam or bags.
- Transforming traditional packing materials into 3-D Printing feedstock.
- Developing a technology that utilizes a novel approach to identify compatible materials for both packing solutions and 3-D Printing. For example, this could include such materials as netting, fabrics, structures, containers, etc.

Examples of traditional packing materials currently used for ISS, as well as commonly used feedstocks and types of 3-D Printed parts are provided below. These are intended to serve as examples rather than requirements. The proposal does not have to be limited to these materials:Â

- Foams currently used on ISS:
  - Plastazote (LD24FR & LD45FR).
  - Polyethylene.
  - Polyurethane.
  - PVDF.
  - PTFE film (for bubble wrap).

- Bagging materials currently used on ISS:
    - Pink Poly (not pink and white).
    - Llumaloy (good for ESD compatibility).
    - Tedlar (particularly for containment).
    - Kynar (positive flammability ratings).
- Common Feedstock Materials:
    - ABS.
    - PTFE.
    - PEAK.
    - Ultem.
- Examples of 3-D Printed Parts:
    - Common hand tools.
    - Handles, containers.
    - Clips.
    - Personal items such as grooming tools.
    - â€˜Seat trackâ€™ strips.
    - Corresponding studs.

Phase I Deliverable is a Technical Feasibility Study and should provide:Â

- Demonstration of a close-looped system that provides launch packing solutions that can be recycled into 1.75mm filament for creating 3-D Printed parts without requiring any additional mass other than the shared packing/printing materials and process. The 3-D Printed part(s) must be able to be printed using 1.75mm filament feedstock via a Fused Deposition Melting (FDM) process.
- A materials assessment, which addresses such things as materials composition, flammability, toxicity, off-gassing, etc.
- Technology Readiness Level (TRL) rating from 2-5.
- A Systems Engineering and Proposed Design path for developing an ISS locker-sized hardware demonstration for functional testing at the completion of the Phase II contract.

The ultimate objective is to evolve this technology into a Phase II SBIR ISS Technology Demonstration payload.Â