Fifth Gait Technologies

CAPABILITIES

SUMMARY

ABOUT US

Fifth Gait Technologies was founded in 2007 by Dr. Kathryn Doughty as a vehicle for subject matter experts to provide government agencies and their prime contractors the knowledge base needed to achieve mission success. Fifth Gait's role in the industry has since expanded and we now provide the next generation of engineers and scientists a place to learn and absorb the decades of knowledge from the very people that established the standards. Led by an ever-growing staff of subject matter experts, our engineers and scientists are embracing the challenges of tomorrow's space and defense systems and establishing the company as the premier survivability resource for the country.

In addition to our headquarters in Santa Barbara, we have laboratory facilities in Colorado Springs, CO and Huntsville, AL. The Goldflam Laboratory in Colorado Springs provides a hub for electronics and sensor testing. Additionally, the Fifth Gait Technologies Neutron Test Facility (NTF) is co-located with the electronics and sensor test labs at Goldflam Laboratory. The Rocket City Laboratory in Huntsville is the Fifth Gait hub for optics and materials testing as well as space environment and effects modeling.

AS9100 CERTIFIED

NIST 800-171 Compliant

Fifth Gait Technologies is an AS9100 certified company and is NIST 800-171 compliant.

Radiation is at the heart of what we do. From environment definition through system testing and risk mitigation, Fifth Gait provides a complete suite of mission assurance support capabilities for prime contractors and government agencies.

TEST SERVICES

We offer comprehensive testing and verification services to ensure the reliability and performance of your systems. Our tools and expertise help you identify and address risks, verifying mission suitability of your hardware.

MODELING & ANALYSIS

We offer cutting-edge modeling and simulation tools to help you analyze complex systems, predict behavior, and optimize performance. Our data analysis solutions provide rigorous statistical methods and data-driven insights to support informed decision-making.

SYSTEM ENGINEERING

We excel in integrating diverse technologies and components to create seamless and efficient systems, ensuring interoperability and performance.

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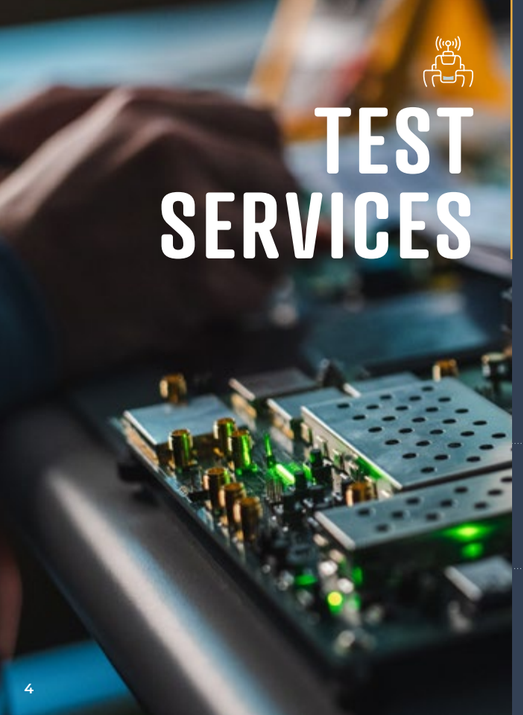


TEST SERVICES

Fifth Gait scientists and engineers have decades of experience directing testing on spacecraft and missile systems. At test facilities large and small, Fifth Gait is leading the way collecting precise and meaningful data that helps our customers assess their system's robustness. In addition to directing and designing complete test solutions for our customers, we also provide test support in the following areas:

- **Design, Build, and Operation of Data Acquisition Systems**
- **System Diagnostics**
- **Facility and Test Setup**
- **Radiation Dosimetry**

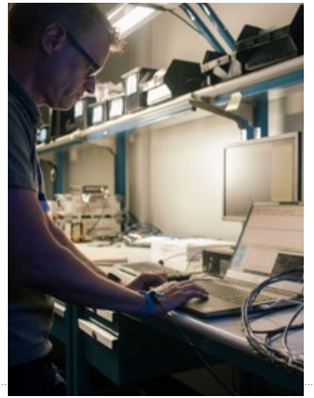
Fifth Gait has developed test approaches that are becoming industry standard, and continues to push the envelope with novel methodologies for complex parts testing.

Our Radiation Testing Services include turnkey solutions for:

- **Microelectronics**
- **Circuit Card Assemblies (CCAs)**
- **Box Level Systems**
- **Optical Designs**
- **Radiation Shielding**
- **Materials**
- **Visible and Infrared Sensors**

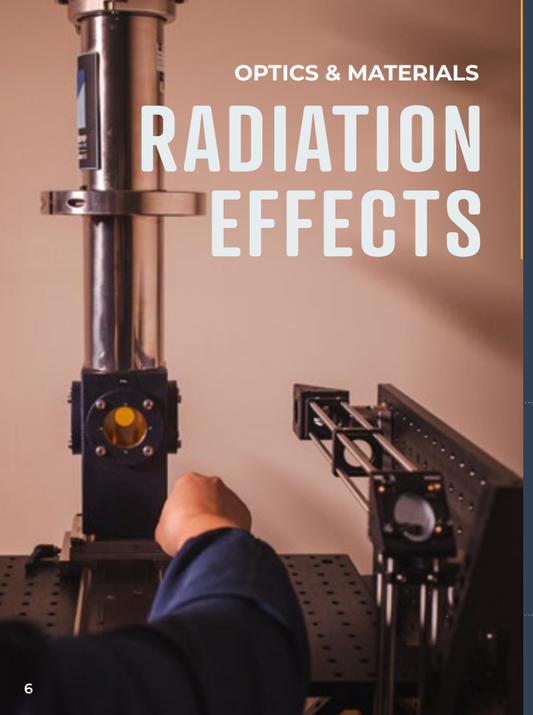
We also provide full characterization testing of visible and infrared sensors. This testing can be for manufacturer design verification and validation or for program mission performance.

Fifth Gait is the custodian and operator of the Missile Defense Agency funded Nuclear Infrared Clutter Simulator (NICS) chamber, located in Colorado Springs.



Electromagnetics Testing Services include all aspects of EMP effects including:

- **EM Probes**
- **Box EMP**
- **Cable SGEMP**
- **Open Cavity SGEMP**
- **Full EMI Evaluation of Cabling and Enclosures**



OPTICS & MATERIALS

RADIATION EFFECTS

The optics team is located in Colorado Springs and Huntsville and supports testing from both locations.

Fifth Gait develops methods for and provides testing of optical components including thin film coatings for mirror and transmissive optics, metallic and composite structures, and radiation shielding materials for space and nuclear environment applications. We maintain and develop mobile optical and materials metrology equipment for on-site and remote site passive and in-situ characterization in support of radiation testing. With our suite of modern test facility diagnostics, we provide hardness information to validate models for assessing current systems.

Our subject matter experts have decades of collective experience testing at world renowned facilities that include:

- **the National Ignition Facility (NIF) at LLNL**
- **the West Coast facility at L3Harris in San Leandro, California**
- **the Sandia Z-Facility at SNL**

ELECTRONICS

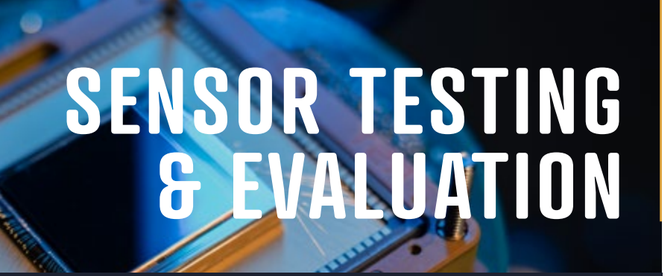
RADIATION EFFECTS

The electronics test team at Goldflam Laboratory tests microelectronics in all types of radiation environments and of all complexity levels, from diodes and transistors to FPGAs and microprocessors. Additionally, our team of engineers develops test systems and procedures for circuit card assemblies (CCAs) and box level testing. The environments in which we test cover the full suite of natural space and man-made radiation:

- **Total Ionizing Dose (TID)**
- **Enhanced Low Dose Rate Sensitivity (ELDRS)**
- **Neutron Displacement Damage (NDD)**
- **Neutron Single Event Effects (nSEE)**
- **Prompt Dose Rate (PDR)**
- **Heavy Ion Single Event Effects (HiSEE)**
- **Proton Single Event Effects (pSEE)**

OUR TESTING IS PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS THAT INCLUDE:

- **MIL-STD-883:** DoD Test Method Standard – Microcircuits
- **MIL-STD-750-1A:** DoD Test Method Standard – Environmental Test Methods for Semiconductor Devices
- **JESD57A:** Test Procedure for The Management of Single-Event Effects in Semiconductor Devices from Heavy Ion Irradiation
- **JESD89A:** Measurement and Reporting of Alpha Particle and Terrestrial Cosmic Ray-Induced Soft Errors in Semiconductor Devices
- **JESD234:** Test Standard for The Measurement of Proton Radiation Single Event Effects in Electronic Devices



SENSOR TESTING & EVALUATION

INFRARED MULTIBAND FPA/ SCA EVALUATION

- **Calibration**
- **Saturation Recovery**
- **Temporal/Spatial/Waveband Cross Talk**
- **Radiation Effects (Survivability/Operability)**

INFRARED MULTIBAND SENSOR MISSION TEST (WITH NICS)

- **Target Acquisition**
- **Tracking & Discrimination**
- **Aimpoint Selection**
- **Imaging**
- **Laser Countermeasures**
- **Dynamic Optical and Radiation Impacts on Mission Performance**

The Sensor Test Lab in Colorado Springs evaluates visible and infrared sensors. Our sensor team is experienced in testing the readout integrated circuit (ROIC) and full sensor chip assembly (SCA) in multiple radiation environments. We provide turnkey solutions to sensor testing in radiation environments. We design and build dedicated test systems, including firmware and capture system. Our test capabilities include complete dynamic scene stimulation of infrared sensors.

Fifth Gait also provides manufacturers and program offices with characterization testing for evaluating sensor design and mission performance. Our radiation-capable portable dewar can house both visible and infrared focal plane arrays (FPA) with cooling provided by either water chiller or liquid nitrogen. The NICS test chamber houses an infrared blackbody, imaging arrays for two-color scene generation and an infrared laser that provides optical flash simulation.

NEUTRON TEST FACILITY

Over the last two decades, Fifth Gait Technologies has led the way in evaluating neutron single event effects (nSEE) and developing fundamental approaches to nSEE testing. Our Neutron Test Facility (NTF) became operational in the summer of 2023 with the installation of a 14 MeV neutron generator. In 2024, a 2.45 MeV source was installed. The NTF is available for external customer rental.

SPECIFICATIONS

DEUTERIUM-TRITIUM FUSION SOURCE

14 MeV neutrons

Max flux (4π) – $1x10^{10}$ neutrons/sec

Max fluence (100 mm²) – $7.9x10^{7}$ n/cm²/s at 1" from drift tube (90% uniformity)

DEUTERIUM-DEUTERIUM FUSION SOURCE

2.45 MeV neutrons

Max flux (4π) – $4x10^{9}$ neutrons/sec

Max fluence (100 mm²) – $4.9x10^{7}$ n/cm²/s at 1" from drift tube (90% uniformity)

FACILITY SUPPORT & AMENITIES

- Neutron and Gamma Dosimetry
- Radioactive Materials Storage
- Facility Power (120 VAC and 208 VAC 3-phase)
- ESD Workstations
- HDPE Enclosure for Moderating Spectrum

MODELING & ANALYSIS

Fifth Gait analysts use both industry standards and in-house developed software tools to perform a wide array of modeling and analyses. Our capabilities span the scope of mission systems and environments.

FIFTH GAIT TOOLKITS

The **Space Ionizing Radiation Environment and Effects (SIRE2) toolkit** includes new and legacy space environment, radiation transport, and radiation effects models. It allows examination of changing environments along satellite orbits and space vehicle trajectories. Most recently, the SIRE2-Now program aims to provide solar radiation environment in real-time, nowcasting, and forecasting for space vehicles and aircraft launch decisions and operations.

The **X-ray Transport and Radiation Response Assessment (XTRRA) toolkit** models and assess materials response to dynamic impulsive loads. We maintain a comprehensive material database using past and current test data to support hardness verification and analysis. XTRRA supports ongoing Strategic and Missile Defense System development, DoD System development, and X-ray, gas-gun, and laser facility test design and execution.

ADDITIONAL MODELING & ANALYSIS CAPABILITIES

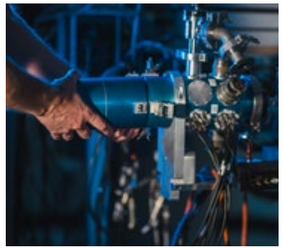
Fifth Gait Technologies' expertise in nuclear environments and effects is translated into our capability to provide anything from radiation response models for use in fast-running engagement codes to detailed end-to-end system simulations. Our models also support development of test design and analyses. Our strengths include electro-optic sensors, electronics circuit design and radiation response, and structure and optics radiation response codes. In addition to our proprietary codes, FGT provides the following:

- **Nuclear threat environments modeling and responses with THTk**
- **Circuit design and radiation response analysis using SPICE**
- **Thin film analysis of optical coatings using TFTCalc**
- **Full suite of EMP analysis using MEEC and THTk, including SGEMP and Box EMP**
- **Radiation transport calculations using SRIM, MCNP, HZETRN and GEANT-4**
- **Sensor engagement modeling using our fast-running HG-SPINE code**
- **Electro-optic sensor radiation response and mitigation codes for assessment and test**
- **Optics, materials and electronics Radiation Test databases**
- **Reactor dosimetry modeling with STAYSL**

SYSTEM ENGINEERING

The System Engineering support provided by subject matter experts at Fifth Gait includes a full scope of mission and system analysis for commercial space and Department of Defense (DoD) programs. Our staff have a deep understanding of industry standards and their implications on mission requirements such as:

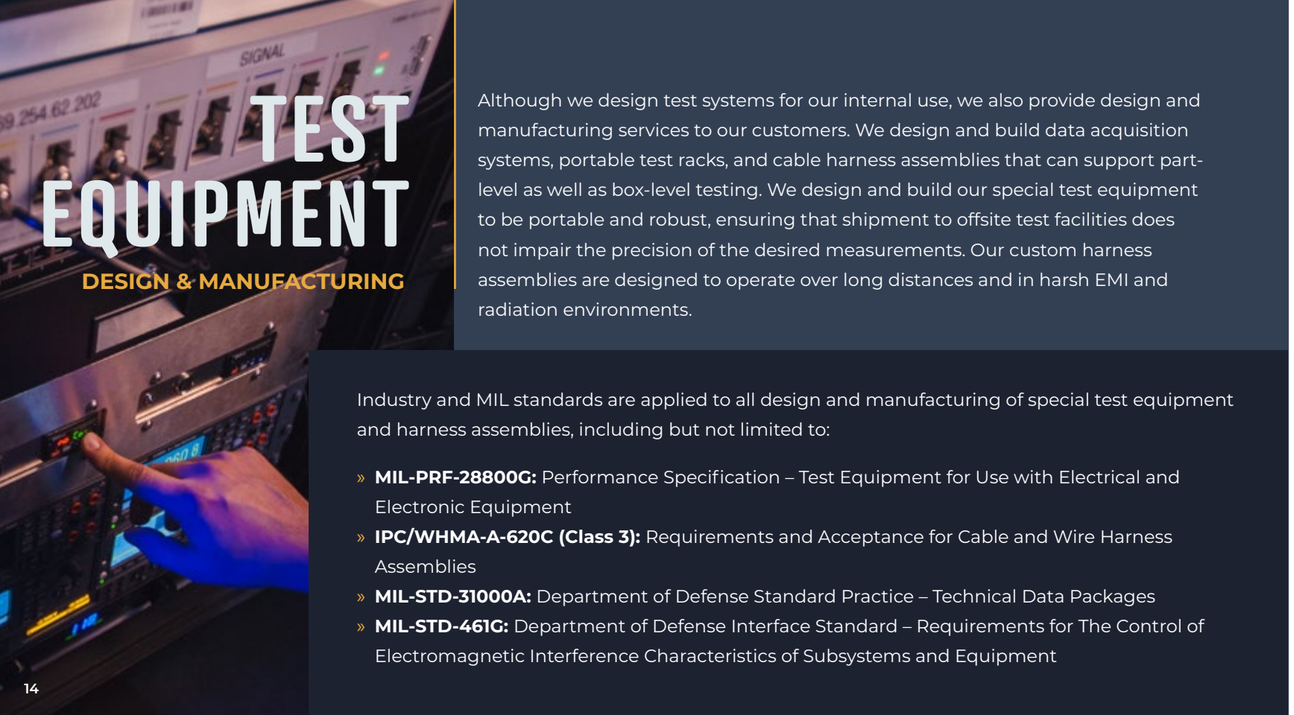
- **Environment Definition**
- **Verification and Validation**
- **System Design**
- **Analysis and Simulation**
- **Advanced Technologies**



Upon identification of the Mission Requirements, programs then require a complete design assessment of their systems. Our staff can help customers at the component, subsystem, and vehicle level. Areas of support include:

- **System Layout for Radiation Hardness**
- **Microelectronics Selection and Testing**
- **Circuit Designs**
- **Materials and Structures**
- **Optical Components**
- **Full Suite of Electromagnetic Pulse (EMP) Effects**
- **Electro-optic Sensor Design and Processing**
- **Radiation Transport and Shielding**
- **Circumvention and Recovery**

FIFTH GAIT'S
SUPPORT & EXPERTISE
CAN PROVIDE
KEY INFORMATION
TO ENSURE
MISSION SUCCESS
TO OUR CUSTOMERS.



TEST EQUIPMENT

DESIGN & MANUFACTURING

Although we design test systems for our internal use, we also provide design and manufacturing services to our customers. We design and build data acquisition systems, portable test racks, and cable harness assemblies that can support part-level as well as box-level testing. We design and build our special test equipment to be portable and robust, ensuring that shipment to offsite test facilities does not impair the precision of the desired measurements. Our custom harness assemblies are designed to operate over long distances and in harsh EMI and radiation environments.

Industry and MIL standards are applied to all design and manufacturing of special test equipment and harness assemblies, including but not limited to:

- **MIL-PRF-28800G:** Performance Specification – Test Equipment for Use with Electrical and Electronic Equipment
- **IPC/WHMA-A-620C (Class 3):** Requirements and Acceptance for Cable and Wire Harness Assemblies
- **MIL-STD-31000A:** Department of Defense Standard Practice – Technical Data Packages
- **MIL-STD-461G:** Department of Defense Interface Standard – Requirements for The Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

CONTACTS

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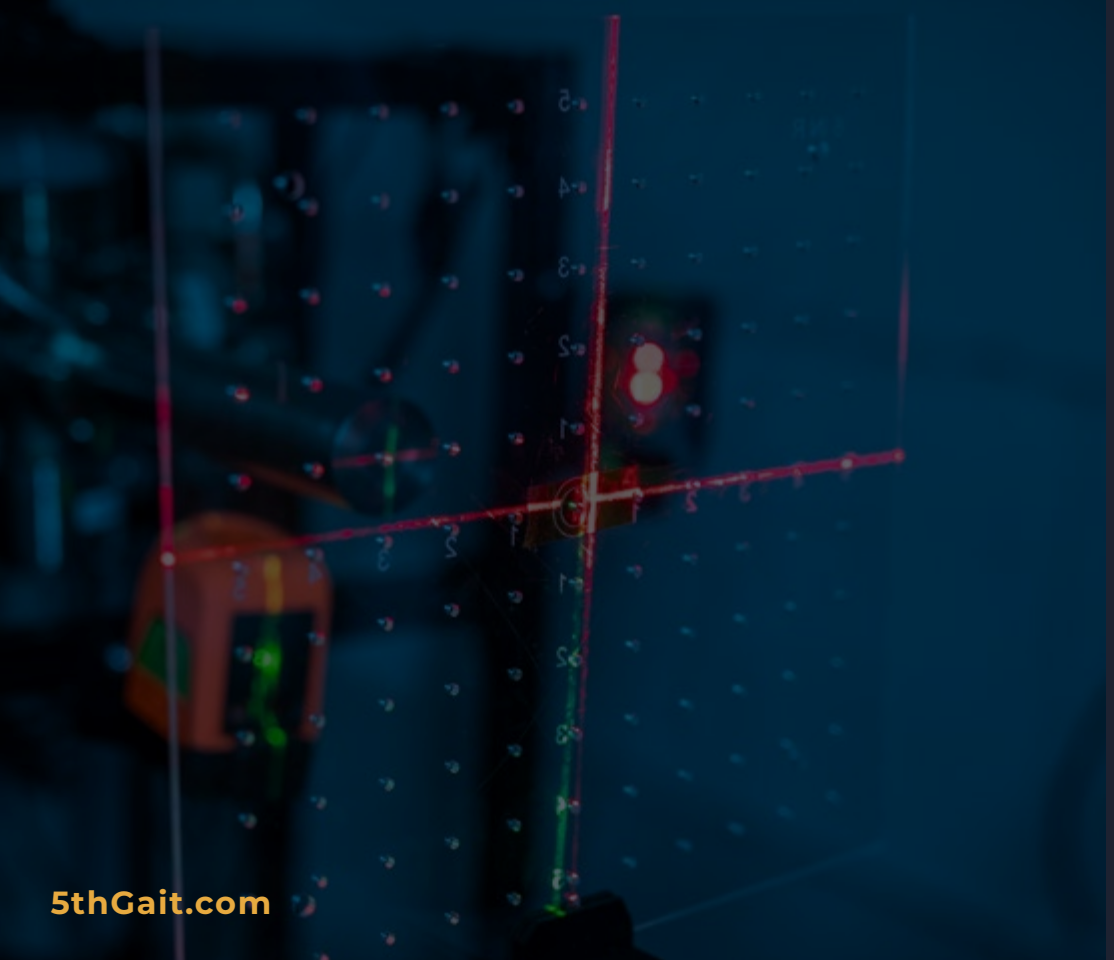

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