

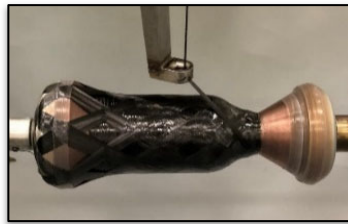


Marshall Space Flight Center Composites Manufacturing

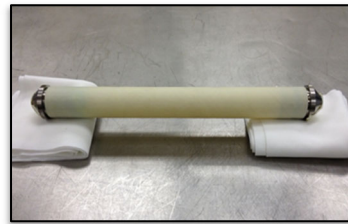
Engineering Solutions for Space Science and Exploration



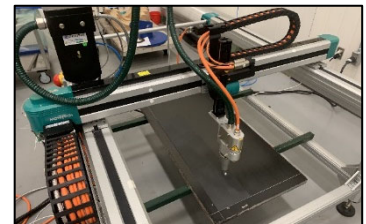
Automated Fiber Placement



Composite Overwrapped
Combustion Chamber



Composite Strut for
Cryogenic Support

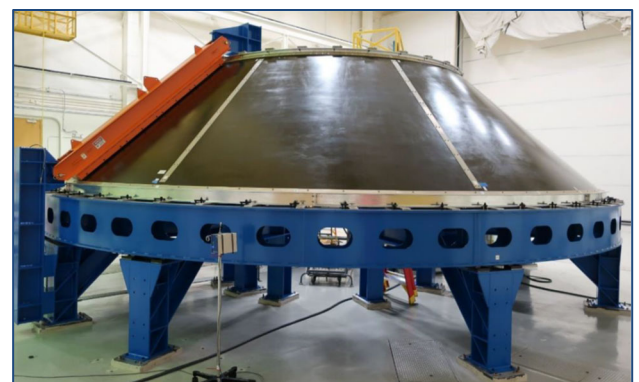
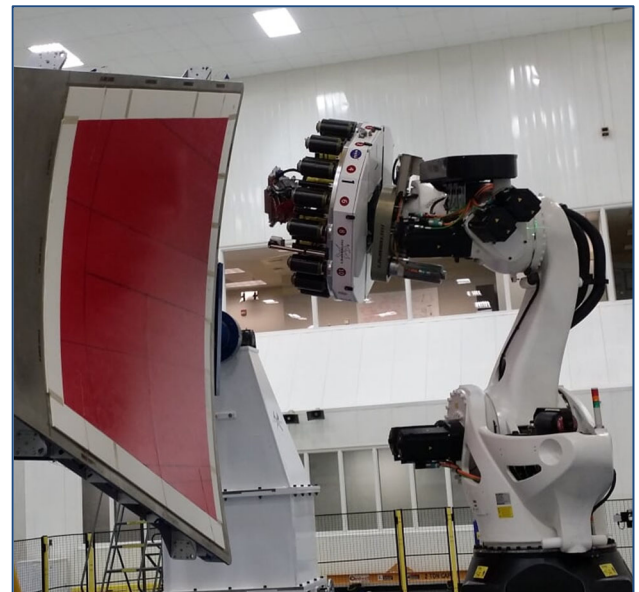


Automated Surface Preparation for
Adhesive Bonding

Composites Manufacturing

capabilities in the Materials and Processes Laboratory at Marshall Space Flight Center (MSFC) include state-of-the-art equipment and facilities coupled with extensive experience and expertise. Key infrastructure includes a modern automated fiber placement (AFP) system capable of precise and repeatable composite layups for large-scale structures; multiple filament winders ideal for composite overwrapped pressure vessel (COPV) and solid rocket motor (SRM) case production; and multiple autoclaves and ovens suitable for a range of composite structure scales. Composites manufacturing personnel work closely with design, analysis, and testing groups to bring composite structures from concept to reality. Together, these capabilities are unique within the Agency with respect to composite structures development.

The composites manufacturing group contributes to a number of NASA efforts across a range of Technology Readiness Levels (TRLs), from small-scale technology development – such as a novel approach to reinforce additively manufactured combustion chamber nozzles via filament winding – to large-scale flight hardware production – such as fabrication and assembly of the Space Launch System (SLS) Payload Adapter (PLA). With a focus on providing unmatched support to a wide range of customers, the composites manufacturing group at MSFC aims to further advance the state of the art in composite structures.



SLS Payload Adapter production at MSFC

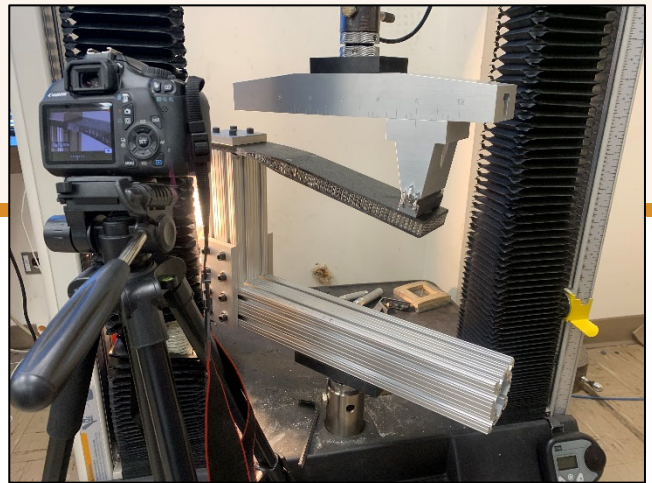
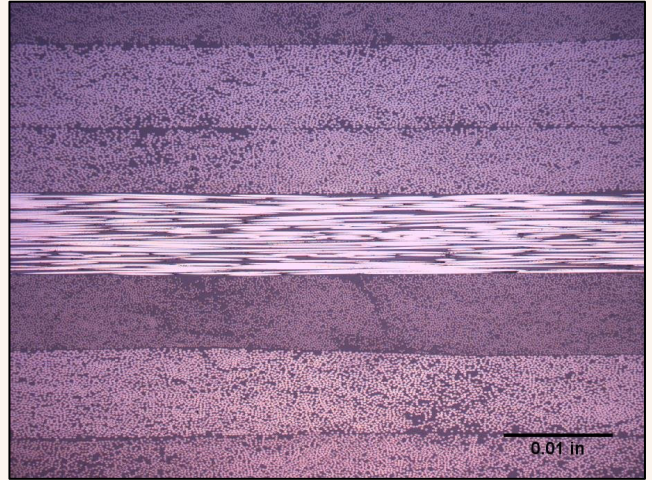
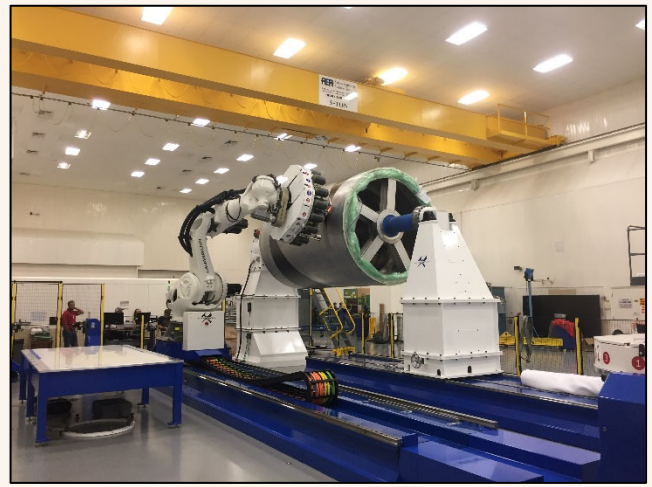
Capabilities

Key Facilities and Equipment:

- 10,000-ft² clean work area suitable for manufacturing of composite structures up to 18-ft diameter
- 5,000-ft² clean room suitable for assembly and integration of structures up to 27.5-ft diameter
- Automated fiber placement (AFP) system with ½-in and ¼-in slit tape heads, rotator assembly capable of accommodating tooling up to 12-ft diameter and 35-ft long, and accompanying laser projectors and laser tracker
- Two four-axis filament winding machines outfitted with state-of-the-art fiber tensioning systems capable of using wet winding and slit tape for producing structures up to 4-ft diameter and 15-ft long
- Three autoclaves: 18-ft × 20-ft. (up to 350 psi and 400°F), 9-ft × 12-ft. (up to 150 psi and 600°F), and 4-ft × 6-ft. (up to 240 psi and 650°F)
- Multiple ovens, from 4-ft × 8-ft to 20-ft × 60-ft
- Multi-zone hot bonder capable of 350°F cures, along with a range of accompanying heat blankets of various sizes

Notable Projects:

- SLS Payload Adapter: includes the development, fabrication, and assembly of 27.5-ft composite frustum for SLS Block IB
- Thermoplastics Development for Exploration Applications (TDEA): focuses on the development of thermoplastic composites manufacturing and joining techniques
- Booster Obsolescence Life Extension (BOLE): aims to develop composite motor cases to replace current steel cases
- Optimized and Repeatable Components in Additive Manufacturing (ORCA): aims to further develop composite overwrap techniques to reinforce turbomachinery housings



Key Benefits

- > The composites manufacturing group at MSFC enables the complete product development of a wide range of composite structures for a variety of space applications. From technology development to flight hardware production, the composites manufacturing group at MSFC is highly capable partner in composite structures development.

For more information, please visit www.nasa.gov/centers/marshall/about/business.html

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