



TVAC-Compatible Systems

Custom Electro-Optical Solutions Designed and Manufactured for Space Payload Testing

Equip Your Mission with Optikos Precision

Optikos specializes in the design and manufacture of precision metrology equipment engineered to operate in high-vacuum environments. Our core capability centers on developing vacuum-compatible electro-optical systems and optical image testing that meets the stringent material and performance requirements essential for space-based applications. By leveraging decades of expertise in optical system design and rigorous adherence to aerospace standards, we deliver solutions that enable reliable testing and characterization of optical systems destined for the vacuum conditions of space.

Our vacuum-compatible product line currently includes front-end components of our **OpTest® system: Collimator, Target Generator, and Multi-Spectral Light Source (VIS-IR)**. We are also advancing the development of a **vacuum-compatible Black-Body Source** for enhanced infrared system testing. Each system is engineered from the ground up to address the extreme material restrictions inherent to vacuum environments, where conventional materials, epoxies, and components often fail due to outgassing phenomena.

The engineering challenge in developing vacuum-compatible systems is substantial. Every material, epoxy, and component must meet NASA's low outgassing requirements, specifically for Total Mass Loss (TML) and Collected Volatile Condensable Materials (CVCM).

NASA Outgassing Standards

Parameter	Standard	Maximum Allowable Value	Description
TML	NA-SA-STD-6016	≤1.0%	Total Mass Loss: The percentage of a material's mass lost when exposed to vacuum conditions at elevated temperature
CVCM	NA-SA-STD-6016	≤0.10%	Collected Volatile Condensable Materials: The percentage of outgassed material that condenses on optical surfaces, potentially degrading performance
WVR	NA-SA-STD-6016	-	Water Vapor Regained: Mass regained when exposed to humidity after vacuum exposure (informational parameter)

At Optikos, we follow rigorous NASA outgassing standards to ensure our systems meet every specification and carry the reliability proven through actual flight heritage.

"We use the NASA-approved material list or obtain outgassing data for particular components. Many companies have material restrictions in their quality manuals; our strategy is to only use materials that have space-flight heritage. We know that this approach gets the job done properly."

- Nathan Wallace, Director of Engineering Services at Optikos

Why TVAC Testing Matters

Electro-Optical testing in a Thermal Vacuum Chamber (TVAC) environment is fundamentally superior to earth-ambient testing for space payloads because it faithfully replicates the conditions encountered in orbit. This eliminates numerous error sources inherent to Earth's atmosphere. Testing in air introduces systematic inaccuracies that can mask critical performance issues, leading to costly surprises once a system reaches space.

Space Payload Validation: TVAC Environment vs. Earth-Ambient Testing

EARTH-AMBIENT TESTING

- ✗ Suffers from Wavefront Distortions
- ✗ Produces Unpredictable Gradients
- ✗ Results in Progressive Performance Degradation
- ✗ Relies on Theoretical Compensations for Air-to-Vacuum Shifts
- ✗ Adversely Affects High Precision MTF Measurements
- ✗ Bypasses Mechanical Validation Leading to Costly Mission Failures

TESTING WITHIN A TVAC

- ✓ Eliminates Air-Induced Optical Errors
- ✓ Reveals True Thermal Behavior of Optical Systems
- ✓ Prevents Contamination and Enables Outgassing Detection
- ✓ Ensures Accurate Verification of Alignment and Focus
- ✓ Enables Complete End-to-End System Validation
- ✓ Reduces Risk of Costly On-Orbit Anomalies

Photo of Comet NEAT by NASA Hubble Space Telescope

Optikos Corporation is actively seeking new partnerships for vacuum-compatible optical metrology projects. Our proven track record in developing space-heritage systems, combined with our rigorous adherence to NASA outgassing standards, positions us as a trusted partner for organizations developing next-generation space optical systems.

Contact us today to discuss how our vacuum-compatible testing solutions can de-risk your mission and ensure your optical systems perform flawlessly from ground test through on-orbit operations.

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The Optical Engineering Experts®

Anywhere Light Goes®

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