NASA'S HIGH EFFICIENCY AND RADIATION DAMAGE SOLAR CELL PROGRAM

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ABSTRACT

The NASA High Efficiency and Radiation Damage (HERD) Solar Cell Program has the objective of improving the conversion efficiency and increasing the end of life efficiency of solar cells and arrays for space applications. The accomplishment of this objective rests upon developing and applying an improved understanding of the conversion of electromagnetic radiation to useful forms of energy. To this end a broad range of advanced concepts are being evaluated.

The research and technology under this program is conducted by four NASA Centers: Jet Propulsion Laboratory (JPL), Langley (LaRC), Lewis (LeRC), and Marshall (MSFC). The elements of NASA program are closely coordinated with similar activities under DOD and DOE sponsorship. This cooperative effort is focussed on a number of key milestones for both cells and arrays as shown in figure. Among these two major components the cell work stresses silicon, gallium arsenide, and multibandgap materials; the array technology includes both planar and concentrator tasks, annealable arrays and advanced systems. In addition related work includes updating the solar cell radiation handbook and maintaining a national testing capability.

The major thrusts of the JPL work are to develop pilot cell production capability for the thin (50mm) Si cell, develop advanced high performance GaAs cells, advance the state-of-the-art of efficient array structures, develop the technology for blankets with a specific power greater than 300 W/kg, develop the technology for concentrator arrays, and to conduct subsystem testing of cells. In addition another important activity is to monitor DOE technology for applicability to space cells.

The LaRC program is devoted at this time to GaAs cell activities. The thrusts include radiation damage and annealing studies, thin cell development using CVD and graphotaxy and developing the technology for high temperature operations.

The LeRC program's major thrust are to produce an 18%-AMO-efficient silicon solar cell, reduce the radiation damage suffered by silicon solar cells in space, develop high efficiency wrap-around contact and thin (50mm) silicon cells for space use, develop GaAs solar cells for concentrator applications, investigate the feasibility of 30% AMO solar energy conversion and develop reliable encapsulants for space blankets.

The MSFC activity is focussed on evaluation of advanced systems for high power applications. Current concepts under study are the spectrophotovoltaics and thermophotovoltaics.

The NASA HERD Program encompasses a range of activities from fundamental science and engineering to applications of advanced technology. The need for future research and technology is evidenced by continuing challenges faced in this important endeavor.

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