A Student Satellite Mission: Interplanetary challenge of Monitoring Energetic Solar Particles by UNITEC-1

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As a piggy-back satellite of Planet-C, the first Japanese Venus explorer, a smallsize university satellite UNITEC-1 was manufactured by 22 participating Universities and Institutes of National College of Technology in Japan, members of the UNISEC (UNIversity Space Engineering Consortium), expecting to be injected to Hohmann orbit to the Venus by H-IIA vehicle. A 30 cm cube satellite was developed within 2 years from the kick-off meeting on May 2008, with a main onboard computer (MOBC), a power control unit (PCU), batteries (BAT), a 5.8 GHz amateur-band transmitter (Tx), a 144 MHz amateur-band receiver (VBR), 6 university on-board computers (UOBCs), a mission camera (MCAM), and a solar particle monitor (SPM). Missions of the UNITEC-1 are to try deep space communication from small-size satellite and a survival competition of 6 studentmade circuits of UOBCs with using commercial-use ICs in deep space environment. There would be the world first university satellite to the interplanetary space.

In order to obtain any scientific results from the UNITEC-1, we installed SPM, an energetic particle counter in a range up to a few GeV. Severe limitation is expected for downlink communication line due to low-power transmission from small-size satellite in deep space (limit at 6,000,000 km from the Earth, in expectation). Nevertheless, we will monitor the energetic solar particles as far as possible, based on optimum on-board data processing in cases of solar events.

Energetic solar particles released from the Sun by flares or CME (Coronal Mass Ejection) events are usually detected, for example, by GOES satellite on stationary orbit as charged particles (mainly protons) in a range between a few tens MeV and a few GeV. These particles are not only harmful for astronaut activities on orbit but also affective on malfunctions of satellites. Monitoring such particles at any other point on interplanetary space is significant for the flare/CME studies because opportunities of interplanetary cruise are very limited. Previously, SPM on-board NOZOMI, Japanese Mars explorer monitored the solar energetic particles during 1998-2004. In this paper, observation plan (and hopefully the first data on orbit) by the UNITEC-1/SPM and its development process will be shown as space educational and scientific view points.

Keywords: Space education; Space engineering, UNISEC; Energetic solar particles; UNITEC-1.