Z3.03-5627 - Additive Friction Stir Deposition for In-Space Manufacturing

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

IERUS Technologies proposes to investigate utilization of additive friction stir deposition (AFS-D), to robotically fabricate and repair large structures in the external space environment. The AFS-D process, commercially known as MELD, provides a new path for coating, joining, repairing and additively manufacturing metals and metal matrix composites The MELD process produces fully-dense, near net-shape structures in open atmospheric conditions without secondary post processing. MELD is a fast, low-power, fully scalable, deposits almost any metal on the market and builds complex 3-D structures without support material. MELD also offers a unique opportunity for in-orbit recycling applications. The MELD process is a capable platform for recycling, using scrap metal chips and damaged components as feedstock to additively manufacture new. MELD could be the technique that unlocks in-space manufacturing potential while simultaneously mitigating orbital debris. The MELD additive manufacturing technique is well suited for on-orbit manufacturing and will bring tremendous advantages

TECHNICAL OBJECTIVES AND PROPOSED DELIVERABLES

Technical Objectives

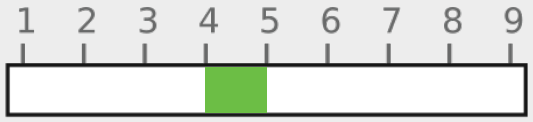
- Develop size, weight, power, and temperature requirements for on-orbit manufacturing
- Develop a preliminary design of a modified AFS-D process with an effort to reduce the footprint, mass and power requirements for on-orbit manufacturing
- Demonstrate rapid build-up of structural aerospace grade metallic materials using the AFS-D process

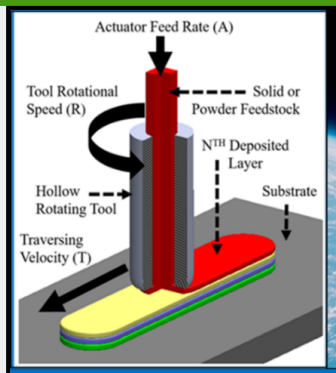
Proposed Deliverables

- IERUS will deliver a preliminary design package of the robotic AFS-D process, detailing the necessary hardware and software modifications for a clear path forward to on-orbit manufacturing.
- IERUS will deliver a thorough ConOps detailing integration of the sub-systems, deployment of the system, and operation within the space environment.

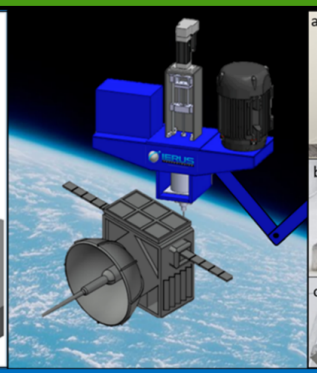
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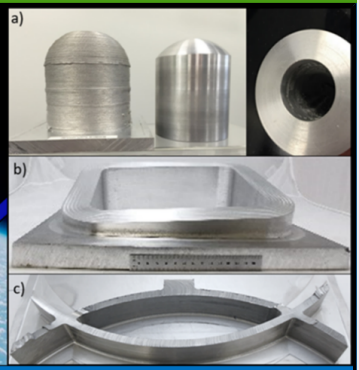




Schematic of the AFS-D process



IERUS proposed in-space AM concept



Previous components fabricated with the AFS-D process

NASA APPLICATIONS

The advantages of the proposed In-space manufacturing stem include the ability to manufacture larger structures, lower launch costs, increased performance, longer satellite life, increased resilience, simplified logistics, and more sustainable spaceflight operations. NASA needs to be ready to move forward and continue scientific and technological advancements by proceeding with in-space manufacturing efforts now.

NON-NASA APPLICATIONS

Commercial markets such as SpaceX's Starlink satellite constellation are emerging that could greatly benefit from the proposed in space manufacturing concept. There also is a continued and constant interest for a commercial space station, that would undoubtedly need in-space manufacturing technologies in order to be successful and reach its true potential.

FIRM CONTACTS

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