Solar Panels for Scientific Missions using CubeSat platforms for LEO, MEO and GTO

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ABSTRACT

DHV Technology is a company specialized on the designing, manufacturing and testing of solar panels for CubeSats and Small Satellites. In this presentation is discussed about solar panels of CubeSat missions developed for Scientific missions with Space Agencies involved as CNES, ESA and NASA Goddard.

DHV Technology have developed the solar panels for **Angels** mission developed by HEMERIA and CNES based on a 12U platform, the solar panels for **GTOSat** mission developed by NASA Goddard based on a 3U CubeSat and the solar panels of **TRISAT-R** mission developed by Maribor University and funded by ESA using a 3U CubeSat.

Angels mission is a LEO mission for Earth Observation with a payload developed by Syrlinks and Thales Alenia Space to analyze the state of the oceans, GTOSat mission is a GTO mission to acquire new data about high energy particles and TRISAT-R mission is a MEO mission for in-orbit demonstration.

The requirements on solar panels for LEO, MEO and GTO missions will be analyzed in this presentation and other subjects as qualification process and the quality assurance will be discussed. There are some key points that are analyzed in this presentation as the features of the solar panels for high radiation environment, the resistance torque analysis and the harness design, the electrical losses analysis and the ATOX degradation analysis.

I - Solar Panels for LEO Mission – ANGELS (Hemeria)

- **Power requirements:**
  - 90 W BOL per complete system (40 W per wing)
  - 10 W on body-mounted panel
- **12U Cubesat with Two wings 12U double deployable**
- **Strong ATOX erosion requirements**
- **Operational Temperature Range:** -100°C and +125°C
- **Vibration, Shock and TVAC qualification**
- **Long thermal cycling test:** 15000 cycles at between -100, +125°C
- **TRL9: Soyuz-Ariane VS23 (18/12/2019 From French Guiana)**

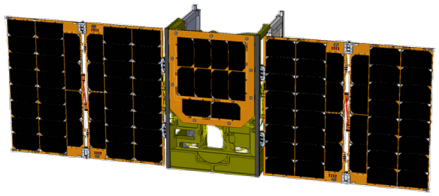

Figure 1. 12U Cubesat Deployable Solar Panels (ANGELS)

II - Solar Panels for MEO Mission – TRISAT-R (LEIS – Univ. Maribor)

- **Power requirements:**
  - Max of 8W per solar panel (16V at nominal)
  - Special design for Solar cells for high radiation environment
- **3U Cubesat with body mounted panels**
- **High-radiation requirement**
- **Operational Temperature Range:** -40°C and +85°C
- **Compatible with ISIPod launcher**
- **TRL9 soon: Vega Launcher on Q3 2020**

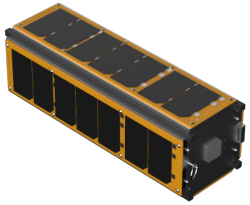

Figure 2. 3U Cubesat Solar Panels (TRISAT-R)

III - Solar Panels for GTO Mission – GTOSat (NASA Goddard)

- **Power requirements:**
  - 51 W BOL per complete system (17 W per wing)
  - 17 W on body-mounted panel
  - Special design for Solar cells for high radiation environment
- **6U Cubesat with two wings 3U double deployable**
- **Diode Board included internally on the satellite**
- **Vibration and Thermal Chamber qualification (current TRL8)**
- **TRL9 soon: ElaNa Program from NASA (2021)**

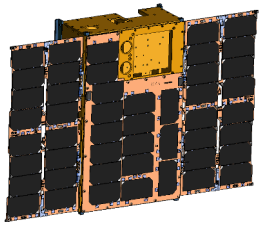

Figure 3. 6U Cubesat Solar Panels (GTOSat)

IV - Conclusion

The requirements for each type of mission, have been separately analyzed for **LEO, MEO and GTO orbits**. The differences in the **radiation** environment per each cases, has driven the whole design of each type of solar panels, reaching individual parameters for the qualification phase of each project. The **power losses** (including the End-Of Life calculations) in these projects have been also analyzed to decide the final harnessing and configuration selected.