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SOLAR POWER GENERATION FOR THE EXOMARS MISSIONS

Abstract

This paper provides a detailed description of the Photovoltaic Assembly (PVA) and, in particular, how the extreme environmental and operative requirements of the Exomars missions are met. "Exomars" is a program established by the European Space Agency to investigate the Martian environment and to validate new technologies in view of future Mars exploration missions. The first mission will be launched in 2016 and will carry a spacecraft composed of the Trace Gas Orbiter (TGO) and the Entry, descent and landing Demonstrator Module (EDM). The second mission is scheduled on year 2018 and will carry a Rover Vehicle (RV). Selex PVA contribution is on both the TGO and RV solar arrays. Moreover we were deeply involved in the design of the power conditioning and distribution electronics of the TGO leveraging on our Power Management and Distribution heritage for scientific platforms. As far as Exomars SA's are concerned, they are significantly different: the TGO is based on two deployable wing system, whose attitude is controlled by the SADM. Each wing comprehends two panels. The RV Solar Array Assembly (SAA) is made of a fixed panel and four deployable (primary and secondary) panels. This SAA is unique with respect to standard deployable systems because of the motor deployment control and trimming possibilities during Martian soil exploration. Each of these missions imposed major design challenges: for the TGO the aero braking maneuvers will cause a significant dissipation of the kinetic energy leading to a solar array temperature increase up to +175C on the rear face, while +135C on the front (active) face. On the other hand, during the cruise phase, the same PVA will experience extreme cold temperatures down to -209C. For the rover SAA the biggest challenge is related to surviving Mars planet environment (i.e. dust, wind and charge accumulation) and the associated mechanical and electrical constraints. We duly considered the experience gained by NASA-JPL on previous Mars lander missions and the selected technical solutions, all taken from the European heritage, represent the evolution to what already successfully flown. Finally the bio burden and planetary protection requirements are also not a standard in SA field. A special manufacturing, assembly and test sequence will be implemented to capitalize our previous experience on the Mars drill tool development. For both the arrays European PVA technology was exclusively used: more specifically high efficiency III-V compounds solar cells and a new glass grounding network.