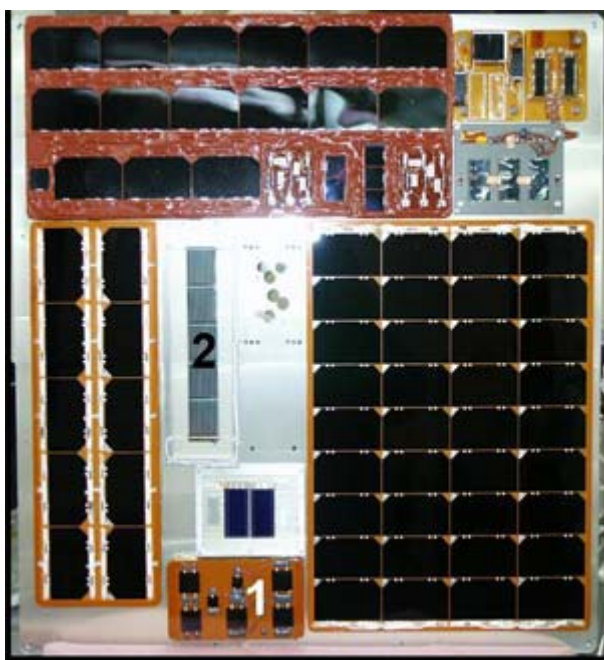


Forward Technology Solar Cell Experiment (FTSCE) for MISSE-5 Verified and Readied for Flight on STS-114

The Forward Technology Solar Cell Experiment (FTSCE) is a space solar cell experiment built as part of the Fifth Materials on the International Space Station Experiment (MISSE-5): Data Acquisition and Control Hardware and Software. It represents a collaborative effort between the NASA Glenn Research Center, the Naval Research Laboratory, and the U.S. Naval Academy. The purpose of this experiment is to place current and future solar cell technologies on orbit where they will be characterized and validated. This is in response to recent on-orbit and ground test results that raised concerns about the in-space survivability of new solar cell technologies and about current ground test methodology. The various components of the FTSCE are assembled into a passive experiment container--a 2- by 2- by 4-in. folding metal container that will be attached by an astronaut to the outer structure of the International Space Station. Data collected by the FTSCE will be relayed to the ground through a transmitter assembled by the U.S. Naval Academy. Data-acquisition electronics and software were designed to be tolerant of the thermal and radiation effects expected on orbit. The experiment has been verified and readied for flight on STS-114.



FTSCE experiment deck to be placed into the MISSE-5 passive experiment container. Glenn's GaAs/SiGe/Si and CuIn(Ga)Se₂ experiments (labeled 1 and 2, respectively) are shown.

The FTSCE consists of an experiment deck (as shown in the preceding photograph) that contains the various solar cells under test, along with a primary solar panel for experiment power, Sun-position sensors, and temperature sensors.

The data-acquisition electronics designed and built by the Glenn team are shown in the following photograph. The electronics consist of one main microprocessor board and nine data-acquisition boards. The main microprocessor board serves as the command interpreter and controls the data-acquisition boards. The core of this assembly is a radiation-tolerant 80C32E microcontroller, random access memory (RAM), and electrically erasable programmable read-only memory. The main microprocessor board includes flash memory so that data are not only transmitted to the ground, but also archived on orbit.



Data-acquisition electronics designed, manufactured, programmed and tested by engineers and technicians at Glenn. The electronics are mounted on the electronics deck. A single main microprocessor board (labeled 0) controls nine daughter boards (labeled 1 to 9) that measure the current-versus-voltage curve, temperature, and Sun angle.

Each data-acquisition board can measure a 32-point current-versus-voltage (IV) curve on four individual solar cells, making two temperature measurements and taking data from one Sun-angle sensor. Multipoint IV curves are created by using a power metal oxide semiconductor field effect transistor (MOSFET) as a variable resistor. In practice, most solar cell experiments employ a bank of switched load resistors or a programmable, bipolar current source for making the IV measurements. The MOSFET configuration provides a substantial improvement over previous IV measurement technology because it is much lighter and smaller than the aforementioned load resistors and it is safer for the cells than a current source.

Bibliography

Walters, Robert J., et al.: Materials on the International Space Station--Forward Technology Solar Cell Experiment. Mater. Sci. Eng. B, vol. 116, 2005, pp. 257-263.

Find out more about this research

Glenn's Optical Instrumentation Technology Branch at
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