Examination of the Magnetic Field Experiment for the OKEANOS Mission

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Magnetic field is a key parameter to study the natural phenomena in the space. Magnetometers have been boarded on a lot of spacecraft launched for the exploration of new area and novel interpretation of the physical process. Meanwhile, in the future space and solar-system exploration missions, very often the available mass and power are limited and there are various restrictions in the system design. We are developing small-size and low power consumption magnetometers for such difficult space missions. One of the specific ones our development is targeting is OKEANOS.
To avoid the interference with the spacecraft, the sensor is very often mounted on the deployment boom and connected with the electronics installed in the spacecraft body. For example, the Voyager spacecraft had one of the longest (13-m) boom to measure the weak magnetic field at the heliopause. We are now breaking that record by OKEANOS; we will put a pair of magnetometer on the tip mass at the corners of the solar power sail, which is at about 30 m distance from the spacecraft body. That configuration provides us an ideal condition to measure very faint magnetic field in the space.
OKEANOS is a project to explore the Trojan asteroid. In view of the space magnetism, the objectives are the measurements of the intrinsic magnetic field of the target asteroid and the disturbances of the interplanetary magnetic field. We will use magnetic field data at the OKEANOS mother spacecraft and data at the lander to determine the magnetic moment of the Trojan asteroid. We need to detect the difference of the magnetic fields at two positions very accurately because the magnetic moment is estimated to be small.
OKEANOS will make the 13-years journey to the asteroid after the launch. That period is very good opportunity to investigate the interplanetary magnetic field at different distances from the sun. One of the subjects we try to solve is the heating process of the solar wind on the way spreading in the solar system. Whistler waves in the interplanetary shocks are the candidate for the providing heats to the solar-wind plasma. We will measure the magnetic disturbances in the interplanetary shock with high resolution and investigate the contribution to the plasma heating.
We are investigating to mount the magnetometer sensors and electronics together on the tip mass at the corners of the solar power sail. We need to develop small-size and low power consumption magnetometers for the OKEANOS mission. We have two development strategies; one is the small-size fluxgate sensor, and the other is ASIC of the electronics. The detail about the development of the sensor is shown in the separated presentation by Murata and Matsuoka. The ASIC is developed based on the heritage of the magnetometers designed for BepiColombo MMO and Arase (ERG). It was firstly manufactured for the SS-520-3 sounding rocket project. The development is now in progress to modify it to measure the small intensity magnetic field and secure the high reliability in the space environment.

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