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AURORA: ESA'S SMALL SATELLITE MISSIONS TO MONITOR THE AURORAL OVAL

Abstract

Under the Space Safety Programme (S2P) and as part of the European Space Agency's D3S (Distributed Space Weather Sensor System), ESA's Space Weather Office intends to implement a small satellite mission constellation monitoring the Auroral Oval for operational space weather applications. The observation of the Sun's activity and its interaction with the Earth through the monitoring of the Aurora is considered to become a core element of future Space Weather (SWE) monitoring systems, through the observation of the corresponding Auroral emissions and of the underlying particle and geo-magnetic state conditions.

The foreseen demonstration mission (Aurora-D) follows a novel approach initially using a single small satellite focused on Auroral Oval imaging, followed by a constellation mission (Aurora-C) of SmallSats in a later period, enabling continuous (24/7) monitoring of the Auroral oval from a MEO orbit that is expected to be accessible only by a micro-launcher. The core instrumentation of Aurora consists of the Auroral Optical Spectral Imager (AOSI) and the Auroral UV Imager (AUI). Furthermore, a modular instrument combining several radiation monitors and magnetometers (RadMag) is baselined as a secondary payload to monitor magnetic field dynamics and the radiation environment. The instruments are based on recent developments employing new technologies that will be deployed to space for the first time. To minimize the number of satellites, while ensuring continuous and guaranteed coverage of the auroral oval, a constellation of four satellites in MEO orbit is envisaged. Such orbit however poses significant challenges for small satellites in terms of accessibility, sustainability, and radiation tolerance.

A Consolidation Phase and Phase B1 mission study is underway led by OHB Sweden, alongside a broad consortium involving partners all across Europe for the payload developments. The Phase B1 study aims at defining the mission baseline that shall enable the fulfilment of the mission requirements in a cost-effective manner while meeting the driving observational requirements including ambitious requirements for global and average revisit times, refresh rate of the Auroral Oval, cadence and data latency. Aurora-D, a demonstrator mission, is classified as low-cost mission for which ESA is developing a framework related to specifically tailored product assurance, engineering and implementation standards. Aurora-D is one of the first missions developed within that framework and therefore at the forefront of establishing a new (space) approach for the development of low-cost small satellite missions at ESA.

The paper will describe the current mission baseline and present the status of its development.