



NASA SBIR 2017 Phase I Solicitation

H7.01 In-Space Manufacturing of Electronics and Avionics

Lead Center: MSFC

Participating Center(s): ARC

Technology Area: TA12 Materials, Structures, Mechanical Systems and Manufacturing

The purpose of this subtopic is to encourage highly collaborative research and development in the area of In-Space Printable Electronics capabilities geared towards laying the foundation and infrastructure for the next generation of in-space advanced electronics manufacturing technologies.

Hardware

3D Electronics Manufacturing Hardware Miniaturization and Adaptation for Microgravity Environment including but not limited to:

- Repackaging and modularization of commercially available state-of-the-art electronics printer platforms such as: aerosol jet, ink-jet, poly-jet, and fluidic dispensing systems.
- Addition of in-line 3D scanning metrology processes to existing printer platforms.
- Implementation of in-line laser and photonic sintering processes into existing electronics manufacturing platforms.
- Integration of advanced robotic and automation processes into printing processes to facilitate hybrid electronic manufacturing and assembly.
- Introduction of advance automated multi-material handling and delivery into electronics manufacturing processes.
- Incorporation of open source flexible hardware architectures into existing printer platforms to promote highly specialized and advance electronics manufacturing solutions.

Software

Advanced Software Development for Ultimate Portability and Autonomy for use in Microgravity based 3D Electronics Printers and Manufacturing Systems:

- Development of open-source flexible intuitive software environments and applications that integrate multiple electronic printing methodologies including but not limited to: aerosol jet, ink-jet, plasma-jet, FDM, fluidic and laser assisted dispensing.
- Improving existing open-source software platforms to support advanced open electronics printer hardware configurations and architectures to support the addition of cutting-edge metrology and digital manufacturing solutions.
- Introduction of advanced integrated design and manufacturing graphical user environments that support

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- autonomous and tele-operation of 3D electronics printers and manufacturing systems.
 - Implementation of Graphical user-friendly utilization cataloging and database software to support organization, classification, and utilization of in-space manufactured avionics.
 - Development of new versatile algorithms and software processes geared towards 3D electronics printer robotic tool-path planning and routine development from inside electrical and mechanical design environment.
 - Advance the state-of-the-art in portable mechanical and electrical design packages for in-space manufacturing through the development of integrated electrical and mechanical design software and tools that include support for in-space multi-material avionics parts production.

Phase I Objectives - Near term performance targets consist of electronics printer prototypes aimed at the in-space production of novel avionics products that are commonly based on passive electronic elements such as: resistors, capacitors, inductors, transformers, and diodes to supply on-orbit non-critical avionics parts production. Near term software targets will focus primarily on increasing portability and reliability of existing open software architectures for 3D printing to include support for in-space 3D electronics printing and multi-material advanced manufacturing processes. *Ending TRL 4 for Hardware and Software Prototypes.

Phase II Objectives - Mid-term objectives will seek to improve existing in-space electronics manufacturing capabilities to include higher complexity active electronic elements such as semiconductor based avionics products. *Ending TRL 5-6.

Phase III Objectives - Far-term objectives will include continued development of advanced in-space electronics manufacturing infrastructure and seek to introduce feasible concepts for deployable self-replicating and self-supporting avionics manufacturing architectures and systems. *Ending TRL 6-9.