

29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Space Science Missions (2)

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A DISTRIBUTED SPACE-WEATHER SENSOR SYSTEM USING SMALL SATELLITES

Abstract

Space weather is becoming increasingly important for space and terrestrial activities and is likely to transition to an operational service. Small satellites are ideally suited to space-weather measurements given the need for making simultaneous measurements across both small and large volumes of space. The “Nanosatellites for D3S” phase 0/A study for ESA was initiated in early 2021 with the objective to assess the feasibility of using nanosatellites for future operational space weather monitoring missions in near-Earth space as part of ESA’s Distributed Space Weather Sensor System (D3S) - which itself forms

part of the wider ESA Enhanced Space Weather Monitoring System. The study team consortium is highly experienced including sub-contractors supporting SSTL from MSSL, Imperial College London, and VZLU. Surrey Space Centre and Northumbria University are also providing expert consultancy.

A survey of the measurement requirements and potential space weather instruments has been carried out as part of the Phase 0 study, alongside an investigation into recent relevant nanosatellite missions and future nanosatellites technologies. In addition an analysis and trade-off of high level mission architecture concepts has been carried out leading down to two of the most promising mission architecture concepts, which have since been further analysed in the Phase 0 study.

The first mission architecture concept is to provide near-real time measurements of radiation, thermal plasma and Ionospheric neutrals/plasma, via a constellation of 20 satellites, in a single LEO orbital plane. The second mission architecture concept is to provide near-real time measurements of radiation, the Ionosphere and the Thermosphere, via a constellation of 6 satellites, in a single LEO orbital plane. The orbit selected for both missions is a 500-600km Sun-Synchronous LEO Orbit with an LTAN/LTDN of 10:30am. Both missions assume an operational in-orbit spare satellite. The estimated launch date for the missions is currently 2025.

The Phase 0 part of the study is almost complete, and one of these nanosatellites concepts will be selected in discussion with ESA for further design and development throughout the Phase A study. This paper will further describe the details of the outcome of the Phase 0 part of the study, as well as and the latest status of the Phase A part of the study.