# Welding in Space

**Name of Technology:**
In-Space Welding, inability to join materials

**Participating NASA Centers:**
LaRC (Lead); MSFC, GSFC

**Technological Area:**
Z4.07Advanced 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 in 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

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

Welding in Space – American Welding Society (AWS)