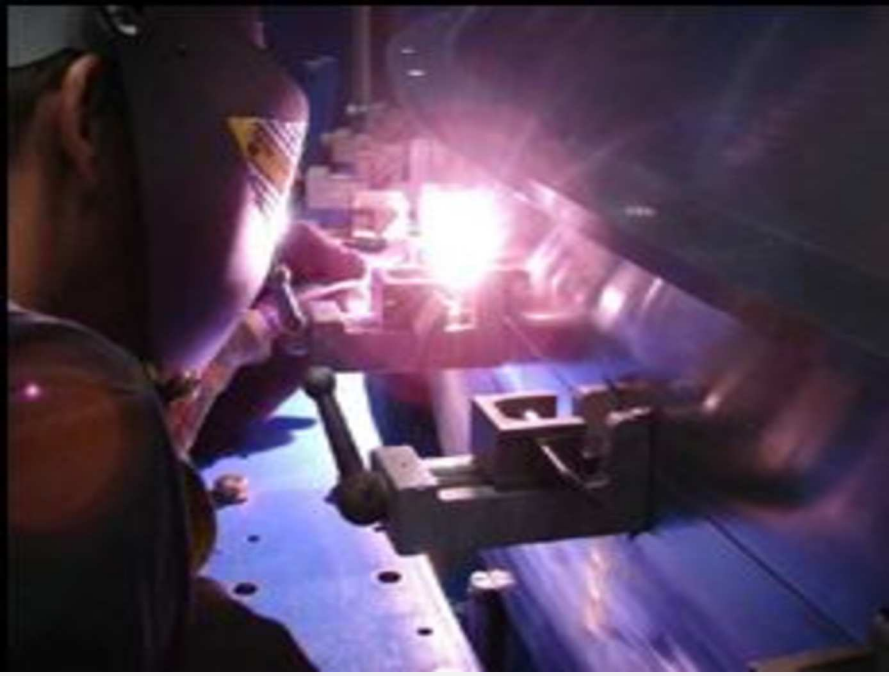


National Aeronautics and Space Administration

Manufacturing

Modular Fixturing for Assembly and Welding Applications

Rigid, adjustable tooling that reduces configuration time and cost

Researchers at NASA's Marshall Space Flight Center have developed new, modular fixtures for holding metal in place during the assembly and welding of cylindrical and conical sections of rocket bodies. Previous methods required time-consuming design, fabrication, and assembly of expensive, project-specific fixtures, which often required up to 6 months of lead time and cost millions of dollars to complete. NASA's modular fixtures are designed to be adjustable and to easily form different fixture body configurations for rocket sections with various diameters and heights. This improved setup efficiency allows for a more rapid shift from one project to the next, reducing the time a newly designed fixture body is complete, allowing welding to begin in a matter of weeks rather than months. NASA is currently seeking licensees that may benefit from modular fixtures in large-scale manufacturing.

BENEFITS

- Modular fixtures can be reused and repurposed for multiple projects of various sizes.
- Tooling design and configuration time is reduced by half.
- Project costs are reduced by as much as an order of magnitude.
- Modular fixtures can enable the economical adoption of friction stir welding.
- Modular fixtures enable large-scale rapid prototype development in a wide range of industries.

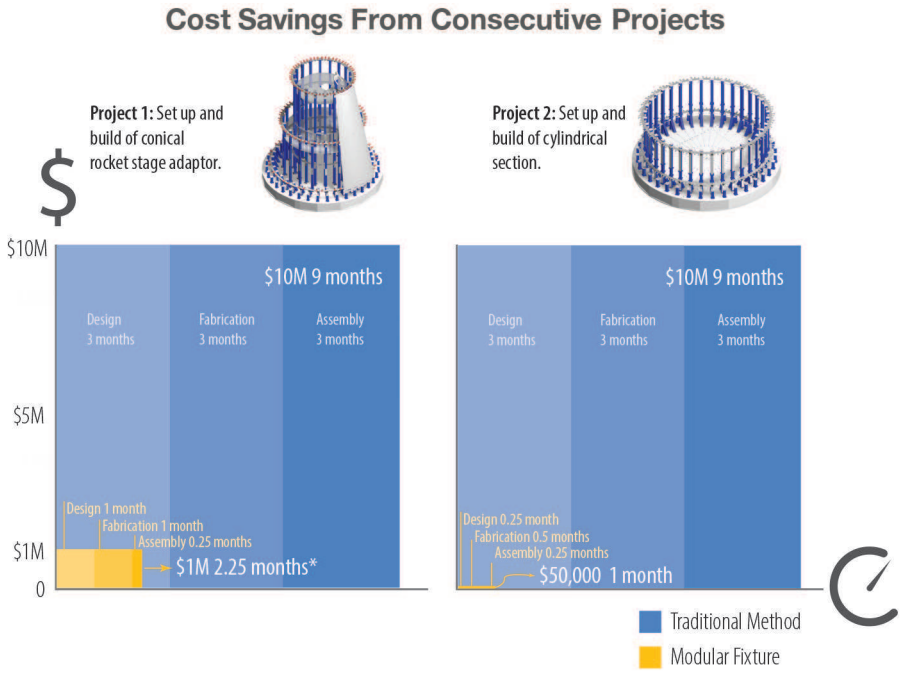
APPLICATIONS

- Shipbuilding
- Airframe assembly
- Pressure vessel assembly
- Commercial space launch vehicle assembly

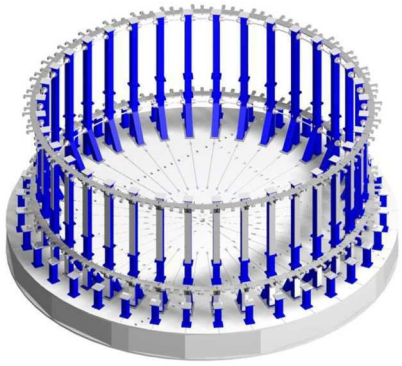
technology solution

THE TECHNOLOGY

NASA's researchers have designed modular fixtures to address inefficiencies in time, labor, and material costs due to the need to fabricate unique, monolithic fixture bodies for different segments of the Space Launch System (SLS). Before NASA staff can configure and weld rocket sections, they must assemble modular tooling atop a large turntable with radial grooves. Supporting braces (tombstones) that form the base of the modular structure slide into radial grooves. Other extending, clamping, and joining fixtures can be variously connected to the base structure to provide circumferential support for producing conical and cylindrical structures. NASA has used the tooling to produce structures with diameters of up to 27 feet. Depending on the desired application, the base can be scaled to produce larger or smaller diameters, and the grooves can be arranged with a longitudinal arrangement for production of parts with bilateral symmetry. The development of these modular fixtures required an initial investment similar to that of a single project's tool design and fabrication costs. Once produced, only a fraction of that time/cost is required to begin all subsequent projects. NASA has used this new, adaptable tooling in the construction of several different rocket stages, proving its cost-saving capabilities.



This graphic illustrates how NASA's development of modular fixtures significantly reduced its costs for designing, fabricating, and assembling welding tooling. *Project 1's cost of $1 million when using the modular fixture method includes the cost for the initial development of the modular fixture platform. Reuse of the modular fixtures results in future cost savings in subsequent projects.



NASA's tooling is made of individual components that are selected, assembled, and adjusted depending on the size and shape of a finished part. CAD models are easily reproduced on the production floor using the modular tooling.

PUBLICATIONS

Patent No: 9,662,751

More Information

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