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#北村 健太郎¹⁾, 増井 博一¹⁾, 阿部 修司²⁾, 魚住 禎司²⁾, 寺本 万里子¹⁾, 藤本 晶子¹⁾, 吉川 顕正²⁾, 趙 孟佑¹⁾, YOSTUABA-KULOVER Team^{1,2)}

⁽¹⁾九州工大, ⁽²⁾九州大学, ⁽⁴⁾九工大, ⁽⁵⁾九大/理学研究院

Current Status of the YOTSUBA-KULOVER Satellite for Precise Geomagnetic Observations

#Kentarou Kitamura¹⁾, Hirokazu Masui¹⁾, Shuji Abe²⁾, Teiji Uozumi²⁾, Mariko Teramoto¹⁾, Akiko Fujimoto¹⁾, Akimasa Yoshikawa²⁾, Meng Cho¹⁾, YOSTUABA-KULOVER Team^{1,2)}

⁽¹⁾Kyushu Institute of Technology, ⁽²⁾Kyushu University, ⁽⁴⁾Kyushu Institute of Technology, ⁽⁵⁾Department of Earth and Planetary Sciences, Kyushu University

Since the first launch of the CubeSat in 2003, many universities and institutes have been developing the CubeSat for the purpose of the aerospace educations. As the commercial use and science observations came to increase from 2013, the number of CubeSat launches exponentially increased. Although many universities in Japan also started many CubeSat programs, their missions are mostly focused on the technology demonstrations.

YOTSUBA-KULOVER satellite is a 2U size CubeSat developed under the collaboration between Kyushu Institute of Technology (Kyutech) and Kyushu University to observe the geomagnetic field variations associated with Field Aligned Currents (FAC) and Current Wedge (CW) due to the substorms and with Interhemispheric Field Aligned Current (IHFAC) during the quiet period. The development of the satellite was conducted mainly by the undergraduate students as a human resource development program. The aim of this program is to implement an actual scientific mission other than a technology demonstration in the student satellite program. The bus and mission systems were developed by Kyutech and Kyushu Univ., respectively.

The mission system consists of two components that are fluxgate magnetometer and compact general-purpose camera for embedded microcontrollers. In order to reduce the cost and risk for the development, COTS (Commercial Off-The-Shelf) components were employed. The Basic specifications of the magnetometer are as followings: (1) full scale measurement range is +/- 60 uT, (2) noise floor is less than 50pT at 1Hz, (3) weight is 94g, (4) dimension of the electronics is 90.2mm x 95.9mm, (5) current consumption is 35mA in full range field (5V) and 8.5mA (3.3V). The satellite will be deployed from the International Space Station with the inclination of 51deg and the altitude of approximately 400km. These specifications and orbit conditions enable us to observe the storm/substorm related current systems like a substorm current wedge and the low-mid latitude ULF pulsations with the lower frequency like PC5.

The development of Flight model of YOTSUBA-KULOVER satellite has completed and necessary environment tests, which are integration test, thermal vacuum test, vibration test etc, were also finished. Currently, several governmental procedures, like frequency coordination, safety review, and procedure of space activity law, are ongoing. It is scheduled to handover to JAXA by autumn in 2024, and to be released from ISS in early 2025.