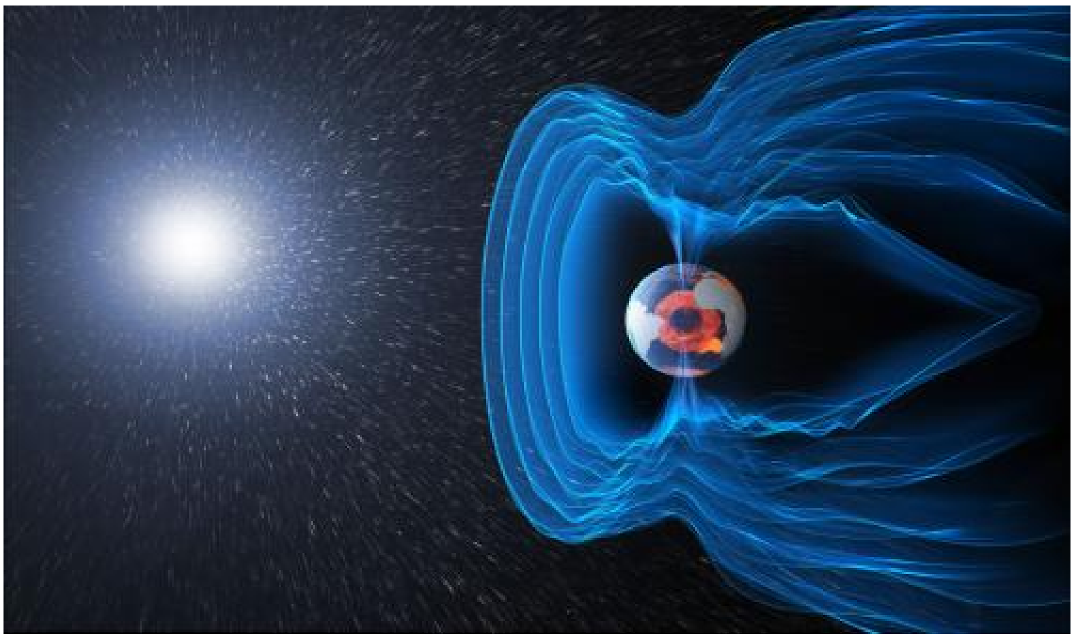
Swarm heads for new heights

February 7 2014



The magnetic field and electric currents in and around Earth generate complex forces that have immeasurable impact on every day life. The field can be thought of as a huge bubble, protecting us from cosmic radiation and charged particles that bombard Earth in solar winds. Credit: ESA/ATG medialab

(Phys.org) —Some tricky manoeuvres are now under way to steer ESA's trio of Swarm satellites into their respective orbits so that they can start delivering the best-ever survey of our magnetic field.

Since the Swarm constellation was launched last November, engineers have been busy putting the satellites through their paces to make sure that the craft and instruments are working correctly.

This commissioning phase is an essential part of the mission before it starts providing data to further our understanding of the complex and constantly changing magnetic field.

Essential to life, the magnetic field protects us from cosmic radiation and charged particles that bombard Earth in solar winds.

Since the intensity of solar activity is currently lower than anticipated, the original plan of where to place the satellites at the beginning of science operations has been reviewed recently by the scientific community and experts in ESA.

Low solar activity means the satellites experience lower atmospheric drag, as clearly demonstrated by ESA's GOCE mission.

Swarm is tasked with measuring and untangling the different magnetic signals that stem from Earth's core, mantle, crust, oceans, ionosphere and magnetosphere.

Launched together, the three identical Swarm satellites were released into adjacent orbits at an altitude of 490 km.

The satellites may be identical, but to optimise sampling in space and time their orbits are different – a key aspect of the mission.

The data acquired from different locations can be used to distinguish between the changes in the magnetic field caused by the Sun's activity and those signals that originate from inside Earth.

The result for Swarm is a slightly different orbit configuration that will save satellite fuel at the beginning of the mission and offer a better return for science at a later stage.

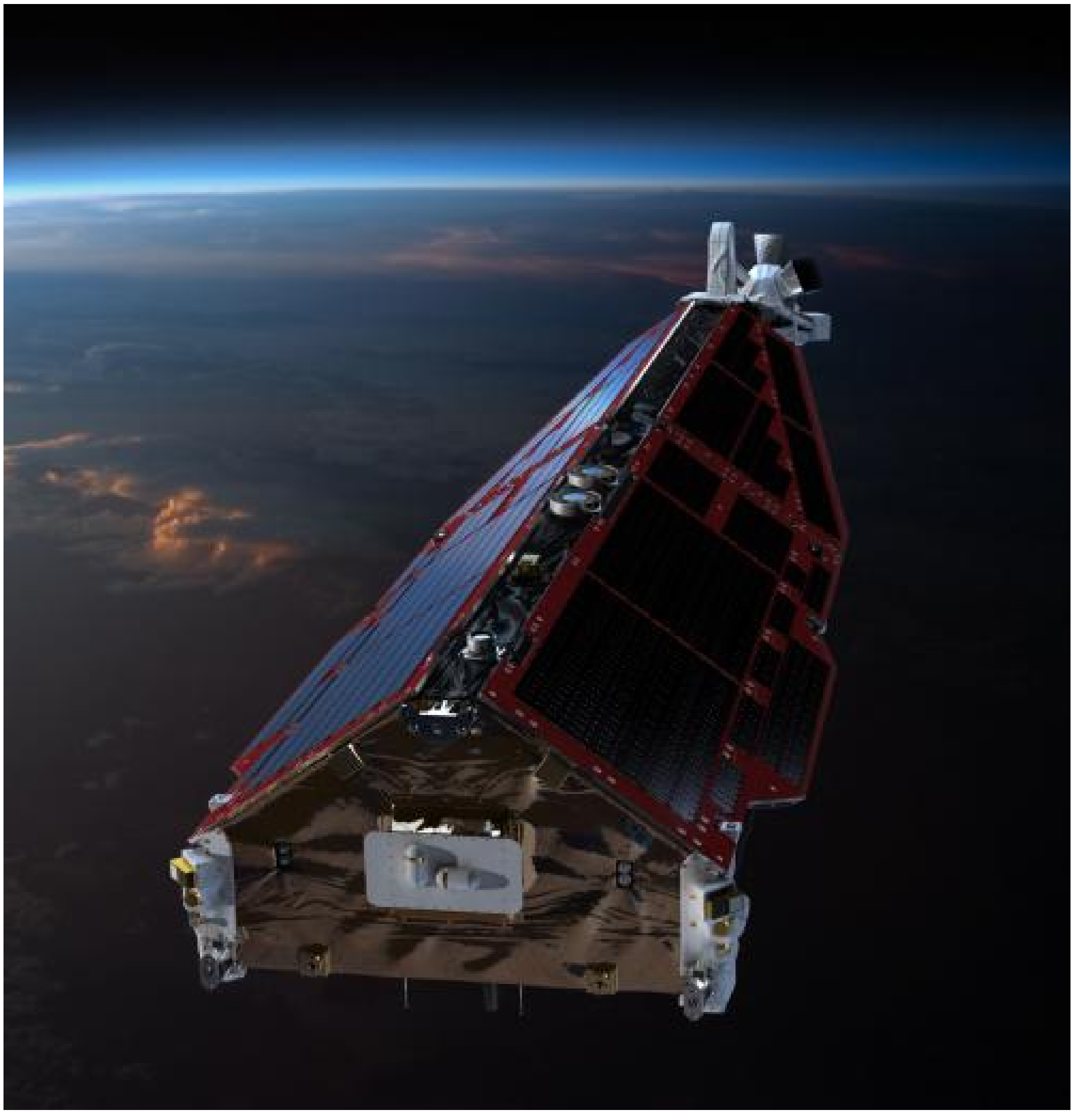
Two satellites are now being lowered to an altitude of about 462 km and an inclination of 87.35°. They will orbit almost side by side, about 150 km apart as they pass over the equator. Over the life of the mission they will both descend to about 300 km.

The third satellite is being placed in a higher orbit of 510 km and at a different inclination of 87.75°, slightly closer to the pole.

The difference in inclination will cause a slow drift of the upper satellite relative to the path of the lower two at increasing angles. After three years, the fuel saved can be used to slow down the relative orbital drift.

Roger Haagmans, Swarm's Mission Scientist, explained, "The constellation originally planned meant a continuous drift between the upper and lower satellites.

"Since we can now slow the relative drift thanks to the current state of the Sun and its even lower activity expected in the next years, we can now obtain more regular observations of the changing magnetic field over time."



Swarm is ESA's first Earth observation constellation of satellites. The trio of identical satellites are designed to identify and measure precisely the different magnetic signals that make up Earth's magnetic field. The electrical field instrument, positioned at the front of each satellite, measures plasma density, drift and acceleration in high resolution to characterise the electric field around Earth. Credit: ESA/ATG medialab

The mission's System Engineer, Ralf Bock, said, "We are taking the satellites to their new heights through careful thrust and aim to achieve the constellation for science operations around mid-April."

Karim Bouridah, the System Manager, added, "We are also continuing to fine-tune the satellite sensors, such as the new electric field instrument."

Each satellite carries a novel instrument to measures the velocity, direction and temperature of incoming ions. This information will be used to calculate the electric field near the satellite, an important counterpart to the magnetic field for studying processes in the upper atmosphere.

In fact, Swarm is the first mission to make these global, multipoint measurements. The animation on the right shows the first data from the electric field instrument from the horizontal and vertical imagers.

Johnathan Burchill from the University of Calgary explains, "This is a time-lapse movie of some of the first ion images observed by Swarm.

"Spanning more than an orbit, the images in this movie demonstrate the capability of the instrument to operate under a wide range of plasma conditions."

Provided by European Space Agency

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