



## **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.