Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MSD05-11 Room:106 Time:May 20 11:45-12:00

Progress Report of the Development of microsatellite RISING-2 for cumulonimbus and sprite observation by multi-spectrum

SAKAMOTO, Yuji[1*], KUWAHARA, Toshinori[1], TAKAHASHI, Yukihiro[2], Kazuya Yoshida[1]

[1]Tohoku University, [2]Hokkaido University

The development of 50-kg microsatellite RISING-2 started in July, 2009 by Tohoku University and Hokkaido University. The primary mission is earth observation with a resolution of about 5 meters. The fabrication of flight model was completed at May, 2011, and now the update of on-board software and the evaluation with simulation environment are being carried out. In this presentation, a summary of mission and system design is reported.

The RISING-2 is the microsatellite which mass is about 50kg and the size is about 500x500x500mm. The orbit is sun synchronous and the altitude of circular orbit is planned from 600 to 800 km. The launch rocket and date is not decided, but the launch opportunities after 2013 offered by JAXA are applied for.

The primary mission is the earth observation with a resolution of 5 meters by using a Cassegrain reflector telescope which diameter is about 10 cm and the focus distance is about 1 meter. The visible infrared and multi spectral images of cumulonimbus clouds can be observed by using a liquid crystal tunable filter (LCTF) as well as usual color images. Continuously observing the cloud images with an interval of about 10ms, the detail structure of cumulonimbus clouds in multi spectrum can be constructed. This resolution is higher than images obtained by conventional satellites such as TRMM, which have 2-km resolution, and ground radar observatories. These observations are expected to solve a mechanism of guerilla heavy rain and contribute to the establishment of basic technology for weather forecasting.

The observation of sprite and transient luminous events are retried, which was planned by the former satellite RISING (SPRITE-SAT) but was not carried out because of bus system troubles. The instruments consist of two spectrum CMOS cameras, which FOV is 29 degrees each, and one wide-view CCD camera. The horizontal structure is solved by simultaneously observing sprites and lightning discharge phenomena. In the same years, several similar missions such as TARANIS, ASIM, and JEM-GLIMS are scheduled. The multiple observations in several missions will have the marvelous influence on the science of atmospheric electricity in the meteorology, the space and terrestrial physics, and the gamma-ray astronomy.

The RISING-2 can observe the designated position around the earth by using the three-axis attitude control system which consists of reaction wheels, star sensors and gyro sensors. The almost instruments of attitude control system including a central control unit, attitude sensors and wheels are newly developed in this project. The angular velocity can be dumped into less than 0.2 deg/s by magnetic torquers and magnetometers. The fine pointing control using wheels, gyro, and star sensors is carried out for 15 minutes in sunshine and 15 minutes in eclipse each.

The progress of evaluation tests with simulation environment is reported. Two types of simulators, the power system evaluation and the attitude control evaluation, are constructed. Imitating the solar generation power and the consuming power of electrical units, the working of on-board power system can be evaluated. Also, the dummy sensor data such as star sensors and gyro sensors are supplied to the on-board attitude control unit, and the rotation speed of wheels are measured. The external computer calculates the orbit and attitude motion, and the precision of attitude errors are evaluated.

Keywords: microsatellite, Cassegrain reflector telescope, liquid crystal tunable filter, cumulonimbus clouds, sprite

MSD05-11 Room:106 Time:May 20 11:45-12:00