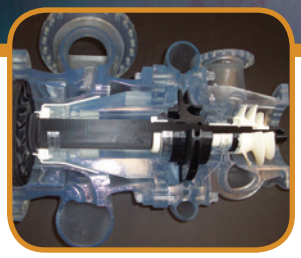
National Aeronautics and Space Administration

Marshall Space Flight Center
Materials and Processes Laboratory


Materials and Manufacturing Solutions for Space Science, Exploration, and Life on Earth

Marshall's Materials and Processes Laboratory

has been a core capability for NASA for over fifty years. MSFC has a proven heritage and recognized expertise in materials and manufacturing that are essential to enable and sustain space exploration. Marshall provides a "systems-wise" capability for applied research, flight hardware development, and sustaining engineering. Our history of leadership and achievements in materials, manufacturing, and flight experiments includes Apollo, Skylab, Mir, Spacelab, Shuttle (Space Shuttle Main Engine, External Tank, Reusable Solid Rocket Motor, and Solid Rocket Booster), Hubble, Chandra, and the International Space Station. MSFC's National Center for Advanced Manufacturing, NCAM, facilitates major M&P advanced manufacturing partnership activities with academia, industry and other local, state and federal government agencies.

The Materials and Processes Laboratory has principal competencies in metals, composites, ceramics, additive manufacturing, materials and process modeling and simulation, space environmental effects, non-destructive evaluation, and fracture and failure analysis provide products ranging from materials research in space to fully integrated solutions for large complex systems challenges. Marshall's materials research, development and manufacturing capabilities assure that NASA and National missions have access to cutting-edge, cost-effective engineering design and production options that are frugal in using design margins and are verified as safe and reliable. These are all critical factors in both future mission success and affordability.

Technology development for materials and manufacturing is unique in its potential reach. For example, it can build capabilities to solve production challenges in exploration systems that dramatically impact the rate of technology transition and directly improve NASA's ability to acquire new systems. Our materials diagnostic and evaluation capabilities provide rapid-response problem assessment, and mitigation throughout all phases of programs. For example, our unique technology development capability for the Virtual Enterprise will develop, demonstrate, and transition new or improved methods and models for integrating design, manufacturing and supply chain management.

Materials and manufacturing R&D are critically important to the nation to enhance U.S. global aerospace and manufacturing competitiveness. Through partnerships and innovative developments such as maturation of friction stir welding, the Materials and Process's capabilities contribute to the viability of a domestic aerospace structures manufacturing industrial base. Subject matter experts in this area provide Marshall a direct link to critical sub-tier suppliers and issues in the aerospace industrial base. Fundamental materials research contributes to the domestic knowledge base and fosters innovation in the commercial sector. Marshall's materials and manufacturing capabilities also frequently "cross-fertilize" into national priorities such as defense, science, homeland security, energy, and civil industry and infrastructure. In some cases, these represent niche (but critical) national research or development capabilities that would not be cost effective to sustain independently in private industry.

Capabilities

POC: Gail Gordon
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Materials Testing

> Real-life and theoretical understanding of materials at the molecular, surface, and bulk level using chemical, compatibility, dimensional, wear, and strength testing methods.
> Materials are evaluated using regulatory methods, industrial standards, and custom protocols in ambient and extreme environments.

POC: Dr. Wayne Gamwell
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256–544–2592

Damage Tolerance Assessment

> Evaluates the ability of a structure to perform reliably throughout its service life in the presence of a defect, crack, or other form of damage.
> Non-destructive Evaluation of hardware to assess the integrity of the part and to reliably detect characteristic flaws.

POC: Timothy Vaughn
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256–544–2607

Metallic Materials Engineering

> Provides world-class support for materials design, development, characterization, and constituent hardware failure analysis.
> Developing manufacturing techniques 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.

POC: Frank Ledbetter
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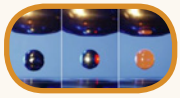
256–544–2673

Nonmetallic Materials and Manufacturing

> Provides advanced materials and processes research and development in areas that include environmentally compliant cryogenic insulation and primers; ablative thermal protection systems; adhesives/bonding; composite nozzle materials; and advanced ceramic matrix composites.
> Provides advanced manufacturing development in areas that include robotics; composites; structured light scanning; photogrammetry; process modeling; kinematic simulation and digital manufacturing/planning; environmentally friendly refurbishment and precision cleaning/surface preparation; and additive manufacturing/rapid prototyping.



POC: Dewitt Burns
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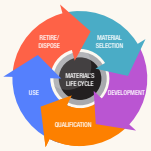
Environmental Effects

> Provides valuable information on materials and processes related to contamination control and the space environment.
> Provides unique test facilities to simulate space environments for evaluating materials and components to verify spacecraft system designs.



POC: Dennis Griffin
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256–544–2493

Materials Selection and Control & Small Projects

> Materials and Processes Technical Information System (MAPTIS) is the one location for acquiring, assessing, archiving, and disseminating materials information to save resources throughout a product life cycle.
> Monitors environmental regulatory requirements to assist customers in planning for material supply changes, toxic substance management, and end of life cycle disposal.

Key Benefits

> Full life-cycle 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 life cycle management.
> A 50 year history of materials, manufacturing and hardware integration expertise in complex aerospace systems.
> We embody the state of the art in engineering practices and discipline, teaming with other government agencies, industry and academia, partners to deliver the most value for the investment.

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Dr. Surendra Singhal, Deputy Lab Manager, 256–544–4236

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