Paper ID: 47485
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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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SOLAR ARRAYS FOR JUPITER MISSIONS JUICE AND EUROPA CLIPPER

Abstract

Airbus Defence and Space Netherlands has been awarded contracts for thedevelopment of solar arrays for two upcoming Jupiter missions: the ESA mission JUICE (Jupiter Icy Moon Explorer) and the NASA mission Europa Clipper. Both spacecraft will explore the habitability of the Jovian moons. They will be subjected to an unprecedented environment for solar powered spacecraft, comprising high sun intensity and temperatures during cruise followed by low sun intensity and extremely cold conditions at Jupiter, high mechanical loads at orbit insertion and an extremely high radiation dose. Besides this harsh environment the instruments on board of both spacecraft impose severe requirements on magnetic field, surface charging and equipotential. Furthermore, Europa Clipper has a large instrument attached to the solar wings.

At Jupiter the sun intensity is only 3% of the intensity at Earth, thus requiring a very large solar array to capture sufficient sunlight. The JUICE and Europa Clipper arrays both consist of 2 wings of five panels each with a total area of 85 m2 and 95 m2, respectively. Both arrays deliver a power in the range of 700 Watts at end of life. The JUICE solar array has two panels per wing deploying in the lateral direction to limit mechanical loads on the SADA interface.

The solar arrays for both missions are based on standard, qualified components of the ARA Mk4 product line. The CFRP substrates and photovoltaic assemblies have been subjected to a thermal cycling program of ca. 200 cycles down to -240C. After thermal cycling, stiffness and strength were tested both at ambient temperature and at low operational temperature. No degradation of mechanical performance was observed. In addition, all non-metallic materials were radiation tested after thermal cycling.

The photovoltaic assembly is composed of 3G28 solar cells by AzurSpace, optimised for the low sun intensity. The solar cells have seen an extensive test program (conducted by ESA) of measurements at low intensity and low temperature, in combination with radiation tests at low temperature. A 300 μm thick coverglass shields the cell against radiation. Both at the front and the rear sides of the panels dedicated measures are taken to avoid electromagnetic interference with the instruments on board of the spacecraft. The presentation will address these and other complex design issues for the solar arrays of two missions which are very challenging in terms of the environment and the science objectives.