

ESA's upcoming Space Weather Missions to the inner Magnetosphere

As an element of ESA's Space Safety Programme, the implementation strategy and needed elements for the establishment of an Enhanced Space Weather Monitoring System have been identified. The system consists of monitoring the Sun, heliosphere and space environment around the Earth from multiple observation points to achieve sufficient spatial and temporal coverage for enabling timely and accurate space weather services. One of two areas particularly targeted within the Programme is the deployment of the Distributed Space Weather Sensor System in Earth's vicinity, to capture the asymmetry and complexity of Earth's magnetosphere, the involved particle environment and its dynamics.

Several dedicated space weather missions are currently being implemented and planned to monitor Earth's inner magnetosphere.

The SWING mission, ESA's first dedicated space weather mission planned to launch in 2027, will be deployed to a LEO Sun-synchronous orbit and focus on the state of the ionosphere. Next to Langmuir Probes, a radio occultation GNSS receiver, and a solar x-ray monitor, the mission will also host a radiation monitor to determine the flux of high energy protons and electrons providing information on the radiation belts and SEPs.

The SAWA mission will be the 2nd Space Weather nanosatellite, planned to launch at the end of 2028 also to a LEO Sun-synchronous orbit. The mission will provide data on Earth's magnetic field in orbit, the radiowave spectra in the kHz to MHz regime, as well as the neutrals density in the thermosphere.

SWING and SAWA aim to demonstrate the potential and value of a future commercial LEO constellation providing a variety of Space Weather data for nowcasting with the required temporal and spatial resolution.

The SWORD mission will provide key data on Earth's radiation belts. The mission is planned to launch in 2032 to a GTO orbit and will consist of two spacecraft equally distributed over the orbit. The mission will provide frequent passages through both the inner and outer radiation belts, with the satellites slowly rotating to allow for the measurement of the full pitch angle distributions. Both spacecraft will host a comprehensive set of instruments to cover charged particles from 10 eV to 500 MeV, provide the local magnetic field, Langmuir Probes to determine the electron density in the plasmasphere, and a plasma monitor to provide the thermal electron and ion fluxes.

The data of all three missions will be made available in near real-time, i.e. within 60 minutes of data collection on board, with a latency goal of 5 minutes for SWORD.

The poster will present the characteristics and status of ESA's planned D3S missions to the inner magnetosphere.