Paper ID: 67998
oral
student

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

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IRIS: AN INNOVATIVE EARTH OBSERVATION INSTRUMENT FOR THE DETECTION OF POLLUTION TRACES IN THE SEAS.

Abstract

Oceans are fundamental to the planetary fauna and flora development, yet during the last decades they have been persistently polluted by human activity. 10 million tonnes of litter are globally dumped in the ocean every year, of which 8 million tonnes are plastic. The Mediterranean Sea suffers especially from such environmental stresses due to its geography and surrounding human activity. To control marine litter the first step is to detect it. To do so we made a feasibility study of IRIS (Imaging of Pollution Traces In the Seas), an orbital-based hyperspectral (VIS and NIR/SWIR) camera designed ad hoc to detect and monitor litter in the Mediterranean Sea. IRIS is based on a push-broom design for a LEO satellite and achieves 30 cm resolution in the VIS channel and 1 m resolution in the IR channel. Such high resolution may allow it to fulfill other Earth observation objectives, enhancing the scientific and industrial return of the mission. The design consists of a 1.8 m long Cassegrain reflector with approximately 50 cm of aperture. Light in the VIS and IR range is captured to simultaneously allow high resolution imaging and litter flagging against the water background. The VIS and IR images are detected on two independent Focal Plane Assemblies equipped with CMOS detectors based on Teledyne's Hawaii-4RG (VIS) and ON Semiconductor's AR0238 (IR). The horizontal Swath is 20 km for all channels. The SNR is always kept above 40 dB. The architecture feasibility has been evaluated considering the dimensioning of the structural, EPS, OBDH and TCS subsystems. The total mass budget for the instrument is 253 kg and the maximum power consumption is 78 W. The instrument has been designed for a 1 tonne spacecraft to be launched on a Vega-C launcher. A 1 to 5 day repetition coverage with constant illumination levels is obtained with a constellation of 31 satellites equally spaced in a sun-synchronous circular orbit of 636

km radius. This also allows the coverage of the entire globe. In conclusion, IRIS is a feasible solution to detect litter in the sea in the framework of very high resolution EO missions, a steadily growing market. The system can fit inside a conventional LEO satellite platform, providing powerful and detailed data with an update rate of just a few days in the selected constellation's configuration.