

Mars Array Technology Experiment

Developed to Test Solar Arrays on Mars



MATE Experiment flight hardware.

Solar arrays will be the power supply for future missions to the planet Mars, including landers, rovers, and eventually human missions to explore the Martian surface. Until Mars Pathfinder landed in July 1997, no solar array had been used on the surface. The MATE package is intended to measure the solar energy reaching the surface, characterize the Martian environment to gather the baseline information required for designing power systems for long-duration missions, and to quantify the performance and degradation of advanced solar cells on the Martian surface.

To measure the properties of sunlight reaching the Martian surface, MATE incorporates two radiometers and a visible/NIR spectrometer. The radiometers consist of multiple thermocouple junctions using thin-film technology. These devices generate a voltage proportional to the solar intensity. One radiometer measures the global broadband solar intensity, including both the direct and scattered sunlight, with a field of view of approximately 130°. The second radiometer incorporates a slit to measure the direct (unscattered) intensity radiation. The direct radiometer can only be read once per day, with the Sun passing over the slit.

The spectrometer measures the global solar spectrum with two 256-element photodiode arrays, one Si sensitive in the visible range (300 to 1100 nm), and a second InGaAs sensitive to the near infrared (900 to 1700 nm). This range covers 86 percent of the total energy from the Sun, with approximately 5-nm resolution. Each photodiode array has its own fiber-optic feed and grating.

Although the purpose of the MATE is to gather data useful in designing solar arrays for Mars surface power systems, the radiometer and spectrometer measurements are expected to also provide important scientific data for characterizing the properties of suspended atmospheric dust. In addition to measuring the solar environment of Mars, MATE will

measure the performance of five different individual solar cell types and two different solar cell strings, to qualify advanced solar cell types for future Mars missions.

The MATE instrument, designed for the Mars-2001 Surveyor Lander mission, contains a capable suite of sensors that will provide both scientific information as well as important engineering data on the operation of solar power systems on Mars. MATE will characterize the intensity and spectrum of the solar radiation on Mars and measure the performance of solar arrays in the Mars environment. MATE flight hardware was built and tested at the NASA Glenn Research Center and is ready for flight.

Find out more about MATE

(<http://powerweb.grc.nasa.gov/pvsee/publications/wcpec2/mate2001.html>)

Bibliography

1. Scheiman, D., et al.: Mars Array Technology Experiment (MATE). The 28th IEEE Photovoltaic Specialist Conference. Anchorage, Alaska, Sep. 2000.

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