# Improving monitoring of the fast changing core magnetic field with the future NanoMagSat 16U nanosatellite constellation high-precision magnetic project

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**Abstract**

The geomagnetic field has been continuously monitored from low-Earth orbit (LEO) since 1999, complementing ground-based observatory data by providing calibrated scalar and vector measurements with global coverage. The successful 3-satellite ESA Swarm constellation is expected to remain in operation up to at least 2025. Further monitoring the field from space with high-precision absolute magnetometry beyond that date is critical for improving our understanding of dynamics of the multiple components of this field, in particular that of the core field. Here, we will report on the latest status of the NanoMagSat project, which aims to deploy and operate a new constellation concept of three identical 16U nanosatellites, using two inclined (approximately 60°) and one polar LEO, as well as an innovative payload. This will include an advanced Miniaturized Absolute scalar and self-calibrated vector Magnetometer (MAM) combined with a set of precise star trackers (STR), a compact High-frequency Field Magnetometer (HFM), a multi-needle Langmuir Probe (m-NLP) and dual frequency GNSS receivers. Data to be produced will include 1 Hz absolutely calibrated and oriented magnetic vector field, 2 kHz very low noise magnetic scalar and vector field, 2 kHz local electron density and 1 Hz electron temperature, as well as precise timing, location and TEC products. The constellation design is such that all local times at all geographic locations between 60°N and 60°S will be covered in a little more than one month, much faster than Swarm, which the NanoMagSat is also designed to complement for even faster local time coverage, should Swarm still be in operation at the time of launch. We will present the latest status of the mission, which started an 18 months ESA funded phase of risk retirement activities in January 2022. We will also more specifically focus on the expected ability of NanoMagSat to recover fast core field signals at mid and low latitudes that no previous mission could detect so far, but which numerical simulations of the dynamo strongly suggest are very likely produced within the Earth's core.

**Keywords:** Core Field, Core dynamics, Nanosatellites

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