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OHB'S PROPOSAL OF AN IN-ORBIT CROSS-CALIBRATION OF SPACE ENVIRONMENT SENSORS

Abstract

All satellite manufactures are currently going through a design change by replacing their chemical propulsion with electrical propulsion, and facing new challenges. All future satellites will use Electrical Propulsion Orbit Raising (EPOR), which will result in an electrical GTO of 142 to 387 days, instead of chemical GTO of 14 days. Those prolonged EPOR periods spend a considerable time in the radiation belts and will cause much more ionizing dose at the beginning of the mission, up to 50% additional total dose of what is expect during 15 years in GEO. There is not enough data of the EPOR-GTO-region in the space radiation models which causes even more high uncertainties in the planning of those missions. Additionally challenges are extreme space weather events like Carrington (1859), Quebec (1989) and Halloween (2003), and an old threat is resurfacing again, High-Altitude-Nuclear-Explosion (HANE), which can cause EMP and radiation belt pumping.

Due to those new challenges are more space environment sensors on satellites needed for housekeeping (e.g. actually measuring instead of guessing), anomaly investigation (analyze in-orbit behaviour), mission life extension (actually dose versus design dose), future designs (validation of the space radiation models).

Space radiation sensors are normally only calibrated on ground. Cross calibration is only applied after the mission when data sets of sensors on different satellites are compiled into one radiation model data set. Both methods have their disadvantages. Ground calibration can't reproduce space radiation (mix of particles and energy-spectrum) and provides only a partial calibration. Post-mission-calibration of data sets is difficult when sensors flew on different satellites at different locations under different conditions. Therefore the conclusion is that more in-orbit cross calibration and qualification is needed.

In-orbit cross calibration of two or more space environment sensors would have the following advantages, it would be on the same satellite, at the same location & time, under the same conditions, and therefore provide a full comparison. The in-flight cross calibration would enhance the scientific value of the data sets of all involved sensors. Cross calibration and qualification could happen at the same time, e.g. old and new sensors flying next to each other on the same satellite.

OHB System started an initiative to promote more cross-calibration in space, with the aim to identify possible candidates of sensors, to research integration costs of those sensors, and to look for possible flight opportunities. The results of this initiative will be presented in this talk.