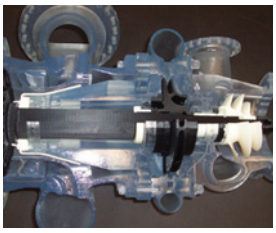
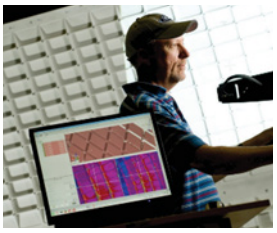
National Aeronautics and Space Administration

Marshall Space Flight Center

Marshall's Materials and Processes Laboratory

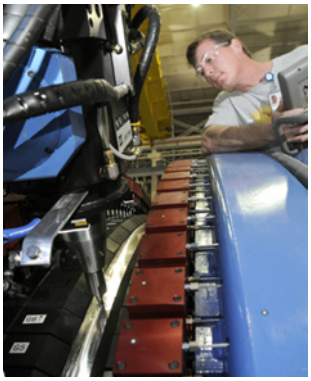




Marshall's Materials and Processes Laboratory has provided core capabilities for NASA for more than 50 years. Marshall has a proven heritage and recognized expertise in the materials and manufacturing essential in enabling and sustaining space exploration. The laboratory provides a "systems wide" capability for applied research, flight hardware development, and sustaining engineering. The lab has provided leadership for the materials and manufacturing discipline through many of NASA's most notable projects including Apollo, Skylab, Mir, Spacelab, space shuttle (main engine, external tank, reusable solid rocket motor, and booster), Space Launch System (core stage, launch vehicle stage adapter, Orion stage adapter), Human Lander System, Hubble, Chandra, and the International Space Station.

The Materials and Processes Laboratory has extensive experience in metals, composites, ceramics, additive manufacturing, materials and process modeling and simulation, material selection, space environmental effects testing, non-destructive evaluation, fracture and failure analysis, mechanical testing, contamination control, and metallurgy. The laboratory provides products ranging from materials research in space to fully integrated solutions to the challenges of large, complex space systems. The capabilities in advanced materials research, development, and manufacturing at Marshall ensure that NASA has access to cutting-edge, cost-effective engineering design and production options capable of using frugal design margins that are verifiably safe and reliable. These capabilities are critical for both future mission success and affordability.

Marshall has a unique capability to develop technology for materials and manufacturing.

The Materials and Processes Laboratory develops, builds, and demonstrates capabilities that solve production challenges in exploration systems. The materials' diagnostic and evaluation capabilities provide rapid-response problem assessment and mitigation throughout all phases of programs. The unique technology development capability for the virtual enterprise, for example, will develop, demonstrate, and transition new or improved methods and models for integrating design, manufacturing, and supply chain management. Recent efforts have focused on developing and implementing digital thread/twin capabilities by developing, demonstrating, and implementing Information Technology (IT) tools which allow for the integration and optimization of the design, analysis, and manufacturing disciplines.



Capabilities

Materials Testing

- Elevated and cryogenic mechanical testing; chemical, crystallographic, thermal, and thermophysical temperatures material properties testing
- Evaluation of oils, greases, dry film lubes, and coatings on materials; highly accurate dimensional and surface measurement expertise
- Bearing applications and computer modeling of bearing systems

Nonmetallic Materials and Manufacturing

- Research, technology, and engineering solutions for nonmetallic materials, processes, and products used in space exploration applications and manufacturing
- Engineering solutions, manufacturing development, and full-scale hardware production of test and flight articles of the most complex sizes and shapes using digital manufacturing, structure light scanning, composites, and additive manufacturing

Materials Selection and Control and Informatics

- Materials and Processes Technical Information System (MAPTIS) — the one location for acquiring, assessing, archiving, and disseminating information to save resources throughout a product lifecycle
- Monitoring of environmental regulatory requirements to assist customers in planning for material supply changes, toxic substance management, and end of lifecycle disposal

Damage Tolerance Assessment

- Evaluations of the ability of structures to perform reliably throughout their service life in the presence of a defect, crack, or other form of damage
- Non-destructive evaluations of hardware to assess the integrity of parts and to reliably detect characteristic flaws

Environmental Effects

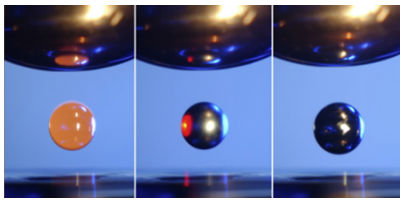
- Valuable materials and processes information related to contamination control and the space environment
- Unique test facilities to simulate spacecraft charging of materials and components at cryogenic temperatures

Metallic Engineering

- World-class support for materials design, development, characterization, and constituent hardware failure analysis
- World-class research in materials science in a microgravity environment on the International Space Station
- Friction stir, thermal stir, ultrasonic stir, and fusion weld development for aluminum and other advanced alloys for aerospace applications
- Manufacturing techniques development for small- to large-scale metallic components using traditional and advanced processes such as spin forming, forging, rolling, casting, powder metallurgy, friction stir welding, and vacuum plasma spray
- High-temperature fuel element materials and processes for nuclear thermal propulsion applications

Key Benefits

- Full lifecycle design, development, testing, and integration of metallic and non-metallic structures into complex systems
- World-class facilities for materials science, materials testing, manufacturing processes development, and lifecycle management
- A 50-year history of materials, manufacturing, and hardware integration expertise in complex aerospace systems
- State of the art in engineering practices and discipline, teaming with other government agencies, industry, and academia to deliver the most value per investment



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