National Aeronautics and Space Administration

Marshall Space Flight Center
Systems Development, Integration & Test

Engineering Solutions for Space Science and Exploration

Instrument Development

Environmental Control and Life Support Systems

ISS Payload Integration

Systems Development, Integration and Test

Systems Development, Integration and Test provides testing of instruments, racks, payloads & subsystems and design & development of specialized sensors & science instruments. Subject matter experts in test methods, planning, procedure development, test data and test reporting are focused on Environmental Control Life Support System (ECLSS), Microgravity Science Research Rack (MSRR) and Hurricane Imaging Radiometer (HIRad). Development activities include the definition, design, integration and operation of flight hardware utilizing a wide variety of disciplines located within the division focused specifically on orbital and suborbital payload and instrument development. Examples of the activities include the Environmental Control and Life Support System (ECLSS) Orbital Replacement Unit (ORU) Processing, Microgravity Science Glovebox (MSG) operation, EXpedite Processing for Experiments to Space Station (EXPRESS) Functional Checkout Unit Rack and the Atmospheric Resource Recovery and Environmental Monitoring (ARREM). The breadth and depth of hardware related experience is a valuable asset to its current and prospective customers. These facilities have supported the integration of approximately thirty payloads in the last ten years, including high altitude balloon payloads, sounding rocket payloads, high altitude aircraft payloads, shuttle flight payloads, micro-satellite payloads, and ground payloads.

These integrated instruments and payloads have supported a diverse range of disciplines including x-ray and gamma-ray astronomy, plasma physics, ion and solar sail propulsion, earth science, micro-electro mechanical system devices, advanced non- volatile computer memory, ferroelectric devices, lasers, x-ray optics, mirror technology, and advanced payload flight system architecture. Systems Development, Integration and Test consists of three groups: Flight Systems Integration and Test, Environmental Control and Life Support Systems, and Instrument Development which perform the following:

- Design, development, testing and evaluation of Environmental Control and Life Support Systems.
- Design and develop specialized science instruments and payloads.
- Plan and implement ground test programs for qualification and certification of flight instruments.
- Design and develop special test equipment and related software to test functionally of flight hardware.
- Develop hardware test beds to support proof of concept, breadboard, and subsystems/systems validation.
- Develop procedures, conduct tests, collect data, archive data for analysis, and provide verification closeout. Conduct anomaly investigation/resolution.
- Provide on-orbit control support.
- Provide ground station monitoring.
- Provide post-flight de-integration.

Capabilities:

Instrument Payload Development provides the design and development of specialized science instruments and payloads.

> Have capability to apply the sputter coatings of iridium, tungsten, carbon, silicon, and other materials to optical surfaces to enhance the performance of high-energy optics and detectors.

> Support the development of ferroelectric-based electronics, high-energy solid-state detectors, micro-electromechanical systems, and low-cost micro-satellites and subsystems.

Capabilities:

Environmental Control and Life Support Systems Development provides facilities, capabilities, and expertise to test Environmental Control and Life Support System (ECLSS) hardware from components to integrated systems.

- Machine Shop–Capability to produce development test articles and test support hardware from design specifications as simple as sketches up to CAD/CAM models.
- Chemistry Laboratory–Wet chemistry analyses tailored for ECLSS use (pH, conductivity, total organic carbon, iodine). Also, higher level analyses using Ion Chromatograph, Gas Chromatograph,-Fourier Transform Infrared instruments.
- Component/Subsystem Life Test Area–Test area capable of supporting long duration tests at levels from small components up to stand-alone subsystems.
- Sorbent-Based Atmosphere Revitalization (SBAR) Test bed–MSFC's first ECLSS efforts at developing new technology for exploration program application. Facility capabilities include large vacuum capacity and precisely adjustable climate control system.
- Regenerative ECLSS Module Simulator–Closed volume used to generate waste products for testing water recovery systems. Exercise equipment, contaminant injection system, and real-time chemical analysis equipment.
- Node 1 (Unity) Simulator–Similar to other ISS Sustaining Engineering test beds. Controllable volume containing. Thermal and humidity control loops. NOTE: currently dedicated to support ISS on-orbit operations as required.
- Flight ECLSS for Station Test and Integration Room–Clean work area used to process ISS ECLSS flight hardware. Electrostatic Discharge workbench.

Facility	Task	Specifications
Space Systems Integration and Test Facility (SSITF)	Enables the design and development of Space Systems from Proof of Concept Studies; Prototype and Development Hardware Checkout; Integration and Assembly of Flight Systems; Qualification and Acceptance Testing of Components, Subsystems, and Integrated Systems; thru real-time operations of on-orbit payloads.	10,000 square foot temperature and humidity controlled high bay equipped for handing flight hardware 20 ton overhead crane forklifts, hydraulic lift carts, and work platforms gas distribution panels, 110 volt and 208 volt 3 phase power including a 100 KVA 80 KW Uninterruptible Power Supply facility grounding system
Mechanical Components Test Facility	Provides leak testing, proof testing, and pressure testing in support of development, qualification, and acceptance of flight payloads, experiments, and components.	High pressure test cell capable of supporting up to 5,000 psig Wide range of pressure and flow instrumentation Leak detection equipment to perform vacuum and pressure decay leak tests and fluid flow testing
Common Module Simulator	Provides controllable (temperature, humidity, gas partial pressures) volume suitable for subsystem or integrated system testing of atmosphere revitalization systems (carbon dioxide removal, carbon dioxide reduction, and oxygen generation).	Two chambers (E-Chamber and V-Chamber): 14 feet in diameter and 23 feet in length Environmental Chamber (E-Chamber): 80 inch diameter aperture for placement of test articles vacuum capability to 8 psia located in thermal enclosure to minimize temp. swings Vacuum Chamber (V-Chamber): 36 inch by 72 inch opening vacuum capability to 4 psia
Payload Rack Checkout Unit (PRCU)	Verification and validation of International Space Station (ISS) facility class payloads and sub-rack payloads.	Provides a high fidelity emulation of ISS resources including Command and Data handling, Power, Cooling, Video, Vacuum, and gas distribution. Is linked to the Huntsville Operations Support Center (HOSC), which provides the capability for true end-to-end testing of payload telemetry.

* Overall ECLSS facility capabilities–120V, 208V 3Φ, 480V 3Φ power sources, High Purity Air (up to 150 psig), gaseous Nitrogen, and ultra pure (18M-ohm) water, 120 ft High Bay (120ft by 200 ft), two 90 ton cranes with two 45 ton hooks each.

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

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George C. Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/marshall

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