YOTSUBA-KULOVER

Geomagnetic Observation by Yotsuba-KUlover

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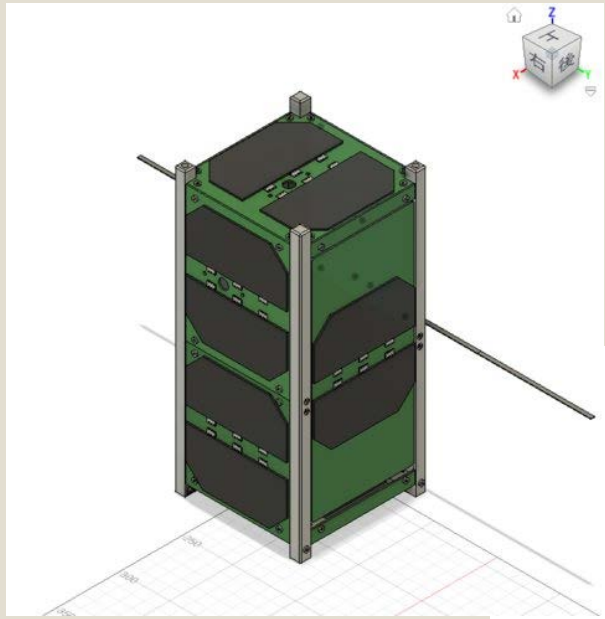
Overview

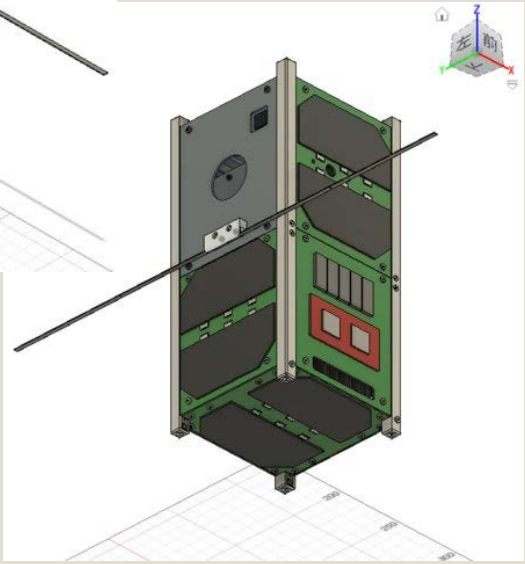
About Yotsuba-KUlover

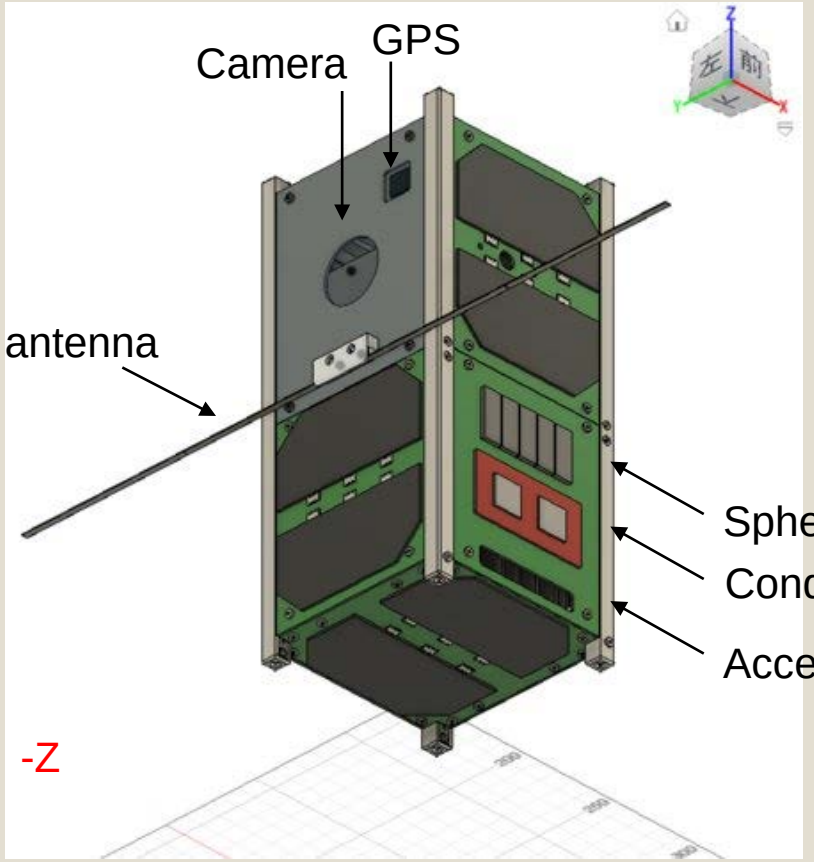
- Student-led Cubesat Development Project
- Composed of undergraduate students from Kyushu University and Kyushu Institute of Technology
- Collaboration between different faculties
- Adopted as a program by the Ministry of Education, Culture, Sports, Science and Technology, between 2021-2023

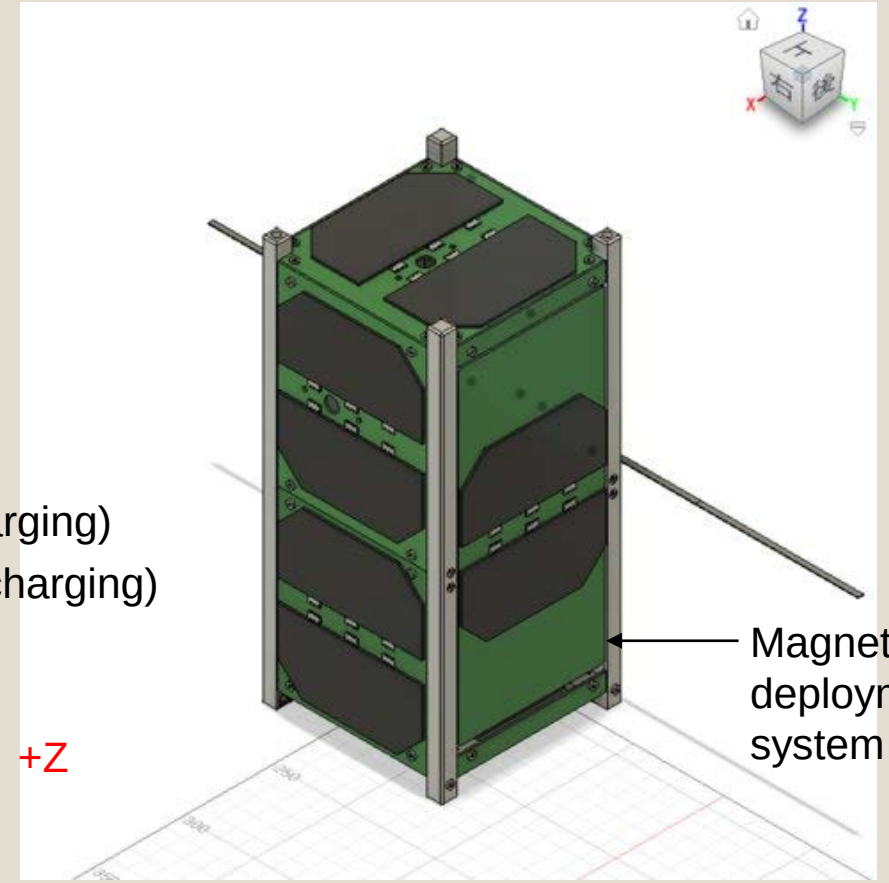
Satellite specifications

Name	YOTSUBA-KULOVER
Size	2U
Launch	Release from ISS
Mission	Magnetic field observation
	Aurora observation by optical camera
	Charging observation in LEO
	Boom deployment mechanism to improve magnetometer observation accuracy

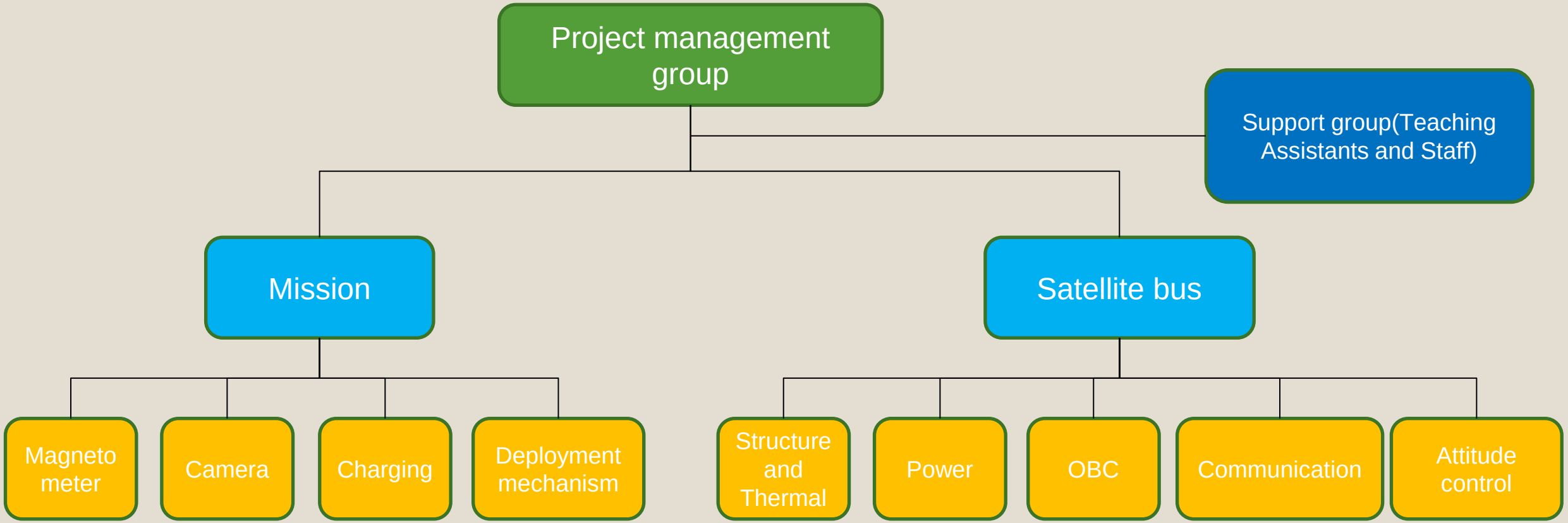





Camera
GPS
Dipole antenna
Sphelar array (for charging)
Conductor plate (for charging)
Access port
-Z


Magnetometer deployment system
+Z

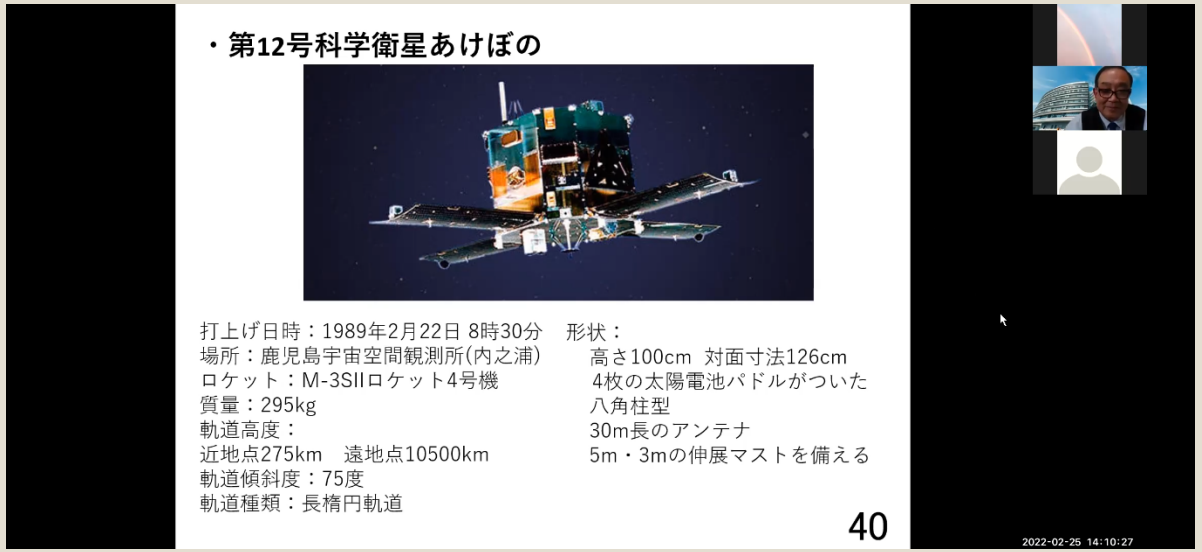
Project organization diagram



Schedule

2021/Nov	Project start
2022/Feb	Science Seminar
2022/Mar	Science Seminar
	MDR
2022/Apr	Conceptual Design
2022/Oct	PDR
	EM development start
2023/Feb-Mar	Factory Tour
	Science Seminars
2023/Apr-	CDR Safety Review Phase 0,1,2 Science Seminars
2023/Oct	FM development complete
2023/Nov	Safety Review Phase 3
2024/Mar	Deliver to JAXA

Member at 2022/Mar on MDR（in Kyutech）

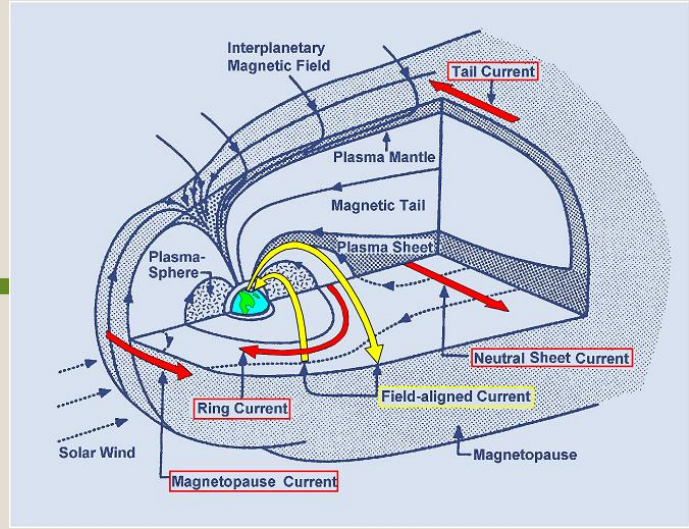


Science seminar about scientific satellite in Japan by Prof. Obara（in virtual）

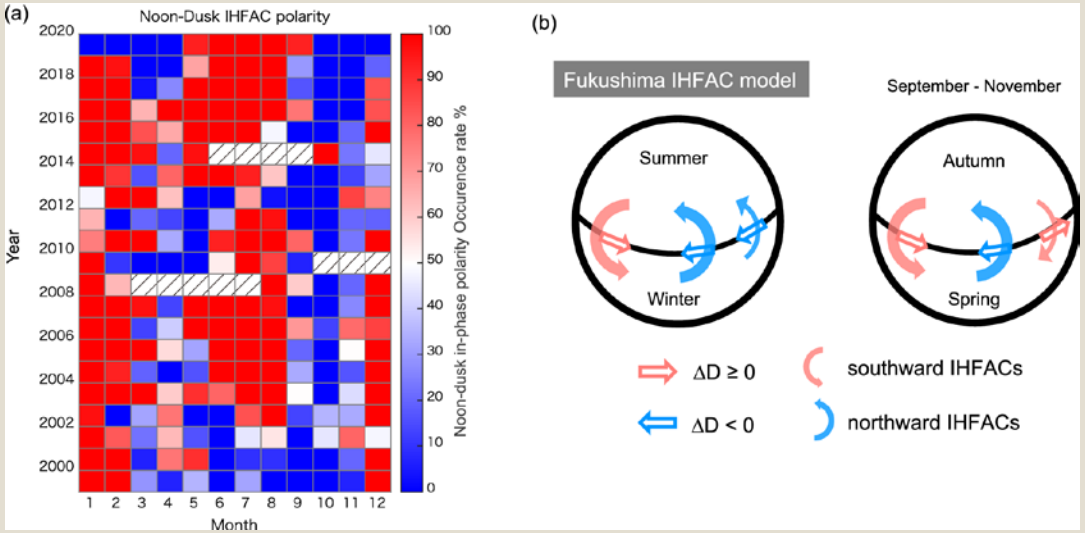
Magnetic field observation mission

Observation target

- Geomagnetic storm
  - The geomagnetic storm is a temporary disturbance of the Earth's magnetosphere caused by a solar wind shock wave and/or cloud of magnetic field that interacts with the Earth's magnetic field.
- IHFAC
  - The Inter-Hemispheric Field-Aligned Current is one of the major current systems causing changes in the geomagnetic field at low and middle latitudes.
- Other phenomena
  - Substorm, geomagnetic pulsations, etc



A sketch of the magnetosphere (modified from Kivelson and Russel (1995)

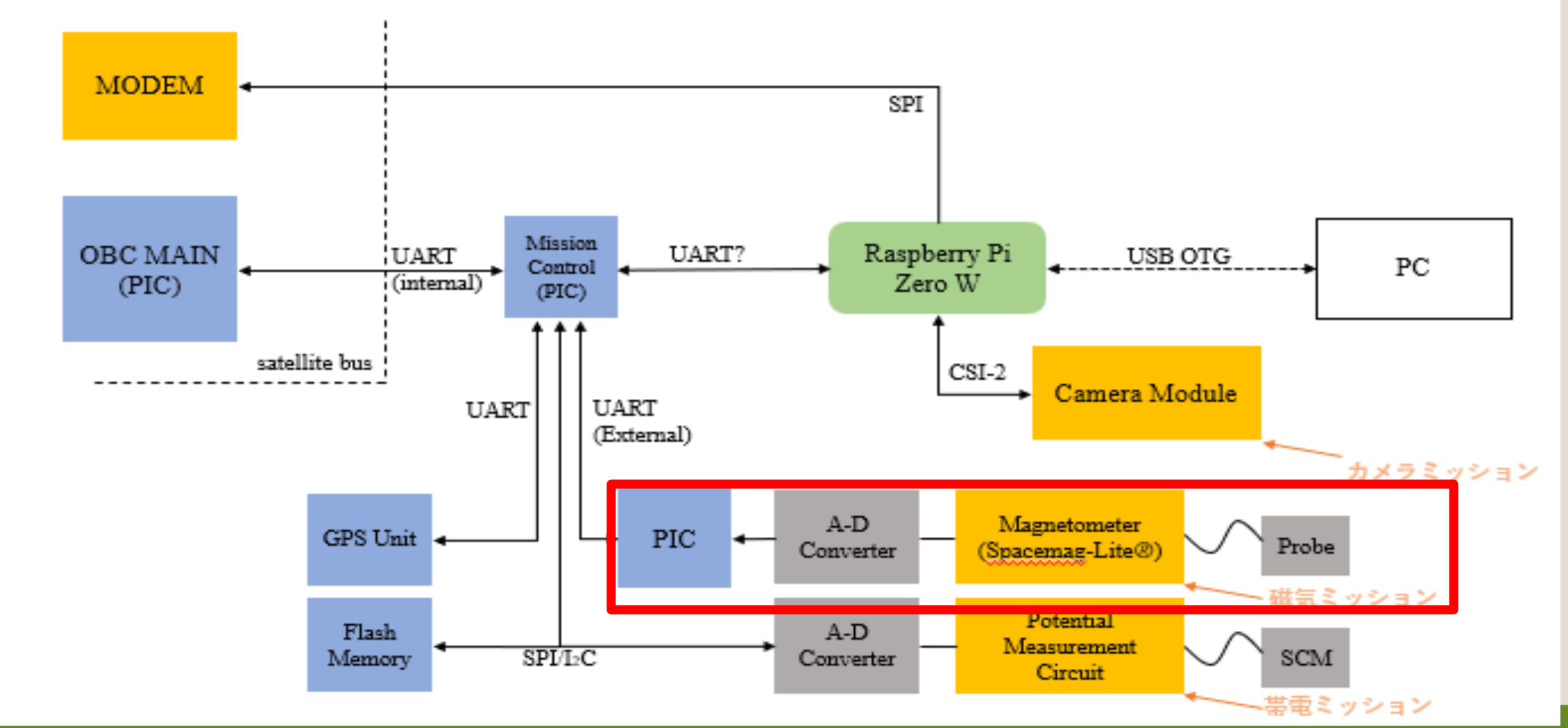


Distribution of the dusk-side IHFAC of the Fukushima's model type, and the illustration of IHFACs polarity(Ranasingh et al., 2021)

Mission criteria

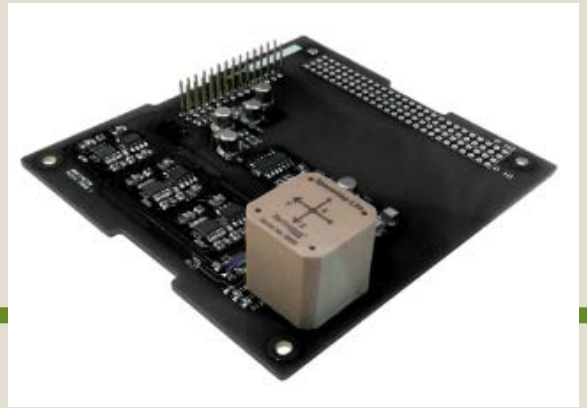
Level	criteria
Minimum	Acquire minute averaged magnetic field data without missing, and receive it at ground stations
Full	Analyze the 1-minute magnetic field data and determine the period which has interesting changes. Download the 1-second resolution magnetic field data during its period by command from the ground station.
Extra	Acquire magnetic field data with 0.1nT resolution considering the removal of magnetic noise emitted from the satellite itself.

Communication Block Diagram

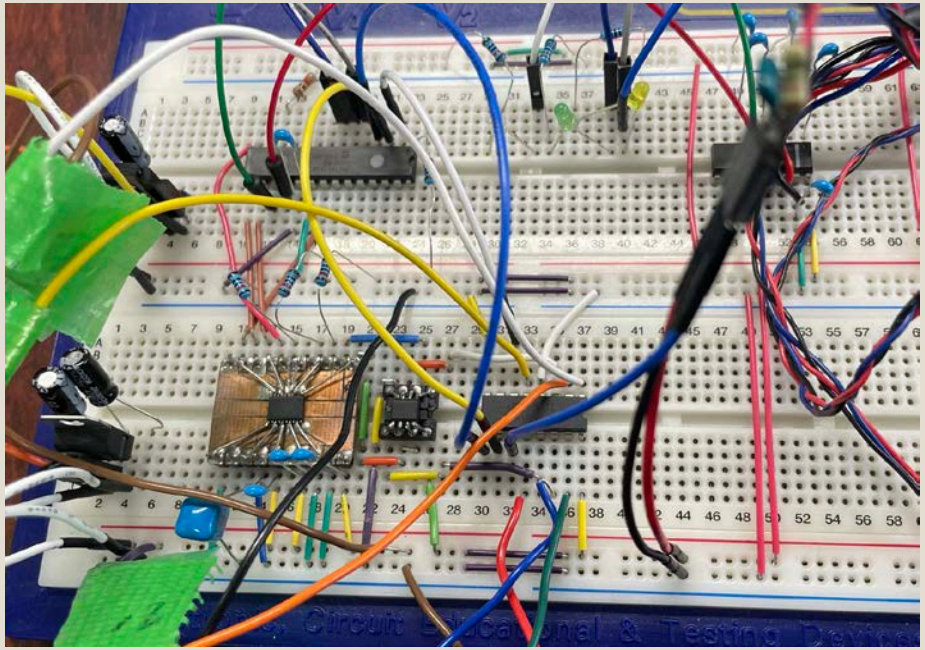


Devices

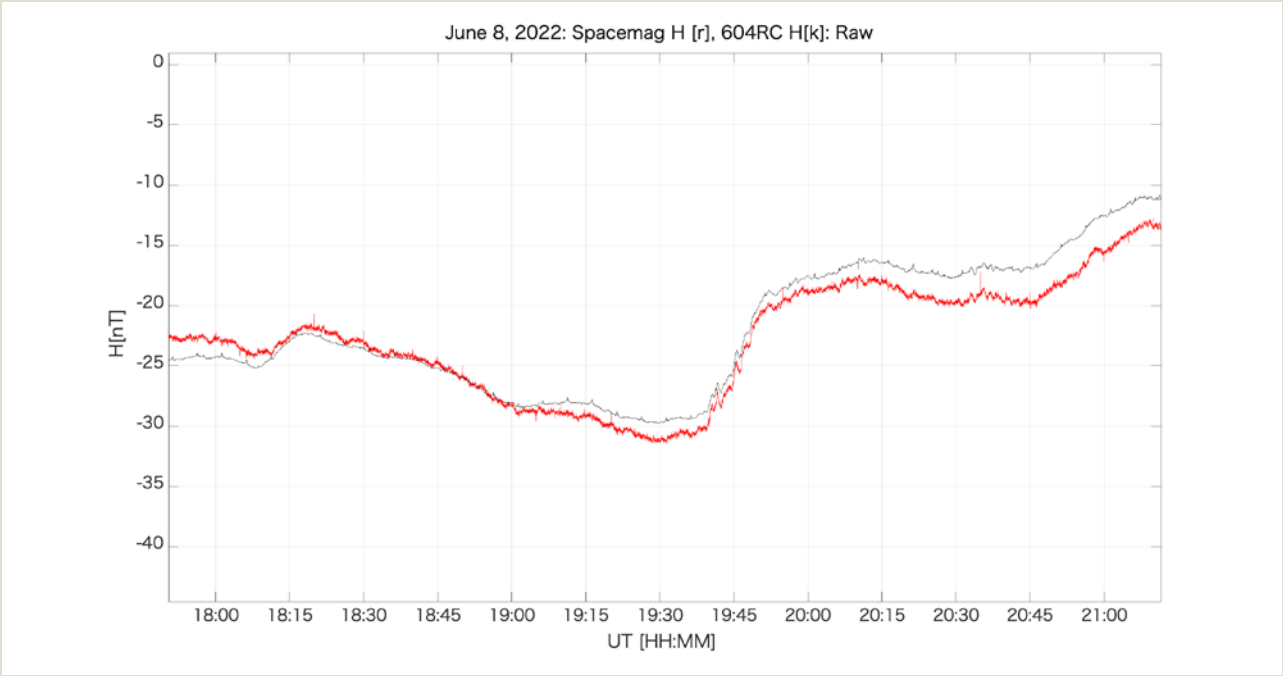
Name	Spacemag-Lite
Manufacturer	Bartington instrument
Size	90.2mm × 95.9mm (Probe:20mm × 20mm × 20mm)
Weight	Board：67g　Probe:42g
Power consumption	0.2W(Typical)
Measuring range	±60μT
Voltage input	5.0V and 3.3V



Magnetometer board(black) and probe(cream)



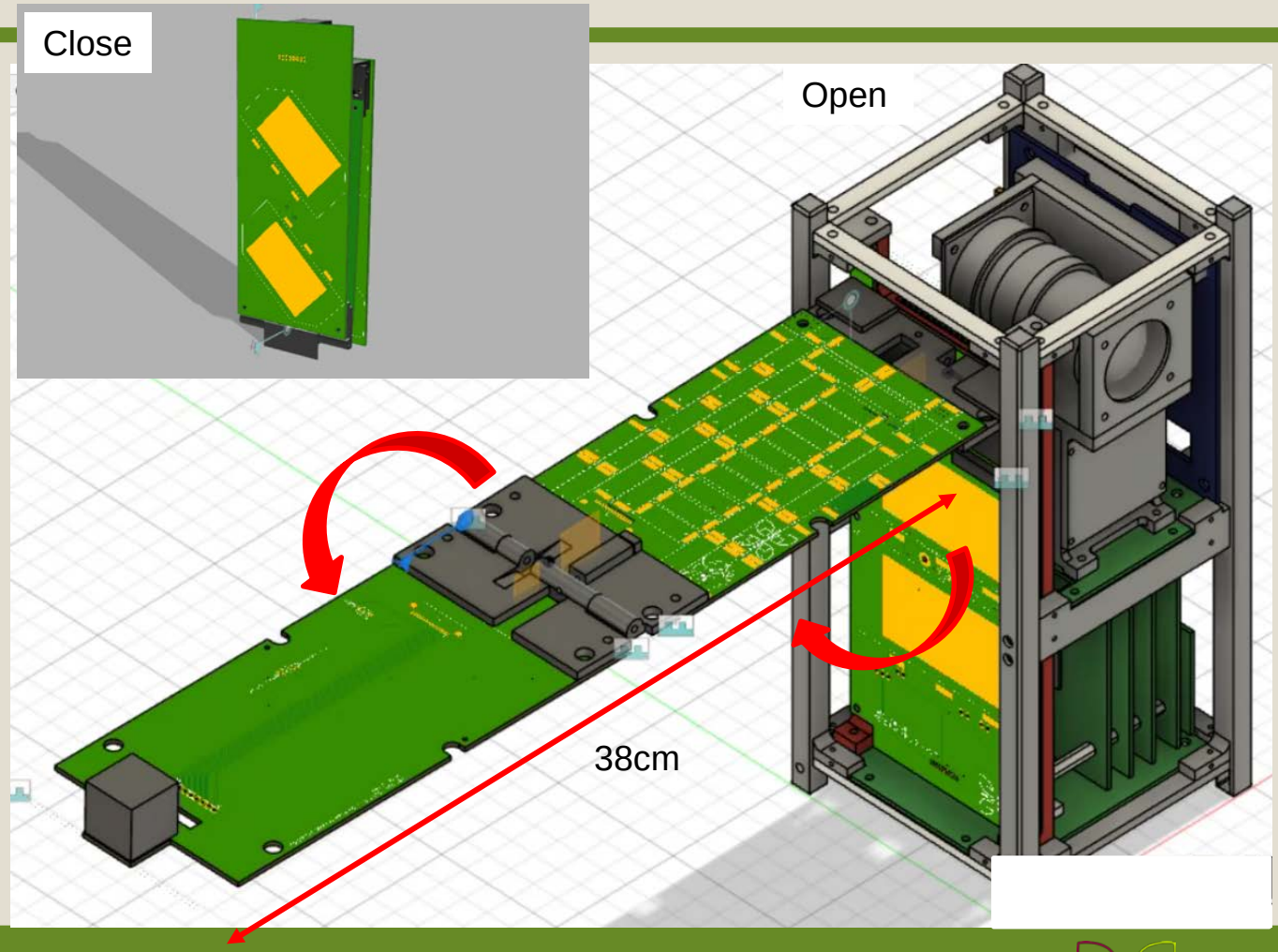
BB model of magnetometer data processing unit
(A/D converter and PIC)



Initial result of comparing spacemag-lite and groun-based magnetometer MAGDAS used for scientific purposes

Boom deployment mechanism

- To avoid noises from the current loop and digital circuit, the magnetometer probe must separate from the payload itself.
- Yotsuba-KUlover plan to install a panel type boom deployment system on the side.



Summary

- Yotsuba-KUlover is an interdisciplinary project between science and engineering in which students from Kyushu University and Kyushu Institute of Technology collaborate to develop a satellite.
- A 2U CubeSat will be developed in 18 months, and it will be released from the ISS in FY2024.
- The magnetic field observation missions aims to conduct a full-scale science with a low threshold development approach using COTS magnetometers.
- Currently, Engineering Model is being prepared.

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