

## Ten years history of Tohoku University ground station and operation system for micro and nano satellites

\*Yuji Sakamoto<sup>1</sup>, Toshinori Kuwahara<sup>1</sup>, Shinya Fujita<sup>1</sup>

### 1. Tohoku University

Tohoku University and collaboration companies have developed three satellites, DIWATA-2, RISESAT, and ALE-1, which were launched on Oct. 2018 and Jan. 2019. The ground station with 2.4-m diameter parabola dish and U/S/X band antennas is being managed in the university, and three satellites are now being operated every day. In this presentation, the hardware and software system included in this ground station are described, which were being maintained and extended since 2009. Also, ground station network with our collaboration universities and companies are introduced, which are located in Philippines, Sweden, Hakodate and Fukui.

Ground station in Tohoku University, called CRESST, was refurbished for our 1st satellite SPRITE-SAT in 2009. In these 10 years, the station used for total 6 microsattellites and 4 cubesats. Low earth orbit satellites are flying over the station for 9 to 12 minutes per opportunity, and the antennas and transceiver frequencies are controlled by calculating the satellite orbits. By only setting the target satellite names, the station is automatically woken up, controlled properly, and suspended again. Operations are not necessary to manage the antennas, and can concentrate on the communication with satellites.

Currently, more 3 satellites, DIWATA-1, RISING-2, and SPRITE-SAT are also tracked and communicated as well as latest 3 satellites. The satellites compatible to this station are registered as JCUBE-B group satellites in International Telecommunication Union. Several satellite are planned to use this station in a few years. The register to ITU will spend the time more than 1 year, and this can make a trouble in project schedule. A satellite can be completed in 1 to 1.5 years in short-term project, and radio license can be a matter. By using this station and compatible radio specifications, it will promote a new satellite project and expand the collaborative partners.

Keywords: microsattellite, satellite operation, ground station