Case Study

Dynavac Delivers Dual-Purpose EPT/TVAC Chamber for CubeSat Propulsion Development at Cal Poly

WHY
Advanced spacecraft development requires flexible systems capable of supporting both propulsion testing and thermal vacuum simulation within a single platform.

HOW
Dynavac engineered a dual-purpose chamber with specialized pumping, cryogenic cooling, and configurable thermal systems to support both EPT and TVAC testing.

WHAT
A 6 ft × 10 ft vacuum chamber that enables electric propulsion testing and thermal vacuum simulation, delivering high performance across both configurations.

THE CHALLENGE

As CubeSat technology advances, propulsion and maneuverability have become critical to expanding mission capabilities. However, testing electric propulsion systems requires maintaining high-vacuum conditions while managing continuous propellant flow—creating significant challenges for conventional vacuum systems.

At the same time, research programs require thermal vacuum (TVAC) testing to validate spacecraft performance across extreme temperature ranges. Supporting both propulsion testing and thermal simulation typically requires separate systems, increasing cost and complexity.

To advance spacecraft research and propulsion development, Cal Poly required a flexible solution capable of supporting both electric propulsion testing and thermal vacuum testing within a single integrated system.

THE SOLUTION

Dynavac designed and delivered a turnkey dual-purpose vacuum chamber system that enables both electric propulsion testing (EPT) and thermal vacuum (TVAC) testing within a single platform.

The 6 ft × 10 ft modular chamber is engineered to maintain high-vacuum conditions while supporting xenon and argon thruster testing at controlled mass flow rates. Advanced internal cold arrays, cooled to 20 K, enable effective pumping of condensable gases, while a liquid nitrogen-cooled plasma beam dump absorbs propellant energy to maintain stable test conditions.

The system can be reconfigured for thermal vacuum testing through the integration of a thermal shroud and platen, with a gaseous nitrogen thermal conditioning unit providing precise temperature control from -180°C to +150°C.

Delivered as a complete turnkey solution, the system includes installation, commissioning, and support—providing Cal Poly with a highly flexible, high-performance testing capability.

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Special Features

- 6 ft × 10 ft modular vacuum chamber design
- Dual-purpose configuration for EPT and TVAC testing
- High-vacuum capability to 1 × 10^{-7} Torr
- Electric propulsion testing with xenon and argon propellants
- Internal cryogenic cold arrays cooled to 20 K (~ -250°C)
- Liquid nitrogen-cooled plasma beam dump
- Vibration isolation platform for propulsion testing
- Thermal shroud and platen for TVAC configuration
- Temperature range from -180°C to +150°C
- Gaseous nitrogen thermal conditioning unit