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THE ORACLE OCEAN HEALTH MONITORING MISSION

Abstract

The human impact on the world's oceans is increasingly important in terms of pollution, climate change and sustainable fisheries. Although agency Earth science missions provide some applicable data sets, there are gaps in coverage in terms of spectral bands and timeliness, which could be solved with small numbers of small satellites providing complementary data sets. The Oracle small satellite mission is therefore aimed at monitoring ocean health. The mission concept was studied under contract to ESA as part of its 'Future EO passive optical missions for small satellites' initiative. The mission provides the simultaneous retrieval of ocean colour, sea skin temperature and aerosol optical depth, using a colour imager, a thermal imager and a spectro-polarimeter respectively, at a high temporal resolution. Synergistic use of these data streams will improve the understanding of phytoplankton production allowing changes in marine health to be monitored, which links closely to climate change. The Oracle multi-modal instrument consists of three standalone imagers: an eight-band multi-spectral pushbroom imager operating in the VNIR spectrum, a tri-band multi-spectral pushbroom imager operating in the LWIR spectrum and an imager able to detect polarised light in the VISIR spectrum in three polarisation orientations, and at seven viewing angles. A multi-modal on-board calibration device ensures that the uncertainties in products of interest are acceptable. The Oracle instrument has also been sized to provide good ground coverage with a swath of 1150km from an orbit altitude of 560km and a spatial resolution of 100m for ocean colour, 300m for sea skin temperature and 900m for aerosol optical depth. The Oracle mission concept aims to proactively determine ocean health with eight evenly spaced daily accesses globally via a sixteen satellite constellation with accesses evenly spread throughout the day. The payload is accommodated on an SSTL-Micro satellite platform which is based around an integrated avionics unit, the Core-DHS, which combines the OBC, AOCS processor, S-Band TTC, GNSS receiver and high performance processor into a single unit to provide a high payload mass fraction. The platform has been designed to fit a broad range of auxiliary launch slots, providing flexibility in the mission schedule.