Electrical Power Subsystem Test Facility

Purpose:

To test and evaluate flight electrical power systems such as batteries, solar arrays, fuel cells, super capacitors, relays, and switches.

Electrical Power Subsystem (EPS) Testing

This facility is equipped with all the necessary components to simulate a full-scale flight EPS. Power supplies or solar array simulators are used to simulate the power generated from the solar arrays or other energy source. Programmable loads or resistor banks are used to simulate the spacecraft loads. Batteries (similar, if not identical, to the flight units) are typically used to serve as the energy storage devices in the system. Thermal chambers, with volumes ranging from 6 to 100 cubic feet, are available to house those EPS components (e.g. batteries) requiring non-ambient temperature / humidity control (typically the batteries). The testing is computer-controlled through the use of a Hewlett-Packard Basic software program that interfaces with the control rack (relays, switches, etc.) via data acquisition and control system. The number of instrumentation channels available is limited only by the scanning frequency desired for a given testbed. The flexibility and power of the programming language allows for virtually any testing scenario to be implemented. The range of testing scenarios is constrained only by the limits of the test equipment being used. EPS nominal operation characterization, flight anomaly investigation, and induced failure / response studies are just a few of the ways this facility has supported some of MSFC's major programs over the last 30 years, including the Chandra X-ray Observatory (CXO) and the Hubble Space Telescope (HST).

Battery and Cell Testing

Using much of the same equipment as for EPS Testing, a full array of battery / cell tests can be performed. This includes conducting electrical qualification and acceptance tests on flight cells or batteries, as well as parametric and life-cycle testing of flight-like or engineering cells or batteries. Another aspect of battery / cell testing that can be performed (similar to the EPS testing capabilities) is that of flight anomaly investigation or induced failure / response studies. Additionally, silver-zinc cell activation can be performed in the facility. The cell chemistries that have been tested in this facility include nickel-hydrogen, nickel-cadmium, silver-zinc, lithium-ion, lithium-thionyl chloride, and nickel-metal hydride. Programs that have benefited from testing in this facility include CXO, HST, Shuttle / Solid Rocket Booster, Propulsive Small Expendable Deployer System, Orbital Maneuvering Vehicle, and Combined Release and Radiation Effects Satellite.

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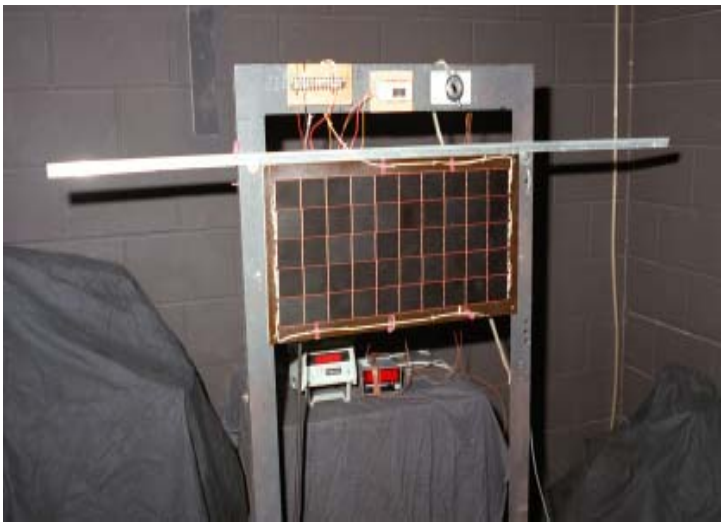
Solar Cell and Panel Testing

The solar cell and panel test section of this facility provides the capability to support design, development, testing, and inspection activities required by various solar array user programs. This facility is equipped with a Spectrolab, large-area pulsed solar simulator (LAPSS) that contains its own data acquisition and control system (DACS). The LAPSS is capable of illuminating a circular target area of 210 square feet to the air-mass-zero intensity level of 140 milliwatts per square centimeter, or 1 sun, with an overall uniformity within 2 percent. The facility has recently been upgraded with a multi-junction LAPSS lamphouse (MJL) designed to provide additional control of spectral distribution needed for testing the state-of-the-art space qualified multi-junction solar cells currently in production. The MJL filtering system has adjustments to vary the total power in each of three wavelength bands representing the spectral response of the junctions of a triple-junction solar cell. It works in conjunction with the LAPSS pulse forming network and DACS of the LAPSS system. The integral DACS is capable of gathering up to 150 simultaneous current-voltage data points from a test article. The required performance curve, current-voltage (I-V), is then plotted from these data points. Test articles with output of up to 100 volts and 10 amperes can be tested. The facility also contains a vertical x-y infrared solar panel inspection station with video output. The inspection station is capable of performing cell-by-cell inspections for cell cracks on panels up to 212 x 212 centimeters in size. Additionally, the facility contains the equipment necessary to perform temperature-coefficient-characterization testing of single solar cells from ambient temperature up to 110 °C.

Nearly 8,000 square feet is dedicated to power systems testing. The facility is protected from inadvertent power outages by a 20 kilowatt (KW) uninterruptible power supply system consisting of a bank of lead-acid batteries continuously in parallel with the facility's primary power bus and a 20 KW diesel generator capable of providing power indefinitely to the facility within 30 seconds of power loss. The facility also receives gaseous nitrogen service for the purpose of purging the thermal chambers in which hydrogen can potentially be emitted. This facility is located in Building 4475.



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