

CASIS™



DIRECTORY  
OF IMPLEMENTATION PARTNERS



*Bringing Home the Magic of Space.*



National Lab photos courtesy of NASA.

## CASIS Connects

Welcome to CASIS and thank you for your interest in the International Space Station (ISS) U.S. National Laboratory. CASIS is a unique organization—the only one of its kind—empowered by NASA to help you meet your unique research and development objectives through the unparalleled research environment of space.

The ISS National Lab is the most unique research facility in the world, offering the benefits of microgravity, extreme temperatures, solar radiation and much more to fuel your research in ways that cannot be replicated on Earth. Through CASIS, it is now possible for you to cost effectively utilize this platform in support of discovery, knowledge and commercial product development that will benefit humankind.

To ensure your success, CASIS has partnered with experienced companies that provide the specialized services you'll need to get your science to space.

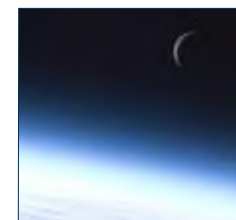
This guidebook will assist you in identifying the right implementation partners to facilitate your cutting-edge research. These companies have been carefully selected, and represent the most talented and established service providers for your space-based research support. We look forward to working with you to *connect* you to the companies profiled in this guide, and to help ensure your R&D goals are met.

Duane Ratliff  
CASIS Director of Operations



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CASIS Director of Operations

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## All About C A S I S

### WHO WE ARE:

The Center for the Advancement of Science in Space (CASIS) was selected by NASA in July 2011 to maximize use of the International Space Station (ISS) U.S. National Laboratory through 2020. CASIS is dedicated to supporting and accelerating innovations and new discoveries that will enhance the health and well being of people and our planet.

### WHAT WE DO:

CASIS is a non-profit, non-government, unique space organization that seeks out promising research projects and facilitates revolutionary discoveries to benefit life on Earth. CASIS provides a gateway for researchers, businesses and educators to take advantage of the unique benefits offered through the ISS National Lab and space-based science.

CASIS provides traditional and non-traditional industries with the ability to conduct R&D on board the National Lab, and facilitates access to essential support services. We link companies, funders and non-NASA government agencies with a limitless supply of innovation that comes from entrepreneurs and researchers. We also seek to inspire a new generation of scientists and engineers to continue the quest for scientific exploration through space-based research.

### WHY CHOOSE CASIS?

CASIS provides the opportunity for U.S. entities to develop and invest in the commercial products and intellectual property that space enables. We want you to succeed. We are here to facilitate the partnerships that will allow you to carry out projects to maximize return on investment and overall value to the marketplace.

We also realize that no R&D project is possible without funding support. To that end, CASIS has access to funding sources that may be able to absorb a significant amount of your project costs.

## Support S E R V I C E S

### FACILITATING SUCCESS THROUGH AN EASY, INTEGRATED PROCESS

CASIS can streamline the process of National Lab utilization by providing a variety of support services to enable easy, efficient execution of space-science initiatives, even for first time users.

#### PREFLIGHT:

Prior to testing in space, CASIS matches private sector companies with Implementation Partners that can provide a wide range of products and services and demonstrated experience with space-based support. These services take place on the ground. CASIS can facilitate:

- ▶ Access to a large repository of previous space experiments that align with promising commercial development and innovation
- ▶ Collaboration with experienced payload developers and other subject matter experts to ensure successful experiments
- ▶ Access to state-of-the-art laboratories at the Space Life Sciences Laboratory at Kennedy Space Center
- ▶ Utilization of unique capabilities and facilities for developing payloads
- ▶ Completion of all mission requirements
- ▶ Coordination with NASA and launch vehicle providers for production of an integrated schedule

#### IN-FLIGHT:

During flight, CASIS, through its Implementation Partners, can support private sector product development and ensure seamless project management, including:

- ▶ Support of “real time” in-orbit payload operations
- ▶ Interfacing with ISS crew during experiment interaction
- ▶ Facilitation of data and software interfaces
- ▶ Coordination of contingency planning and mission changes to preserve science objectives

#### POST-FLIGHT:

After the project comes back to Earth, CASIS coordinates with its Implementation Partners to assist with the following:

- ▶ Coordination of in-situ experiment termination including cold stowage, fixation and data analysis
- ▶ All post-flight data & report requirements are submitted to NASA and the principal investigator in a timely fashion
- ▶ Logistics support for sample and hardware return from ISS
- ▶ Identification of appropriate facilities for post-processing activities
- ▶ Help in finding resources for intellectual property identification, registration and protection
- ▶ Help in finding resources for compliance with export control regulations
- ▶ Coordination and collaboration with the principal investigator to ensure overall project success



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THE AEROSPACE CORPORATION | [www.aero.org](http://www.aero.org)

The Aerospace Corporation, a world leader in the application of space technology, provides advanced scientific engineering services for space and related high-technology systems.

*Advanced Technology. Objective Analysis. Innovative Solutions.* As an independent, nonprofit corporation operating federally funded research and development center, The Aerospace Corporation performs objective technical analyses and assessments for a variety of government, civil, and commercial customers. With five decades of experience and a staff widely recognized for its technical knowledge and capabilities, The Aerospace Corporation provides leadership and support in all fields and disciplines of research, design, development, acquisition, operations, and program management.

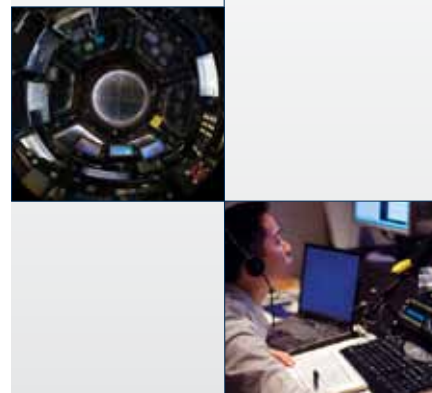
Assuring Space Mission Success. Aerospace supports its customers in a broad range of space-related technology disciplines, providing value-added knowledge and insight to state-of-the-art space systems, application and related technology areas.

**Research, Engineering & Technical Support Services:**

- ▶ Launch vehicle design and integration
- ▶ Mission planning
- ▶ Operations concepts
- ▶ Acquisition and program management
- ▶ Prototype development
- ▶ Reliability analysis
- ▶ Systems engineering
- ▶ Test and evaluation
- ▶ Independent readiness reviews
- ▶ Risk analysis and lifecycle cost modeling
- ▶ Laboratory evaluation
- ▶ Nondestructive testing

**Principal Areas of Scientific & Engineering Expertise:**

- ▶ Launch vehicle design and integration
- ▶ Satellite design and orbital systems
- ▶ Guidance and control
- ▶ Structural design and modeling
- ▶ Sensors and imaging
- ▶ Computer and network architectures
- ▶ Software development and validation
- ▶ Satellite control and ground systems
- ▶ Telecommunications
- ▶ Astrodynamics
- ▶ Advanced materials
- ▶ Propulsion
- ▶ Microelectronics
- ▶ Signal processing
- ▶ Computer security



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ASTRIUM NORTH AMERICA | [www.astrium-na.com](http://www.astrium-na.com)

Astrium North America is a U.S. based company incorporated in 1973 specializing in program and project management, software engineering, external carrier development and integration services, experiment and payload processing, life and physical sciences hardware and flight simulation and training for the international aerospace community.

**Primary Services:**

- ▶ External Platform Program (in cooperation with NanoRacks)
- ▶ Physical and Life science hardware and services
- ▶ Hardware design, manufacture and certification
- ▶ Hardware analytical and physical integration
- ▶ Full lifecycle software development, integration and testing
- ▶ Program management
- ▶ Export Compliance
- ▶ Mission control flight support
- ▶ Hands-on crew training

**ISS-Certified Hardware:**

- Astrium was the prime contractor for the development of several major payload facilities used onboard the International Space Station. Astrium is currently under contract to maintain most of these facilities. The following is a partial list of ISS-certified, Astrium built, hardware available for use.
- ▶ Microgravity Science Glove box (MSG)
  - ▶ Minus Eighty Degree Freezer (MELFI)
  - ▶ Material Science Lab (MSL)
  - ▶ European Modular Cultivation System (EMCS)
  - ▶ BIOLAB
  - ▶ Protein Crystallization Diagnostic Facility (PCDF)
  - ▶ Rodent Life Support System

**Ground and/or Flight-based Research:**

- ▶ Hardware verification and certification
- ▶ Ground and Flight Safety Reviews and Data packages
- ▶ Certificate of Flight Readiness (CoFR)
- ▶ Interface Control Documents (ICD's)
- ▶ Bench reviews
- ▶ Crew training
- ▶ ISS simulator operations
- ▶ Ground and Test procedure development
- ▶ Photo documentation and cataloging
- ▶ Late access and early retrieval of flight hardware and samples
- ▶ Real time, pre and post flight data analysis
- ▶ Export Compliance (License, TAA, etc.)
- ▶ Bonded storage



ASTROTECH CORPORATION | [www.astrotechcorp.com](http://www.astrotechcorp.com)

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Astrotech Corporation, formerly SPACEHAB, Inc., has led the commercial space industry for more than 25 years, preparing and sending satellites, cargo and science into space. Our goal is to facilitate the most demanding of projects.

**Primary Services:**

- ▶ PAYLOAD STOWAGE, INTEGRATION, AND PROCESSING: Certified flight hardware design, development and fabrication; microgravity research and educational outreach; program and project management; laboratory and clean room operation and maintenance; regulatory and NASA governance compliance
- ▶ ISS CERTIFIED HARDWARE: Microgravity research platform
- ▶ SUPPORT SERVICES: Engineering services; regulatory compliance; permitting, governance and approvals; documentation and reporting; financial modeling and planning; administrative and logistical support; spacecraft encapsulation and hazardous operations fueling; payload transportation; flight hardware operation and training

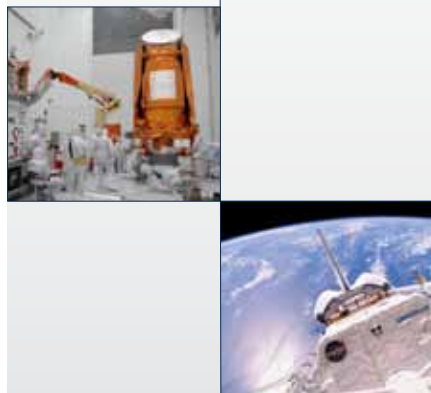
**Labs, Shops & Test Facilities:**

TITUSVILLE, FL (1515 Chaffee Road, 32780):  
 150,000 sq ft of class 100K clean room processing high bays, hazardous operations facilities, control rooms, safety and support facilities, and office and administrative areas

CAPE CANAVERAL, FL (620 Magellan Road, 32920):  
 74,000 sq ft of class 100K clean room processing high bays, control rooms, support facilities, and office and administrative areas including 11 temperature and humidity controlled Customer Work Areas

VANDENBERG AFB, CA (Bldg 1032, Tangair and Red Road, 93437):  
 24,000 sq ft of class 100K clean room processing high bays, hazardous operations facilities, control rooms, safety and support facilities, and office and administrative areas

HOUSTON, TX (907 Gemini Street, 77058):  
 Flight certified hardware design and fabrication capabilities including a machine shop, office, and administrative areas



AURORA FLIGHT SCIENCES | [www.aurora.aero](http://www.aurora.aero)

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Aurora Flight Sciences has over 25 years experience building and flying spaceflight hardware, with no unrecoverable failures. We have an excellent reputation in the NASA and DoD spaceflight community, and continue to be actively engaged in emerging space technology and science programs. In 2007, Aurora acquired the space flight payload developer, Payload Systems, and incorporated the team into its Cambridge, Massachusetts Research and Development Center. This team was instrumental in the development, deployment and operation of the SPHERES satellites, as well as several other spaceflight programs including PPRV, MACE, MODE, EDLS and others.

Aurora's experience, knowledge, and resources ensure its efficacy as an implementation partner, while the small business aspects of the company provide the flexibility and agility to adapt to changing schedules and needs. *Specifically, we'll provide you with the following services:*

**Engineering Project Support:**

- ▶ System requirements definition
- ▶ Flight system design and fabrication, including mechanical, electrical and software engineering
- ▶ Acceptance and certification testing
- ▶ Hardware integration and documentation
- ▶ Ground / on-orbit crew training and procedures development
- ▶ Ground processing and mission support

**Electromechanical Systems:**

- ▶ Pressure relief/atmospheric sampling systems
- ▶ Cooperative satellite constellations
- ▶ Telerobotic systems and workstations
- ▶ Biological habitats
- ▶ Structural dynamics and control
- ▶ Human factors

**Systems Engineering:**

- ▶ System architecture/configuration
- ▶ Systems analysis
- ▶ Project management
- ▶ Test plan development
- ▶ Quality assurance

**Technical Support:**

- ▶ Electronic system assembly and testing
- ▶ Mechanical prototyping
- ▶ Sterile system assembly and biological testing
- ▶ Environmental testing
- ▶ Web-based project management



**BIONETICS CORPORATION** | [www.bionetics.com](http://www.bionetics.com)

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The Bionetics Corporation is headquartered in Yorktown, Virginia, and we serve our clients from operating locations nationwide. Bionetics' operating philosophy is to place the capability required to meet and exceed customer requirements as close to the customer as possible. Thus, we maintain a very lean corporate infrastructure and empower our local managers and employees to make decisions and solve problems on our customers' behalf. We employ short, direct lines of communication and work hard to build a spirit of teamwork and partnership in all of our business operations.

**Primary Services:**

- ▶ Turnkey services for all support required for ISS Ground and Flight-Based Research provided for 49 separate spaceflight experiments to date

**Bionetics Developed ISS Certified Hardware Available for Use:**

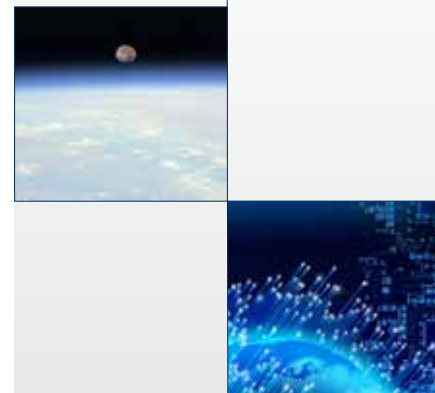
- ▶ KSC Fixation Tubes (certified for use with multiple fixatives)
- ▶ Biological Research in Canisters (various configurations, fixation and lighting)
- ▶ Advanced Biological Research System (ABRS)

**Service Offerings Include (Ground and/or flight-based):**

- ▶ Flight Experiment proposal support
- ▶ Flight Requirements Definition and Mission Documentation development
- ▶ Flight and Ground systems development and certification (hardware and software)
- ▶ Missions Management support for required documentation, ISS reviews and approvals
- ▶ Flight crew/ Experiment Procedures Development and Training
- ▶ Flight Experiment Processing, Operations and Integration (Pre, Post and in-Flight)
- ▶ Experiment integration and verification testing
- ▶ Data management, acquisition and analysis
- ▶ Calibration and Photography services

**Facilities Available for Support:**

In addition to having access to all NASA facilities for certification testing, payload verification, experiment and missions support Bionetics' shop, laboratory and administrative support facilities are available in Cape Canaveral, Florida.



**BIOSERVE** | [www.colorado.edu/engineering/BioServe](http://www.colorado.edu/engineering/BioServe)

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For 25 years, BioServe has developed space flight hardware to support microgravity life science research. BioServe has an extensive suite of flight certified hardware and space life science expertise. We are a full-service organization that can guide the novice or experienced researcher, organization or company through the process of conducting research on board the International Space Station (ISS) or other space flight vehicles.

**Services:**

- ▶ Science Support/technical guidance
- ▶ Feasibility/trade study assistance
- ▶ Science team hardware training
- ▶ Ground test facilities
- ▶ Mission simulations
- ▶ Experiment verification testing
- ▶ Large suite flight certified hardware
- ▶ Manifest negotiations
- ▶ Mission management
- ▶ Engineering integration
- ▶ Software/firmware development
- ▶ Payload operations and control center
- ▶ Flight and ground safety processing
- ▶ In-house manufacturing, assembly and test
- ▶ Flight qualification services
- ▶ Launch and landing site support
- ▶ Physical payload integration and de-integration
- ▶ Flight readiness reviews
- ▶ Crew procedure authoring
- ▶ Crew training/operations planning
- ▶ Support real-time crew operations
- ▶ International experience

**Facilities:**

- ▶ Automation Test Facility (ATF)
- ▶ Dedicated machine shop
- ▶ Rodent housing facility
- ▶ ESD safe electronics lab
- ▶ Dedicated hardware integration and test lab
- ▶ Sterile cell culture room with standard associated equipment
- ▶ Wet lab with standard equipment
- ▶ In-house environmentally controlled testing chambers
- ▶ Local vibration, EMI and EMC test facilities

**Electromechanical Systems:**

- ▶ Commercial Generic Bioprocessing Apparatus (CGBA) refrigerator/freezer -15C – 37C
- ▶ CGBA Freezer
- ▶ Group Activation Pack (GAP) various configurations
- ▶ Fluid Processing Apparatus (FPA)
- ▶ Opticell Processing Module (OPM)
- ▶ Culture Habitat (CHAB)
- ▶ Single Loop for Cell Culture (SLCC)
- ▶ Multiple Orbital Bioreactor with Instrumentation and Automated Sampling (MOBIAS)
- ▶ BioServe Culture Apparatus (BCA)
- ▶ Plant Generic Bioprocessing Apparatus (PGBA)
- ▶ BioServe Fixative Tube
- ▶ Various small habitats that support a wide variety of small organisms
- ▶ HD Video and Still imaging capabilities



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CSS-DYNAMAC | [www.css-dynamac.com](http://www.css-dynamac.com)

CSS-Dynamac is a science-based enterprise with 17 years of experience supporting 170 scientific payloads flown on the International Space Station (ISS) or Space Shuttle. CSS-Dynamac can assist ISS NL researchers and technologists in successfully navigating the complex life cycle of a space flight project, from concept definition to Certificate of Flight and pre-flight through mission operations and post flight processing.

**Our Expertise Encompasses:**

- ▶ Science Payload Processing & Integration
- ▶ Hardware Support, Development & Testing
- ▶ STEM Education & Outreach Support
- ▶ Data Analysis
- ▶ Ground-Analog & Post-Flight Processing
- ▶ Laboratory Support Services

**Our Qualifications:**

- ▶ Operator of the Space Life Science Laboratory (SLSL), a ground-based ISS asset located at KSC
- ▶ Coordinated ground processing of 170 space flight experiments
- ▶ Designed, fabricated, tested and supported flight operations for 49 experiments
- ▶ Designed proprietary payload operations requirements tool (IPORT)
- ▶ Conducted Preliminary Design Reviews, Critical Design Reviews, Science Readiness Reviews, Science Verification Tests, Payload Verification Tests, Flight Safety Analyses and mission support
- ▶ Provided support for Bench Reviews and Crew Training
- ▶ Managed control experiments using Orbital Environmental Simulators
- ▶ Designed and conducted first-of-their-kind experiments in microgravity and served as Principal Investigator
- ▶ Operated AAALAC-accredited animal care facility
- ▶ Documented Ground Support Requirements for all life science payloads and provided procurement and logistics support
- ▶ Provided host services, reconfiguring and equipping ground laboratories to support visiting science teams, data collection services including a monitoring solution for experiments for pre-mission testing, mission operations for ground analog and post processing data analysis



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HAMILTON SUNDSTRAND | [www.hamiltonsundstrand.com](http://www.hamiltonsundstrand.com)

On June 10, 1999, Hamilton Standard and the Sundstrand Corp. merged, forming HAMILTON SUNDSTRAND. The company's heritage spans the course of 100 years, tracing its roots to the founding of the Sundstrand Corp. in 1905 and Hamilton Standard in 1919. With more than 50 major facilities worldwide, Hamilton Sundstrand is among the world's largest suppliers of technologically advanced aerospace and industrial products. Headquartered in Windsor Locks, Conn., the company's revenues reached \$6.2 billion in 2011. Hamilton Sundstrand designs and manufactures aerospace systems for commercial, regional, corporate and military aircraft, and is a major supplier for international space programs. Hamilton Sundstrand's industrial products serve industries ranging from hydrocarbon, chemical and food processing to construction and mining.

**Company's Primary Services:**

- ▶ Hamilton Sundstrand Space Systems International (HSSSI) has developed and delivered technology and hardware to the National Aeronautics and Space Administration (NASA) over the course of all manned NASA programs from Apollo to the International Space Station (ISS) to Orion
- ▶ Provides sustaining engineering services including real-time mission support of on-orbit operations for HSSSI supplied hardware
- ▶ Payload integrator between HSSSI supplied hardware and other interfacing hardware including coordination with international partners

**All ISS-certified Hardware Available for Use:**

- ▶ HSSSI ISS hardware has been delivered to the US government under government contracts and is under the control of NASA project management.

**Services that can be provided for Ground and/or Flight-based Research Support:**

- ▶ Hardware development and certification in accordance with SSP 50835, ISS pressurized Volume Hardware Common Interface Requirements Document. This includes developing and obtaining approvals of the applicable safety paperwork and processing Government Certification Approval Requests (GCAR)
- ▶ Project management of hardware development adheres to the management process outlined in EA-WI-023, Project Management of GFE Flight Projects
- ▶ Integration with other hardware providers and hardware items, including international partners
- ▶ Support creation of on-orbit procedures and crew training
- ▶ Real-time mission support and continuous analysis of data down linked from ISS
- ▶ Failure investigation, troubleshooting and resolution of hardware and system issues

**Labs, Shops & Test Facilities that can be Provided:**

HAMILTON SUNDSTRAND SPACE SYSTEMS INTERNATIONAL:  
 (18050 Saturn Lane, Suite 400, Houston, TX 77058)



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KENTUCKY SPACE, LLC | [www.kentuckyspace.com](http://www.kentuckyspace.com)

We provide R&D solutions for entrepreneurial commercial space projects. Our team of engineers, scientists, and business leaders has the expertise to develop technologies and assist researchers with projects from start to finish: experiment design, hardware interface, flight readiness, on-orbit ground communication, data return and post-flight analysis.

**ISS-Certified Hardware:**

CubeLab® plug n’ play research module. The original research module design interfacing with an existing commercial platform on station also designed and manufactured by us. CubeLab® modules are adaptable for many types of research designs.

**Other Hardware:**

Firefly™ board. A solar rechargeable, self-powered C&DH system with onboard storage and wireless communications. Can be used with CubeLab® module hardware.

**Ground and/or Flight-based Research Support Services:**

RESEARCH SUPPORT:

- ▶ Experiment design, validation and testing
- ▶ Preparation of step-by-step procedures for installation of experiments on station by astronauts
- ▶ 24/7 ground communications support for researchers
- ▶ Payload certification testing
- ▶ Payload integration
- ▶ Coordination of experiment return to Earth and ground transportation

TECHNICAL EXPERTISE:

- ▶ Systems engineering
- ▶ Mechanical, electrical, software and RF engineering
- ▶ Structural analysis
- ▶ Rapid prototyping and manufacturing
- ▶ Embedded systems design
- ▶ Electronic assembly and testing

**Labs, Shops, Test Facilities:**

- ▶ ISS ground operations center to monitor and support astronaut interaction with hardware
- ▶ Anechoic chambers
- ▶ Class 10,000 clean rooms
- ▶ Vibration, Thermal Vacuum, and Decompression Environmental Test Facilities
- ▶ 21-meter space tracking antenna with 40-foot, 24-foot, and 20-foot diameter antennas for redundancy
- ▶ Access to labs, test equipment and facilities at Space Life Sciences Lab, Kennedy Space Center



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MDA provides advanced information solutions that capture and process vast amounts of data, produce essential information, and improve the decision-making and operational performance of business and government organizations worldwide. Focused on markets and customers with strong repeat business potential, MDA delivers a broad spectrum of information solutions, ranging from complex operational systems, to tailored information services, to electronic information products.

**MDA Primary Service:**

The process of ISS based experimentation begins and ends with the Principle Investigator (PI) who conceives the idea for a payload which will address an area of fundamental or applied research. MDA has extensive experience in developing hardware and systems for the ISS that can support the PI with an end-to-end payload development service. This includes the effort to design, fabricate, test, certify, launch, and operate the payload. During the design phase, MDA can prepare technical documentation as required, develop the hardware and software, simulate the operation of the payload, develop the verification plan, perform hazard analyses as required, and perform the necessary safety and design reviews. During the fabrication and test phases, MDA can build the hardware and generate the software, perform verification tests, support the necessary reviews, plus certify the payload for launch to the ISS. During flight, MDA can support on orbit installation, operation (including telescience), and removal activities. As the robotics Prime Contractor for the ISS, MDA has unique expertise to design and operate payloads that require remote robotic handling. After flight, MDA can safely store the payload and return any generated samples to the PI.

**ISS-certified Hardware Available for Use (with NASA & CSA approvals):**

- ▶ Space Station Remote Manipulator System (SSRMS)
- ▶ Special Purpose Dexterous Manipulator (SPDM)
- ▶ Robotic Workstations (RWS)
- ▶ Enhanced Orbital Temporary Platform (EOTP)
- ▶ Mobile Base System (MBS)

**MDA Facilities to Support ISS Utilization:**

- HOUSTON, TEXAS
- PASADENA, CALIFORNIA
- DENVER, COLORADO
- WASHINGTON, DC
- TORONTO, ONTARIO





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MEI TECHNOLOGIES | [www.meitechinc.com](http://www.meitechinc.com)

MEI Technologies, Inc. (MEIT) offers more than 20 years experience in payload integration and related services for NASA, DoD, and commercial customers. We have integrated almost 200 payloads and more than 50 individual launches aboard every launch vehicle used to reach the ISS.

**Key Services:**

- ▶ Identification of launch options and negotiating launch agreements—we have relationships in place with key launch providers and sources of rideshare and hosting opportunities to get to the ISS
- ▶ Payload development and engineering assistance—we work with project leaders and principal investigators to help optimize payloads for most efficient operation and maximum scientific return
- ▶ Payload integration with launch vehicle or host—we are experienced with all physical and functional interface requirements and have experience fitting payloads to ISS internal and external locations
- ▶ Guidance and support to principal investigator throughout the development, launch, and on-orbit operations process—we understand that PIs are generally new to NASA's processes and have extensive experience helping them to navigate procedures, paperwork, and other requirements
- ▶ Payload operations support and data distribution—we can continue supporting the payload and project throughout the operations and retrieval phases
- ▶ Support for NASA documentation and reviews, including safety, configuration management, interface documentation, and others—we have templates in place for all required NASA documents and can quickly customize them for individual payloads



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NANORACKS LLC | [www.nanoracks.com](http://www.nanoracks.com)

NanoRacks LLC was formed in 2009 to provide quality hardware and services for the U.S. National Laboratory onboard the International Space Station. The company operates the first commercial laboratory in low-earth orbit. Today, we have onboard or manifested three research platforms, which can house plug and play NanoLabs using the CubeSat form factor for inside the Space Station. And we are now working with Astrium for the world's first commercial External Platform Program planned for 2014. NanoRacks has also been awarded the task to design and fabricate the research racks for Virgin Galactic's SpaceShip Two. The current signed customer pipeline of over 60 payloads, including domestic and international educational institutions, research organizations and government organizations, has propelled NanoRacks into a leadership position in customer utilization in low-earth orbit and beyond.

**Facilities:**

- ▶ NanoRacks' ISS National Lab Facilities—available for your choice of commercial and educational microgravity research
- ▶ NanoRacks' low-cost model puts microgravity research projects within the budgetary realm of hundreds of universities, smaller organizations and first-time commercial space research users

Our U.S. National Lab facilities provide turnkey opportunities for your choice of experimentation and currently includes two NanoLab Platforms, NanoRacks Plate Reader, NanoRacks Microscope and Nanoracks MixStix, providing repeatable microgravity research opp-ortunities onboard the ISS.

**Services that can be Provided for Ground and/or Flight-based Research Support:**

NanoRacks provides everything you need to conduct repeatable microgravity research on the Space Station and soon, beyond.

- |  |   |   |
|--|---|---|
| <ul style="list-style-type: none"> <li>▶ 20 years of space program experience</li> <li>▶ Partnerships with payload integration organizations</li> <li>▶ Full service NASA safety system</li> </ul> | <ul style="list-style-type: none"> <li>▶ Extensive Interaction/Experience with:</li> </ul> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px; text-align: center;">NASA PAYLOADS OFFICE</div> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px; text-align: center;">NASA SAFETY</div> <div style="border: 1px solid gray; padding: 2px; text-align: center;">NASA MOD</div> | <ul style="list-style-type: none"> <li>▶ Interface Control Document Generation</li> <li>▶ Full Service Verification Capabilities</li> <li>▶ Experts at minimizing verification waste</li> </ul> |
|--|---|---|



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PARAGON TEC | [www.paragontec.net](http://www.paragontec.net)

Paragon TEC is a science, technology, engineering and mathematics (STEM)-focused company that designs and implements exciting, highly engaging award-winning STEM initiatives for learners of all ages.

**We Develop & Deliver STEM:**

- ▶ Educational Programs
- ▶ Management Tools & Systems
- ▶ Exhibits & Campaigns
- ▶ Brochures & Pamphlets
- ▶ Annual & Quarterly Reports
- ▶ Evaluative Studies
- ▶ Curriculum Design & Implementation
- ▶ Professional Development & Training
- ▶ Technical Monographs

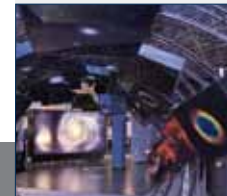
**We are Known for Creating Educational Materials that Convert Technical Concepts into Laypersons Terms that Facilitate Understanding & Ease of Use:**

- ▶ Paragon provides nation-wide STEM initiatives that pique participant interest, engages them in hands-on activities and/or exhibits, and sparks desire to learn more
- ▶ Since 2002, Paragon has worked with NASA to implement and support educational outreach initiatives including:

- STEM EDUCATION FORUMS
- EXHIBITS
- PRE-LAUNCH SHUTTLE EDUCATION FORUMS
- NATIONAL CONFERENCES
- SHUTTLE CREW VISITS
- MAJOR STEM EDUCATIONAL CAMPAIGNS

**We Appeal to All Audiences in the Public & Private-sectors:**

- ▶ Paragon has engaged tens of thousands of participants in memorable, educative STEM-focused initiatives



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Core Technical Capabilities (CTC) laboratories provides the foundation for Kennedy Space Center to excel as the nation's leading spaceport through the development of advanced technologies, systems, and equipment. This technical base is composed of expert scientists, engineers, and technicians. Supported by state-of -the-art instruments and equipment in multidisciplinary laboratories, these teams conceive, develop, and perfect the innovative technologies that improve spacecraft processing, lower its cost, and further America's exploration mission. It is the innovative problem solving and rapid response of the CTC laboratories that enable KSC to overcome the technical challenges of spacecraft processing and launch operations.

**Laboratories:**

- ▶ Chemistry and Physics
- ▶ Applied Chemistry
- ▶ Applied Physics
- ▶ Chemical Analysis and Sampling  
Chemical Analysis
- ▶ Electromagnetic Effects
- ▶ Electrostatics and Surface Physics
- ▶ Granular Materials and  
Regolith Operations
- ▶ Polymer Science and Technology
- ▶ Electrical and Electronic
- ▶ Advanced Electronics and  
Technology Development
- ▶ Advanced Range and Systems Health
- ▶ Control Systems Development
- ▶ Electronic Development and Test
- ▶ Electrical Failure Analysis
- ▶ Instrumentation Systems Development
- ▶ Power Systems Development
- ▶ Fluids, Mechanisms and Structures
- ▶ Corrosion Technology
- ▶ Cryogenics Test
- ▶ Prototype Development Shop
- ▶ Materials Failure Analysis
- ▶ Physical Test and Analysis
- ▶ Launch Equipment Test Facility Shop
- ▶ Metrology
- ▶ Nondestructive Evaluation
- ▶ Standards and Calibration
- ▶ Information Technology  
and Communications
- ▶ Design Visualization
- ▶ Experimental Imaging
- ▶ Fiber Optics and Communications
- ▶ Spaceport Processing Systems Development
- ▶ Telescience and Internet Systems
- ▶ Life Science
- ▶ Analytical Chemistry Core
- ▶ Applied Genetics Technology Core
- ▶ Bio-Medical
- ▶ Controlled Environment
- ▶ Earth Systems Modeling and  
Data Management
- ▶ Environmental Microbiology
- ▶ Experiment Support
- ▶ Flight Experiment Development
- ▶ Human Physiology Core
- ▶ Light Testbed
- ▶ Animal Care Program
- ▶ Meteorology
- ▶ Applied Meteorology Unit

## Space Systems CONCEPTS

### SPACE SYSTEMS CONCEPTS, INC.

Space Systems Concepts, Inc. is a small technical services company that provides expert consulting services on space systems research, development, test and operations. We are located close to the NASA/JSC facilities in Clearlake, TX, and can supply up to 30 highly experienced Subject Matter Experts with rapid response, great flexibility and attractive labor rates.

#### Capabilities:

- ▶ Support the development and evaluation of ISS research proposals
- ▶ Interface with CASIS and the ISS Program Office at NASA/JSC on behalf of the researchers
- ▶ Develop and submit documentation as required by CASIS and the NASA ISS payloads office
- ▶ Support bench reviews with NASA
- ▶ Conduct data analysis and other technical or management support activities per user needs

#### Services that can be provided for Ground and/or Flight Research Support:

- ▶ **Support the development and evaluation of ISS research proposals.** Our Subject Matter Experts have unique and extensive experience with the NASA proposal development and evaluation process. We can help you evaluate the technical and programmatic merits, and clearly document the strengths and weaknesses in your ISS research proposals.
- ▶ **Interface with CASIS and the ISS Program Office at NASA/JSC on behalf of the researchers.** Many of our Affiliates recently retired from NASA and the contractor community supporting NASA/JSC, and still reside in the local area. They had distinguished careers working closely with the ISS Program Office staff, and are well known “players” in this community. Having long term, close working relationships with key NASA people, we can provide timely access to critical decision makers and facilitate the communications process.
- ▶ **Develop and submit documentation as required by CASIS and the NASA ISS payloads office.** We can provide highly experienced people to help your payload researchers understand NASA’s technical and management data requirements, generate the right information, format it effectively, and deliver their documentation to the ISS Program Office in a timely and efficient manner.
- ▶ **Support bench reviews with NASA.** We can provide expert technical support to help your researchers get their hardware and documentation ready for successful bench reviews with NASA. Having done this many times, our Affiliates know how to make what can be a difficult bench review process into a “win-win” situation for your ISS payload researchers and for NASA.
- ▶ **Conduct data analysis and other technical or management support activities per user needs.** We have a pool of 30 truly experienced Subject Matter Experts with extensive and unique technical and management expertise covering virtually every discipline involved in human rated space systems design, development, test and operations.

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Vice President & General Manager  
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#### Company’s Primary Service:

Space Systems Concepts, Inc. is a small technical services company that provides expert consulting services on space systems research, development, test and operations. We are registered in the Federal Central Contractor Registration (CCR) database, and our subcontracts qualify for woman-owned small business subcontracting goals under CAGE Code 6M9U0 and DUNS Number 019914481.



### SPACE SYSTEMS RESEARCH CORPORATION

[www.spacesystemsresearch.com](http://www.spacesystemsresearch.com)

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The Space Systems Research Corporation has provided Systems Engineering and Project Management for shuttle and ISS payloads of various types. We currently provide a variety of services from proposal development through hardware development, payload integration and qualification, and on-orbit operations. Specifically, we provide the following capabilities:

#### Project Management:

- ▶ Life Cycle cost estimates
- ▶ Proposal Management
- ▶ Project Review Support
- ▶ Financial Tracking and Reporting
- ▶ Earned Value Management
- ▶ Project Scheduling, tracking and maintenance
- ▶ Acquisition Management Support
- ▶ Risk Management
- ▶ Operations Management

#### Scientific & Engineering Analysis:

- ▶ Scientific Analysis and Modeling
- ▶ Structural Thermal Optical (STOP) analysis
- ▶ Electronics boxes & circuit board analysis
- ▶ Detailed finite element analysis
- ▶ Safe-life analysis, leak before burst determination
- ▶ Bolted joint analysis
- ▶ Data storage and Archiving
- ▶ IDL (& GDL) Scientific Programming and support
- ▶ FEMAP for pre and post processing of finite element models
- ▶ MSC/NASTRAN – finite element solver
- ▶ NASGRO – Fracture Mechanics and fatigue crack growth analysis software
- ▶ Operations Center Setup and Support Software

#### Systems Engineering:

- ▶ Requirements definition and development
- ▶ ICD development
- ▶ Instrument design
- ▶ Performance modeling
- ▶ Acceptance Data Packages
- ▶ System Specification and Analysis
- ▶ Project Review Support
- ▶ Assembly, Integration and Performance Test Support
- ▶ Environmental Test Support
- ▶ Safety Data Packages
- ▶ Verification and Validation
- ▶ Risk Identification and Analysis



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TEC-MASTERS, INC. | [www.tecmasters.com](http://www.tecmasters.com)

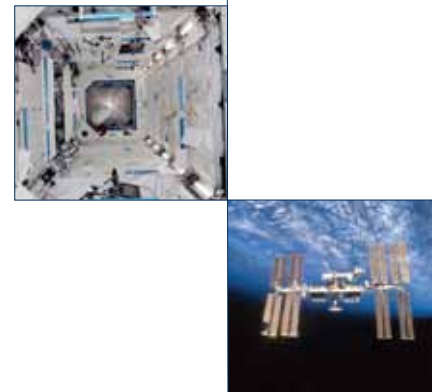
Tec-Masters, Inc. (TMI) has 20 years of experience designing, developing, integrating and operating flight hardware for NASA. TMI has developed and supported several payloads flown aboard the Shuttle and the International Space Station (ISS) and also supports ongoing flight operations of the Microgravity Science Glovebox (MSG) facility aboard the ISS. TMI's engineering services include:

**Engineering Design & Development:**

- ▶ Hardware and Software Requirements Definition
- ▶ Prototype Development
- ▶ Flight Unit Development
- ▶ Sample Development

**Payload Integration:**

- ▶ Requirements Compliance Verification
- ▶ Testing and Analysis
- ▶ Integration Documentation
- ▶ Safety



**Payload Operations:**

- ▶ Operations Concept Development
- ▶ Crew Procedures
- ▶ Crew Training
- ▶ Real Time Console Operations

**Post Flight Operations:**

- ▶ Data Analysis
- ▶ Ground Sample Processing
- ▶ Lessons Learned

**Facilities:**

TMI has developed a general purpose Research and Development (R&D) Lab to support experimentation, prototyping, fabrication of small parts, assemblies and complete systems in support of flight and ground hardware/software development, and verification. TMI's R&D Lab is equipped with:

- ▶ A machine shop for small parts fabrication
- ▶ Stations for electronic design, fabrication, test, calibration, and verification activities
- ▶ Stereo and metallurgical microscopes, both equipped with digital photo capability for inspection activities
- ▶ Chemistry capabilities to support special cleaning of experiment/test parts and flight test ampoule preparation
- ▶ CAD capabilities to support drawings as well as stress and thermal
- ▶ Labview data acquisition system



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TECHSHOT | [www.techshot.com](http://www.techshot.com)

Techshot is a contract new product development company. With 25 mechanical, electrical and software engineers, plus a staff of scientists, Techshot designs, prototypes and readies for manufacturing new products. Industries for which it develops new products include aerospace, automotive, green tech, defense, consumer products and medical devices.

**Turnkey Spaceflight Equipment:**

- ▶ Space-qualified hardware design and fabrication since 1988
- ▶ Flight hardware verification testing
- ▶ Safety Review Process, Phases 0, I, II & III
- ▶ Project Scheduling, tracking and maintenance
- ▶ Transition Management Support
- ▶ Risk Management
- ▶ Operations Management

**Available Spaceflight Hardware:**

ANALYTICAL CONTAINMENT TRANSFER TOOL (ACT2) ICD DEVELOPMENT

- ▶ Transfers or stores fluid between or from experiment modules

AVIAN DEVELOPMENT FACILITY (ADF)

- ▶ Incubates quail embryos
- ▶ 0-2 g artificial gravity

ADVANCED SPACE EXPERIMENT PROCESSOR (ADSEP)

- ▶ High throughput processor of experiment cassettes

CELLCULT

- ▶ Dynamic cell culturing/tissue engineering cassette with a bioreactor

FLUID PROCESSING CASSETTE (FPC)

- ▶ Custom configurable bags, pumps
- ▶ C-elegans, bacteria, etc.

LIGHT MICROSCOPY MODULE-DYNAMIC STAGE (LMM-DS)

- ▶ Microscope stage for observation of fluidics and suspensions

LMM-DS COLLOIDS CELL

- ▶ Translatable observation cell, applies and monitors a thermal gradient to colloids
- ▶ Mixer stir bars homogenize samples

MULTI-SPECIMEN VARIABLE-GRAVITY PLATFORM (MVP)

- ▶ 20 in-flight interchangeable specimen containers
- ▶ Two 12.5" rotors, 0-2 g's
- ▶ Total environmental control
- ▶ Video observation
- ▶ Cells, aquatics, plants, algae, invertebrates

FLOW CYTOMETER

- ▶ Automated counter for blood, other cell type



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TELEDYNE BROWN ENGINEERING, INC. | [www.tbe.com](http://www.tbe.com)

TBE has more than 30 years of expertise in the entire payload operations and physical and analytical integration process, from concept development to hardware fabrication, software development, and on-orbit science operations.

**Capabilities:**

- ▶ Physical & Analytical Payload integrator
- ▶ Hardware developer and manufacturer
- ▶ On-Orbit Operations

**Key Areas of Support Include:**

- ▶ Requirements Definition
- ▶ Mission Planning and Integration
- ▶ Safety and Requirements Verification
- ▶ Command and Data Processing
- ▶ Payload Integration and Interface Testing
- ▶ Crew and Ground System Personnel Training
- ▶ Flight Operations Products and CoFR
- ▶ Flight Operation Execution

**Facility:**

Covering over 550,000 square feet, the Huntsville fabrication and assembly facilities of Teledyne Brown Engineering provide a wide array of capabilities for hardware manufacturing and testing. Our facilities include a fully equipped machine shop, electrical and electronics assembly areas, sheet metal and welding shops, laser cutters, a paint booth, NDE inspection equipment, clean rooms, and controlled storage.



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THALES ALENIA SPACE | [www.thalesgroup.com/space](http://www.thalesgroup.com/space)

Thales Alenia Space has the world-class space system capabilities that meet today's pressing needs, whether civil or military. Our skilled experts and state-of-the-art resources mean we deliver top-quality satellite navigation, integrated communications and services.

**Company's Primary Services:**

- ▶ Contractual/Technical coordination
- ▶ Engineering Support
- ▶ Operations
- ▶ Logistics
- ▶ Crew Training
- ▶ User Support
- ▶ Design, development, manufacturing, integration, testing, of payload facilities and experiments

**ISS-certified Hardware Available for use:**

- ▶ MDS (Mice Drawer System): space multi-cage accommodates 6 mice
- ▶ Complete set of experimental facilities, assemblies, components, and cargo transportation elements qualified for ISS use available on request
- ▶ All hardware developed is verified and certified according to customer and Agency requirements; all associated documentation provided

**Ground and/or Flight-based Research Support Services:**

- ▶ Interface with NASA ISS Payloads Office
- ▶ Development and submission of required documentation
- ▶ Support bench reviews and crew training
- ▶ Design of flight-certified hardware to support research objectives, including CAD/CAE modelling and simulations
- ▶ Support the entire end-to-end process, from the development of initial concepts to the operations of the experiments on board and recovery from landing systems, including training of the astronauts (ALTEC crew trainers are certified by NASA and ESA)
- ▶ Feasibility assessment of possible accommodation of onboard experiments
- ▶ Implementation and certification of payloads
- ▶ Ground development and qualification testing
- ▶ Definition and implementation of training for ground and flight procedures.
- ▶ Payload operations on the ISS.
- ▶ Archiving and dissemination of data

**Labs, Shops, and Test Facilities that can be Provided:**

Neutral Buoyancy Test Facility (NBTF) to simulate activities typical of reduced gravity

Real time Operations Support from ALTEC Mission Control Room

Development and testing of breadboards in laboratory environment

Integration and Testing of space systems in Clean Rooms (ISO8 and ISO5)



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WYLE INTEGRATED SCIENCE AND ENGINEERING GROUP | [www.wyle.com](http://www.wyle.com)

The Wyle Integrated Science and Engineering Group has more than 40 years of experience and is the recognized leader in life sciences research, space medical operations and engineering for the enhancement of human performance and safety in air and space.

**Primary Services:**

- ▶ Biomedical Research & Development
- ▶ Commercial Human Spaceflight
- ▶ Engineering Design, Development, Test & Evaluation
- ▶ Human Performance & Protection
- ▶ ISS Mission Operations
- ▶ ISS Payload Integration
- ▶ Occupational Medicine, Health
- ▶ Program Management Consulting
- ▶ Flight Qualification & Certification
- ▶ Sustainment & Systems Engineering

**Available ISS-Certified Hardware:**

- ▶ Biotechnology Specimen Temperature Controller (BSTC)\*
- ▶ Rotating Wall Perfused System (RWPS) (In Re-Certification)

**Facilities:**

- ▶ Rocket Engine/High Pressure Fluids Test Laboratory
- ▶ Space Environment Test Chambers
- ▶ Human-Rated Hypobaric/Hyperbaric Research Chamber

**Shops:**

- ▶ Prototype, Machine & Soft-Goods Fabrication

**Labs:**

- ▶ Bone & Mineral
- ▶ Cardiovascular
- ▶ Core Bioanalytical
- ▶ Immunology & Biochemical Analysis
- ▶ Neurosciences
- ▶ Nutritional Biochemistry
- ▶ Space Toxicology
- ▶ Pharmacotherapeutics
- ▶ Radiation Biophysics
- ▶ Space Cell Biology
- ▶ Water & Food Analytical
- ▶ Flight Motion Effects/Human Performance RDT&E

**Flight & Ground Research Services:**

- |  |  |   |
|--|--|---|
| <ul style="list-style-type: none"> <li>▶ Develop 3D tissue models for rotating bioreactors</li> <li>▶ Transition Standard Cell Culture Protocols to Flight Experiments</li> <li>▶ Ground Phase Testing in Simulated Microgravity to Validate Flight Protocol</li> <li>▶ Conduct 2D &amp; 3D Cell Biology/Tissue Engineering Flight Studies</li> <li>▶ Dual Energy X-Ray Absorptiometry Scanning</li> <li>▶ Quantitative Computed Tomography Bone Imaging</li> <li>▶ Research Magnetic Resonance Imaging (MRI)</li> </ul> | <ul style="list-style-type: none"> <li>▶ Cardiovascular Research</li> <li>▶ Renal Stone Risk Validation/Countermeasures</li> <li>▶ Immune function research in extreme environments</li> <li>▶ Design/Validate immune function countermeasures</li> <li>▶ T-Cell Signal Transduction Studies</li> <li>▶ Ambient Storage for Human Biological Fluid</li> <li>▶ Neuroscience Research</li> <li>▶ Clinical Dietetics/Intake Analysis</li> <li>▶ Biochemical Nutritional Assessments</li> <li>▶ Micronutrient Food Analysis</li> </ul> | <ul style="list-style-type: none"> <li>▶ Stable &amp; Radioisotope Analysis</li> <li>▶ Calcium/Iron Absorption</li> <li>▶ Clinical Pharmacotherapeutics Research</li> <li>▶ Biodosimetry Analysis</li> <li>▶ Ground/Flight Exercise Physiology &amp; Countermeasures</li> <li>▶ On-Orbit Experiment Operation Support</li> <li>▶ Ground/Flight airborne contaminant testing, analysis &amp; monitoring</li> <li>▶ Inhalation Toxicology Research</li> <li>▶ Chemistry, Immunoassay, hematology &amp; serology testing</li> <li>▶ Sophisticated Commercial Equipment Access</li> </ul> |
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ZIN TECHNOLOGIES | [www.zin-tech.com](http://www.zin-tech.com)

ZIN Technologies, Inc. (ZIN) is a minority owned small disadvantaged business (SDB) and experienced developer of ground and flight systems and components for manned and unmanned aerospace applications. ZIN has extensive experience developing NASA human-rated space flight systems. Our engineering Team has designed, fabricated and operated over 150 space flight payloads with thousands of hours of on-orbit operations logged on the shuttle, MIR, and ISS. ZIN has also launched flight hardware to ISS on Progress, ATV and HTV vehicles.

**Engineering & Technical Services:**

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• PROGRAM &amp; PROJECT TECHNICAL MANAGEMENT</li> <li>• ENGINEERING SUPPORT TOOLS                             <ul style="list-style-type: none"> <li>▶ Configuration Control, Risk Management, AS9100 certified, Parts and Materials Tracking and Bonded Stores</li> </ul> </li> <li>• ENVIRONMENTAL TESTING</li> <li>• STRUCTURAL THERMAL &amp; FLUID SYSTEM DEVELOPMENT                             <ul style="list-style-type: none"> <li>▶ Full Analysis and Design Capability</li> </ul> </li> <li>• OPTICS &amp; LASER DIAGNOSTIC SYSTEMS DEVELOPMENT                             <ul style="list-style-type: none"> <li>▶ Particle Imaging and Stereo Imaging Velocimetry</li> <li>▶ Dynamic and Static Light Scattering</li> <li>▶ Digital Imaging and Processing/Compression</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• POWER, ELECTRICAL &amp; CONTROL SYSTEMS DEVELOPMENT                             <ul style="list-style-type: none"> <li>▶ AC/DC, DC/DC Conversion Aerospace/Radiation Hardened Design</li> <li>▶ Electrical Design, Schematics, PCB Layouts</li> </ul> </li> <li>• FABRICATION, ASSEMBLY &amp; TEST                             <ul style="list-style-type: none"> <li>▶ Space Flight Certified Technicians-Cabling And Harnessing, COTS Hardening, Conformal Coating, PCB Assembly</li> <li>▶ 10,000 Sq. Ft. Visibly Clean Assembly Labs</li> </ul> </li> <li>• SOFTWARE SYSTEM DEVELOPMENT                             <ul style="list-style-type: none"> <li>▶ Real-Time Embedded Software Design</li> <li>▶ System Architecture Definition</li> <li>▶ Embedded Control Systems</li> </ul> </li> <li>• PAYLOAD INTEGRATION, SAFETY PACKAGE DEVELOPMENT</li> </ul> |
|---|--|

**Products:**

- ▶ Human Rated Space Flight Avionics Boxes
- ▶ Pc104 Based Data Acquisition Units Used In Microgravity Science Glovebox
- ▶ MEMS-based Inertial Measurement Units (Imu)
- ▶ Wireless Bio-Monitoring





888.641.7797 • [www.iss-casis.org](http://www.iss-casis.org)

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*Manager of the International Space Station U.S. National Laboratory*

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