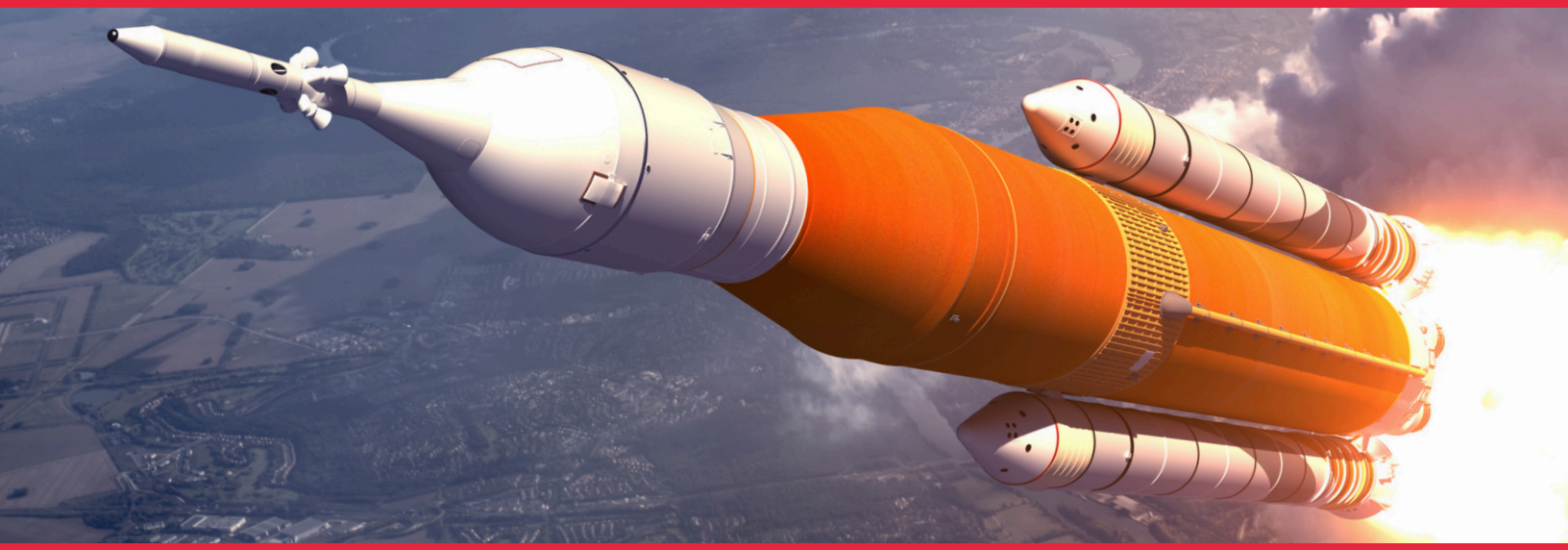
Specialized Engineering & Project Support



At TriVector, we are renowned for our expertise in specialized engineering and project support, backed by industry leading experience. We have successfully performed a wide range of complex tasks for NASA at Marshall Space Flight Center (MSFC) and Johnson Space Center (JSC). Starting from concept design and continuing through integration, testing, and mission operations, our proven results deliver significant value to our customers.

Areas of Expertise

- Systems Engineering Requirements
- Systems Engineering V&V
- Systems Engineering Human Factors
- Guidance, Navigation, and Control (GN&C)
- Ground and Flight Hardware/Software Integration & Test
- Test Planning, Execution, and Data Analysis
- Cross-Program Integration & Interface Management
- ECLSS / Thermal Control
- Software Systems Engineering
- Project Management & Controls
- Electromagnetic Environment Effects (E3)
- Induced Environments
- Jira Project Integration

Program / Project Support

- Space Launch System (SLS)
- Human Landing System (HLS)
- Orion Spacecraft
- International Space Station
- Planetary Mission Program Office (PMPO)
- Commercial Crew Program
- Commercial Low Earth Orbit (LEO) Development
- Moon to Mars (M2M)
- Multi-Purpose Habitation (MPH)

Delivering Engineering Excellence . . . Ensuring Technical Performance

Systems Engineering and Integration

Our team led HLS Systems Engineering & Integration (SE&I) for Requirements & Verification (R&V), focusing on HLS Interface Requirements Document (IRDs), interface verification definitions, and Interface Control Document (ICD) development. We developed initial HLS to Gateway, HLS to Orion, and HLS to Mission Systems IRDs, crucial for HLS Appendix H Solicitation and forming the contractual baseline for HLS interfaces. Our team also established Interface Development planning and strategy for external interface requirement maturity within the HLS Program.

Guidance, Navigation, and Control

Our team on the ESS at MSFC contract specializes in high-fidelity simulation design and analysis using MATLAB, Simulink, and C++, particularly for the Space Launch System (SLS). We conduct independent time and frequency domain simulations for mission objectives and system identification, utilizing Monte Carlo techniques for uncertainty and bounding case analyses. Additionally, we developed a trajectory stitching tool to integrate Monte Carlo ascent and in-space trajectory data, significantly reducing calculation times from over 30 hours to under 2 hours for a single Monte Carlo case with 3000 individual trajectories.

Spaceflight Hardware and Software Support

TriVector contributed to NASA's SLS by providing design, analysis, and development services for field programmable gate arrays (FPGAs) and digital/analog electronics, primarily focusing on power systems. Their involvement encompassed system testing, including the creation and execution of test procedures, along with environmental testing. TriVector also supported electronics hardware design at component and enclosure levels, as well as integration activities, Interface Control Document (ICD) development, and Hardware/Software (HW/SW) Interface documents.

Design and Technology Development

Our team holds extensive expertise in Environmental Control and Life Support Systems (ECLSS), managing upgrades and specifications for systems such as the Purge Pump and Separator Assembly (PPSA) and Urine Processing Assembly (UPA). Additionally, we offer ECLSS support to the Commercial LEO Destinations program office and Chief Engineer Office, providing guidance based on past experiences from ISS and Shuttle programs. Through requirements identification, operations review, and technology development, we contribute to the design process to ensure alignment with both NASA and commercial needs.

Human Factors

Our team contributes to hardware development projects for NASA and Commercial Partners by providing Human Factors expertise, influencing design with inputs on human systems engineering. Utilizing tools like Process Simulate Human, Virtual Reality, and physical mockups, we ensure hardware design accommodates diverse workforce sizes and is operable by ground and flight personnel. Additionally, we conduct formal human factors analyses to verify requirements compliance, supporting projects like Space Launch System Core Stage, design evolution for future SLS versions, and habitat designs for various space missions.

Thermal Engineering

Our subject matter experts oversee technical management and systems engineering for the ATCS on SpaceX Dragon and Boeing Starliner, ensuring safe transportation to the ISS for US astronauts. Leading a team of NASA and contractor specialists, we provide oversight throughout design, development, testing, and verification to certify commercial crew vehicles for flight readiness. Additionally, we support to HLS's induced environments team by providing specialized thermal modeling expertise, delivering critical analysis for the program and their commercial providers.

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