Figure 10.7 The NASA Glenn Research solar cell calibration aircraft. (Photo courtesy of NASA)

terrestrial, aerospace, and satellite products as a long-term simulated sunlight exposure system to test optical coatings, thermal control coatings, paints, and so on. Pulse simulators make it possible to test large solar cell assemblies and solar array blankets.

NASA Glenn uses a Spectrolab Spectrosum Large Area Pulsed Solar Simulator. It has a xenon arc lamp that is flashed to produce approximately 1-sun illumination with a nearly AM0 spectrum. The flash lasts approximately 2 ms, during which time the voltage across the cell is ramped and the resulting current is measured. At the same time the short-circuit current from a standard solar cell of a similar type is used to adjust the measured test sample current for the slightly changing illumination during the flash.

The standards for space solar cell calibration fall under the auspices of the ISO technical committee 20: Aircraft and Space Vehicle, sub committee 14: Space Systems and Operation. The working draft ISO 15387 addresses the requirements for reference solar cells, the extraterrestrial solar spectral irradiance, and the testing conditions. Round robin testing procedures, which rotate the cell measurements from agency to agency, involving NASA, CAST, and ESA for space solar cell calibration are currently under way.

10.3 SILICON SOLAR CELLS

Silicon solar cells are the most mature of all space solar cell technologies and have been used on practically every near-Earth spacecraft since the beginning of the US space program. In the early 1960s, silicon solar cells were $\sim$11% efficient, relatively inexpensive, and well suited for the low-power (100 s of watts) and short mission duration (3–5 years). The conversion efficiency of current "standard-technology" silicon ranges from around 12 to 15% under standard AM0 test conditions [19]. The lower efficiency cells are generally more resistant to radiation.

Cell efficiencies for any application should be adjusted for the array packing factor, radiation damage, ultraviolet degradation, assembly losses, and for corrections due to variations in intensity and temperature from standard conditions. At operating temperature, a silicon solar cell will degrade about 25% over 10 years in GEO orbit owing to charged