SMALLSAT VERIFICATION & VALIDATION

Proper testing reduces preflight risk and verifies requirements before flight. The Space Dynamics Laboratory's (SDL) small satellite experts use advanced SmallSat verification and validation (V&V) to characterize and verify satellite system and subsystem performance. In addition to small satellite V&V, SDL provides environmental testing and calibration for comprehensive satellite testing.

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 CAPABILITIES

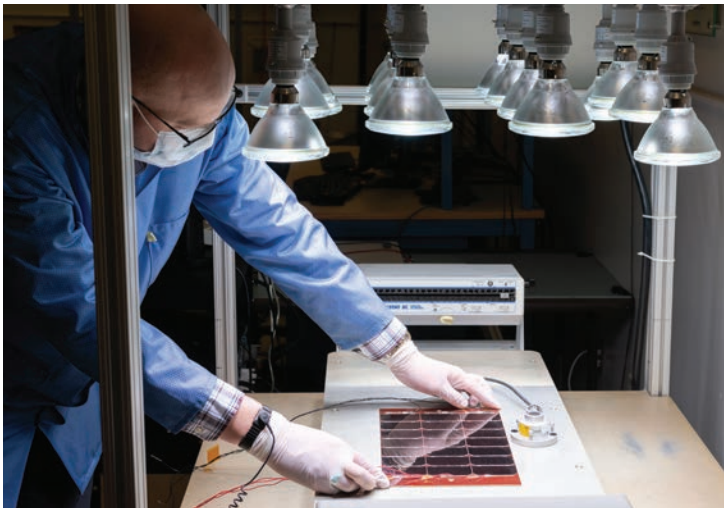
The mass properties test offers high-accuracy mass, center of mass, and MOI capabilities for CAD validation, flight acceptance, or static and dynamic balancing of spacecraft. Mass can be measured within 0.5% and the CG to within 2 mm for spacecraft and components from <1 kg to 136 kg. MOI are available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

The Attitude Determination and Control System (ADCS) test 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 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. A GPS reradiator is available to rebroadcast local signals from the visible GPS constellation. 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 includes 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.



Solar panel illumination.

Battery simulation.