

SPACE POWER SYMPOSIUM (C3)  
Advanced Space Power Technologies and Concepts (3)

Author: Dr. Dale Ferguson  
Air Force Research Laboratory (AFRL), United States

Mr. Ryan Hoffmann  
United States  
Dr. Daniel Engelhart  
United States  
Dr. Elena Plis  
United States

ARC PREVENTION ON SOLAR-POWERED MANNED SPACE VEHICLES BEYOND LEO

**Abstract**

Up to the present time, manned space vehicles have only been solar powered in Low Earth Orbit (LEO). SkyLab, Salyut, MIR, the International Space Station, and the Chinese space station (Tiangong) have employed or will employ technology proven on various LEO scientific missions, including PIX, PIX-II, SAMPIE, PASP+, VOLT, MISSE, etc, and have used LEO standards and software, such as NASA-HDBK-4006, NASA-STD-4005, NASCAP-LEO, Nascap-2k, the Environments WorkBench, PIM, etc. Manned missions beyond LEO, ie the Apollo flights, have been fuel-cell powered. Now, manned missions back to the Moon, to an asteroid, or to Mars are being contemplated that will require reliable and efficient solar power. Lately, it has been hypothesized that despite designing spacecraft the existing standards, arcing in transfer orbits, MEO, or GEO occurs much more commonly than heretofore believed, that contamination from such arcing has led to severe contamination on GPS solar arrays, degrading their performance over time, and that Radio Frequency Interference (RFI) generated by the arcs has led to false signals in USNDS detectors on-board GPS. In addition, sustained arcing, that can occur both in LEO and other orbits, has occurred on ISS, due to meteor or debris strikes on the large high voltage solar arrays. It is imperative that sustained arcing, and its precursor trigger arcs, be prevented on manned missions beyond LEO. Non-LEO standards such as NASA TP-2361 and NASA-HDBK-4002A must be revamped and updated to allow for man-rated levels of reliability, and adjusted for the new lightweight, high efficiency, thin-film solar arrays that will be used outside of LEO. In this paper, a path forward is outlined to enable confident engineering of solar-powered manned missions outside of LEO.