

Welding in Space



Name of Technology:

In-Space Welding, inability to join materials

Participating NASA Centers:

LaRC (Lead); MSFC, GSFC

Technological Area:

Z4.07 Advanced Materials and Manufacturing for In-Space Operations

Vision for the Technology:

NASA needs an innovative welding technology to enable repairs, assembly, and manufacturing for on-orbit or Deep Space missions. Crews and robots will need the ability to perform welding in space with multi-materials.

Challenges:

Laser and friction stir welding are technologies that are of interest to NASA because of their high precision, low heat input, and good reliability. Laser welding provides a flexible foundation for assembly, repair, and maintenance. Laser beam welding has the ability of interacting with practically all materials.

NASA Seeks to Meet the Following Specs:

- Rapid prototyping technology to low gravity, 3/8 and 1/6 g level free-form fabrication of

near-net shapes from metals, ceramics, and polymers for fabricating spare parts and repairs.

- Joining and repair of components at the subsystem level, habitat modules, trusses, solar arrays, and/or antenna reflectors
- Repair of metal panels, longitudinal joining of two curved metal panels
- Joining of a truss to an adjacent truss
- Manufacturing and assembly of new parts and structures

Overview of Student Project:

NASA seeks an innovative welding technology(s) to join multi-materials on-demand while on-orbit and on Mars and the moon. Inversely, NASA is interested in laser and friction stir welding and their capabilities and practicality in space.

Innovative Areas Student Projects Can Address:

- Research new welding technologies for use in space
- Research laser and friction stir welding techniques for space applications including the practical everyday use for crew

Project Phases

- I. Conceptual and feasibility study with characteristics
- II. Proof of Concept/Prototype in lab environment

Research Funded by NASA on this Topic:

Proposal Number: 19-1- Z3.02-3008
[Welding and Repair in Space](#)

Proposal Number: 22-1- Z4.07-2773
[Solid State Welding for Space](#)

Proposal Number: 04.14-9500
[Space Welding Power Control Unit](#)

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Proposal Number: 19-1- Z3.01-3319
[High Performance Tungsten Carbide Cermet
and Composite Friction Stir Welding Tools](#)

Proposal Number: 19-2- Z3.01-3986
[Tool Material Design for Friction Stir Welding of
High Strength Materials](#)

References:

[Z4.07 Advanced Materials and Manufacturing
for In-Space Operations](#)

[Z4.01 In-Space Structural Assembly and
Construction](#)

[Z3.02 Development of Mobile Welding
Capabilities for In-Space Manufacturing](#)

[Z3.03 Development of material joining
technologies and large-scale additive
manufacturing processes for on-orbit
manufacturing and construction](#)

[Z3.03 Development of Advanced Joining
Technologies, Large-Scale Additive
Manufacturing Processes, and Metal Recycling
Technologies for On-Orbit Manufacturing](#)

[B1.03 Materials Science for In-Space
Fabrication and Radiation Protection](#)

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