

Novel Space Environment Monitor, Instrument, and Space Propulsion Systems

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1. Monitor system for Space Electromagnetic Environments (MSEE)

The main objective of the MSEE (Monitor system for Space Electromagnetic Environments) is to monitor the electromagnetic disturbances caused by human activities in space. It consists of the small sensor units distributed around the target space (Fig. 1). Our main activities on the development of the MSEE in 2007 are as follows: (a) Development of the analogue ASIC containing the differential amplifiers and A/D converters, (b) Simulation study on the location estimation method for each sensor unit.

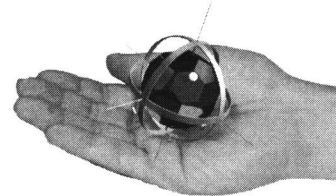


Fig. 1: Sensor unit of the MSEE.

2. Magneto-Plasma Sail (MPS) Space Propulsion System

An MPS (Magneto-Plasma Sail) is a unique propulsion system, which travels through interplanetary space by capturing the energy of the solar wind, which inflates a weak original magnetic field made by a super-conducting coil of about 2-10 m in diameter with an assistance of a high-density plasma jet. From our theoretical estimations, momentum transfer from the solar wind to a spacecraft with a coil is large enough if the plasma source is operated to inflate only the magnetic field away from the spacecraft. Our activities in 2007 are as follows: (a) Sizing (mass, dimension, current, etc.) of the super-conducting coil to produce magnetic field around the spacecraft, (b) Preparation of the experiment facility to measure magnetic field, temperature, current etc. around super-conducting coil.

3. Wave-Particle Interaction Analyzer (WPIA) Instrument for Spacecraft Observation.

Main science target of the WPIA is to detect an energy transfer between plasma wave and plasma particle directly. Generally in collisionless space plasma, wave-particle interaction between plasmas and plasma waves plays much important role of energy exchange. Though direct capture of the interaction was much difficult because of data discontinuity and low time resolution in previous science missions, one of the effective methods is proposed as the interaction measurement between plasma waves and particles. The WPIA which we designed is a new direct calculation system of energy perturbation in space plasma. In the WPIA, we calculate the inner product between electric field and electron particles as following formula in one chip FPGA (Field Programmable Gate Array).