SPACE POWER SYMPOSIUM (C3)
Advanced Space Power Technologies and Concepts; Part 1 (3)

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DESIGN, DEVELOPMENT, ASSEMBLY, INTEGRATION AND TESTING PROCESS OF FLIGHT QUALITY SOLAR PANEL FOR LEO SATELLITE

Abstract

Astronautic Technology (M) Sdn. Bhd. (ATSB) thrive towards the development of Malaysia space technology has created several small project initiatives for its future satellite programs. The objectives of the the project can be described as development of small scale flight quality solar panel for Low Earth Orbit (LEO) satellite and catering for future small satellite missions. The scope of work covers several phases namely System Design phase, Detail Design phase, Manufacturing and Assembly phase and Testing phase. The System Design phase involves design drivers identification for solar panel assembly. The electrical, structural and thermal design requirements are imposed in System Design phase to ensure the panel specifications are achieved. Solar panel assembly and fabrication procedures are documented and sectioned into cell assembly and panel preparation procedure. The Detail Design phase includes selection of suitable materials and equipment. Among materials considered are solar cells, interconnectors, coverglass, adhesive and insulators. Triple junction galium arsenide solar cells with monolithic diode at efficiency higher than 27% is considered for better fill factor. The interconnector and bus bar material is made of either silver-coated Invar or silver-coated molybdenum (MoAg) to survive LEO environment. Adhesive and bonding material selection shall have low outgassing properties and wide operating temperature range. The electical power per panel was benchmarked at 110W with maximum panel voltage of 60V and current of 1.80A within area of 830mm x 605mm. At the Manufacturing and Assembly phase, the carbon fibre reinforced plastic (CFRP) panel is manufactured. The panel construction is based on a sandwhich architecture whereby aluminium honeycomb core is sandwhich in between two uni directional prepreg carbon fibre laminate. Electrical insulative film is placed on the panel facet. The whole panel assembly is cured inside autoclave with pre determined curing profile. Cured panel with electrical insulative film is now ready for solar cell laydown. Solar cells are then connected by welding the interconnector to the cell using parallel gap welder. Adhesive and bonding material are then applied to the welded cell strings and transferred to the CFRP panel by using vacuum holding fixture. The bus bars are then connected to the strings and harnessing is routed to the rear of the panel. The final phase of the project is Testing phase for the panel. Among the tests that will be performed are I-V curve test using large area pulse solar simulator (LAPSS), rapid thermal cycle, random vibration and bent test.