SMALLSAT VERIFICATION & VALIDATION LABORATORY

Proper testing reduces preflight risk and verifies requirements before flight. The Space Dynamics Laboratory's (SDL) small satellite experts use the advanced SmallSat Verification and Validation (V&V) Laboratory to characterize and verify satellite system and subsystem performance. The SmallSat V&V Lab augments SDL's environmental testing and calibration facilities to enable comprehensive small satellite testing for SDL's contracted missions.

FEATURES

- Systems engineering best practices for formal requirements V&V
- Full spacecraft systems testing from 1U to 12U
- Partial testing capabilities for ESPA spacecraft
- High-fidelity testing support for fast-paced, low-cost programs
- Testing facilities co-located with manufacturing, assembly & environmental test facilities

CAPABILITIES	FOR TESTING
High-accuracy mass properties testing for measurement of mass, center of gravity (CG) & moments of inertia (MOI)	• Component mass, CG & MOI • System mass, CG & MOI
High-accuracy, three-axis magnetic field generation with real-time closed-loop control & zero-gauss chamber for magnetometer calibration	• Accuracy & alignment of magnetometers • Torque & polarity for torque rods
Single-axis air bearing with high-resolution encoder & three-axis air bearing	• Reaction wheel, control-moment gyro, momentum wheel, or similar system characterization & performance
Solar illumination simulator & NIST-traceable pyranometer	• Solar panel power output verification • System testing using self-generated power (test algorithms, controls, interfaces)
Solar array simulator & battery/charger simulator	• System testing using simulated power (test algorithms, controls, interfaces)
Hardware-in-the-loop (HWIL) system testing	• Test & verification of system interfaces, algorithms & flight software • Component test stations provide for a high-fidelity HWIL model
Star field simulator with Hipparcos star catalog	• Star tracker testing, including static quaternions & simulated slew maneuvers

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TEST STATIONS

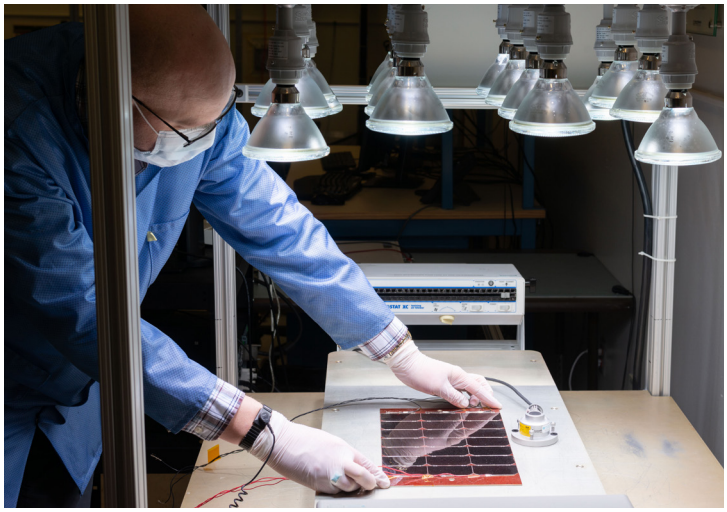
The mass properties test stands offer high-accuracy mass, center of mass, and MOI capabilities for CAD validation, flight acceptance, or static and dynamic balancing of spacecraft. Mass can be measured within 0.5% and the CG to within 2 mm for spacecraft and components from <1 kg to 136 kg. MOI are available for spacecraft up to 113 kg.

The Attitude Determination and Control System (ADCS) test station includes a 2 m Helmholtz cage with a 60 cm working volume capable of closed-loop magnetic field control within 100 nT in the range of +/- 100000 nT. A single-axis air bearing inside the cage with a high-resolution encoder enables torque verification for reaction wheels or magnetic actuators, static alignment and pole verification, and basic ADCS algorithm functionality tests. A star field simulator using the Hipparcos star catalog is also available for star tracker testing.

The communications test station includes software-defined ground radio equipment for UHF and S-band communications. This can be readily used with Cadet, Innoflight, Tethers Unlimited, and Iris radios to command spacecraft over-the-air within the SmallSat V&V Lab. A GPS reradiator is available to rebroadcast local signals from the visible GPS constellation within the lab. A GPS simulator is available to produce the output of the GPS constellation at any time and location, including on orbit.

The power subsystem test stations include a solar illumination simulator with a continuous AM0 light source to verify the power output of solar arrays to a class BBA (IEC 60904-9). A NIST-traceable pyranometer is used to measure the irradiance in the 3U x 3U target area. A solar array simulator supplies a programmable DC power source that simulates the output characteristics of a solar array. The simulator provides up to two outputs and up to 1200 W. An eight-channel automated battery tester is available for battery cycling of packs up to 60 V and 13 A. A battery simulator models lithium battery charge and discharge characteristics to enable functionality testing for electronic power systems.

Functional testing at the ADCS station.



Solar panel illumination at the solar simulation station.

Battery simulation at the battery test station.