



Student Representative Presentation

UNISEC Japan

From CanSats to Cubesats & Small Sats

Nobuhiro Funabiki

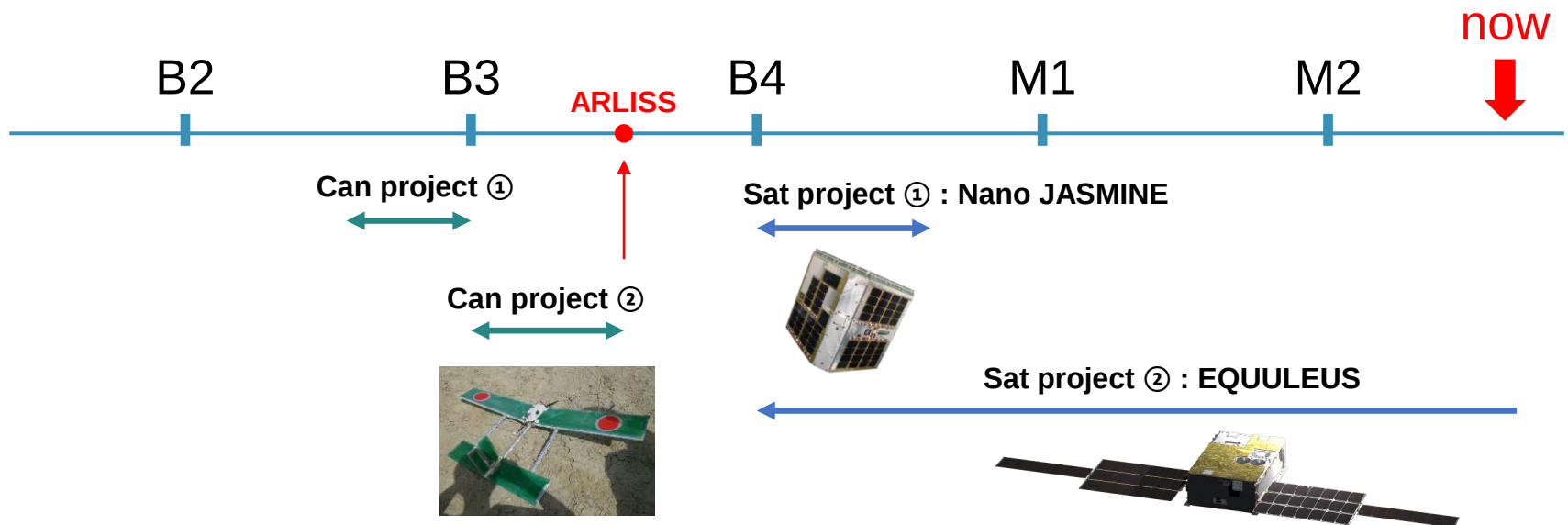
Intelligent Space Systems Laboratory (Nakasuka/Funase Lab.)

Department of Aeronautics and Astronautics

The University of Tokyo, JAPAN

Self Introduction

- ▶ Name : Nobuhiro Funabiki (船曳 敦漠)
- ▶ Affiliation : The University of Tokyo
: UNISEC Japan
- ▶ Grade : 2nd year master student
- ▶ Supervisor : Prof. Shin-ichi Nakasuka
- ▶ Research : Spacecraft Formation Flight
- ▶ Project : Electrical Power System



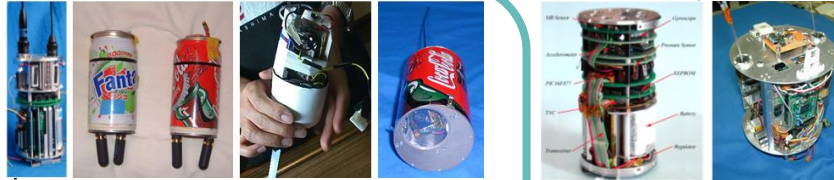
Student Activities of UNISEC Japan

High School

Undergraduate School

Graduate School

CanSat



① Noshiro Space Events

② ARLISS

B1

B2

B3

B4

M1

M2

Satellite Development



Noshiro Space Events

► Competition of amateur rockets and autonomous robots (Cansats)

- Launch of Hybrid rockets
- Cansats drop from balloons

► Venue : Noshiro, Akita, Japan

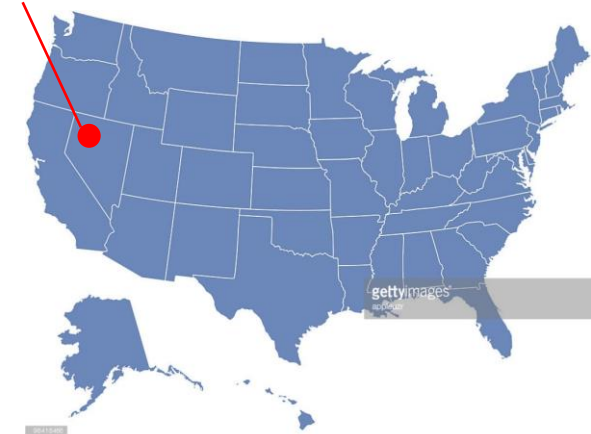
Noshiro (Japan)



ARLISS: A Rocket Launch for International Students Satellite

- ▶ Competition of autonomous robots (Cansats)
 - Comeback competition
 - Mission competition
- ▶ Venue : Black Rock Desert, Nevada, USA
- ▶ Date : About 1 week on September every year
- ▶ Participants : Japan, Korea, USA, Egypt, Peru, Costa Rica,...

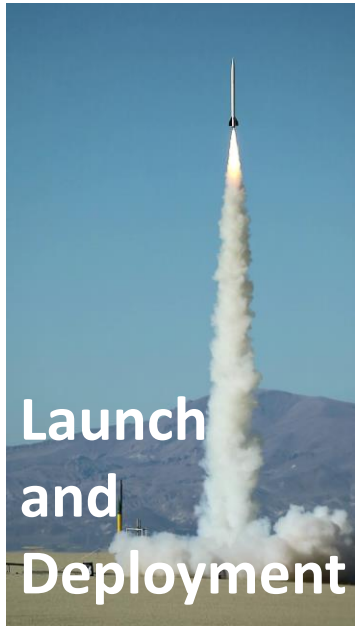
Black Rock Desert (Nevada)



ARLISS: A Rocket Launch for International Students Satellite

Comeback Competition

experience the whole process of a mission like a planetary exploration.



Rover Type



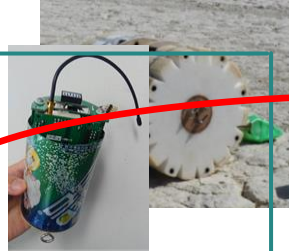
Airplane Type



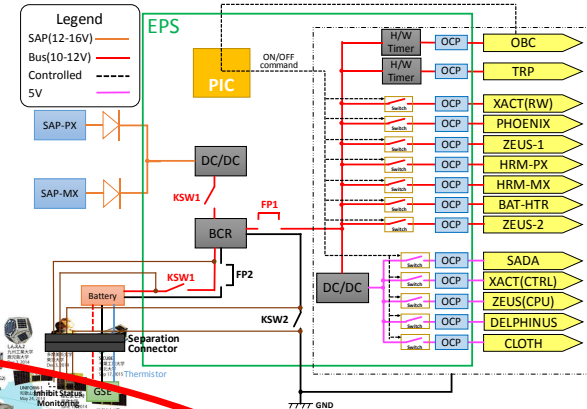
From Cansats to Cubesats

CanSat

- ▶ How to make a circuit?
- ▶ How to use a microcomputer?
- ▶ How to manage a team?
- ▶ How to design and verify?



Electrical Power System

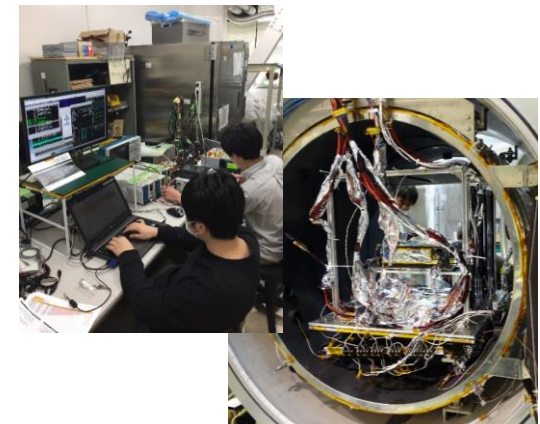
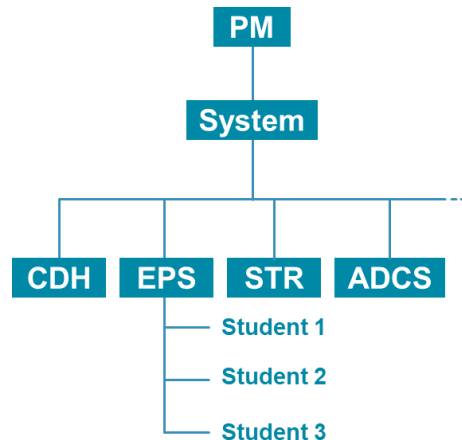
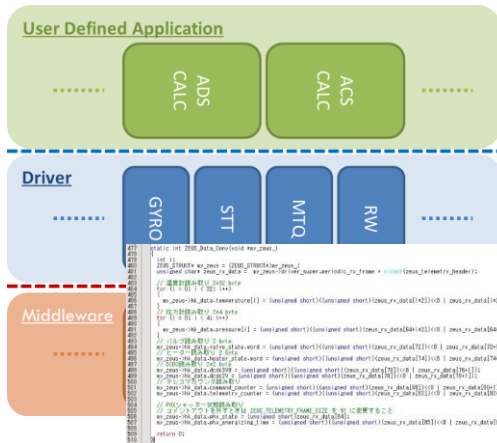


CubeSat

CDH

Project Management

Test & Verification



From Cansats to Cubesats

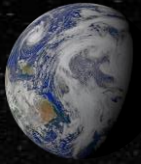
Cansats Development

Cube & Small Sats Development



EQUULEUS

EQUilibriUm Lunar-Earth point 6U Spacecraft



Development

- ▶ Mainly by the University of Tokyo & JAXA

Spacecraft-System

- ▶ Weight : 12 [kg] ▶ Power : 48 [W]
- ▶ Size : 6U (10cm × 20cm × 30cm)

Launcher

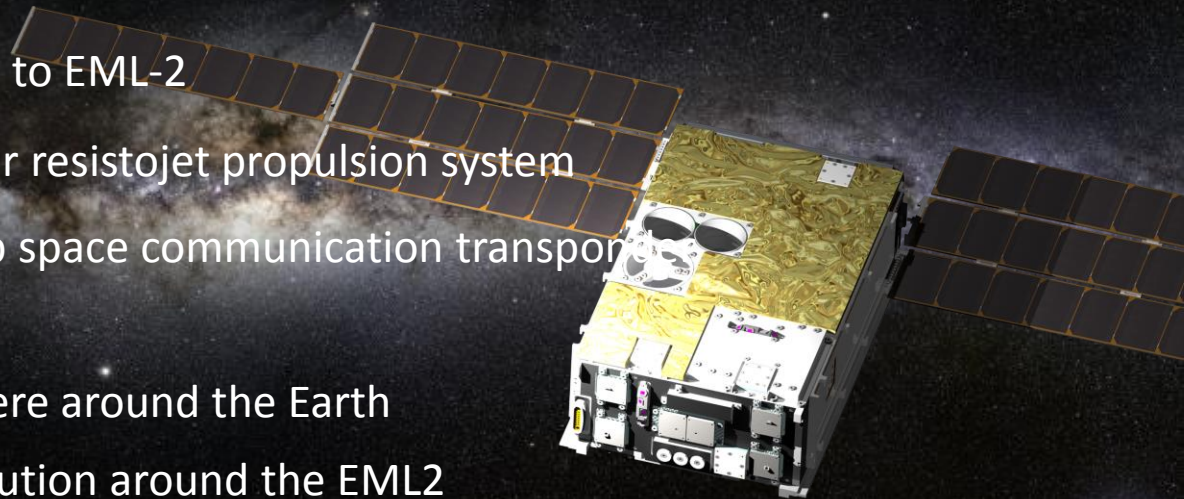
- ▶ NASA Space Launch System (SLS) EM-1

Technological Mission

- ▶ Trajectory design & control to EML-2
- ▶ Demonstration of the water resistojet propulsion system
- ▶ Demonstration of the deep space communication transport

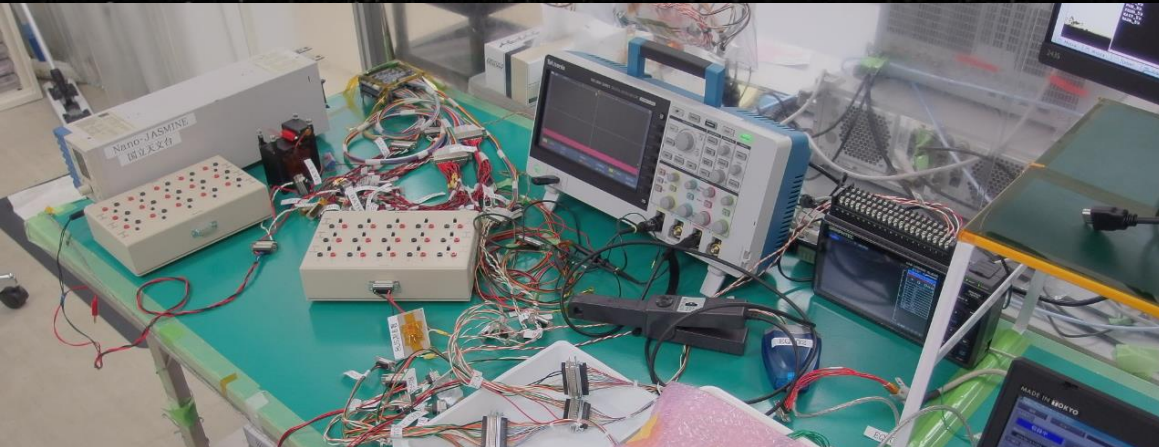
Science Mission

- ▶ Observation of plasmasphere around the Earth
- ▶ Observation of dust distribution around the EML2
- ▶ Observation of lunar impact flush on the moon surface



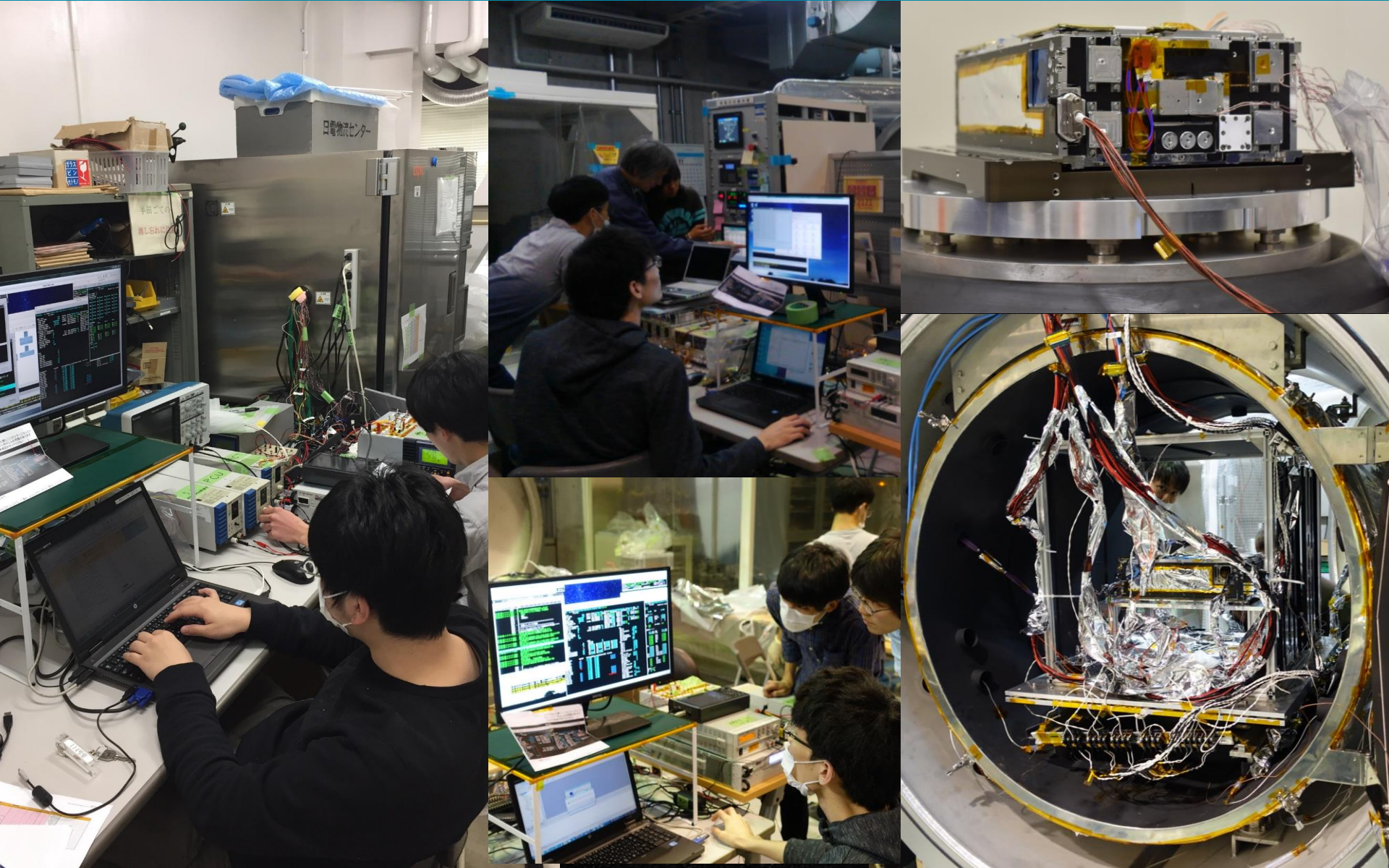
Cubesat Development (EQUULEUS) ①

Assembly



Component Tests

Cubesat Development (EQUULEUS) ②



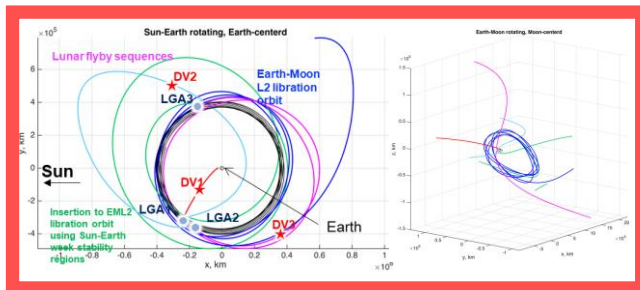
Temperature, Vacuum, and Vibration Test

Mission of EQUULEUS

Technology

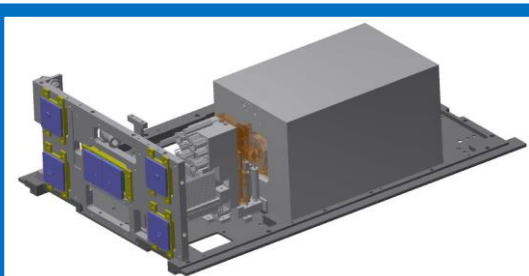
Trajectory Control to EML2

- ~6 months flight to Earth-Moon Lagrange Point 2
- Multiple lunar gravity assists



AQUARIUS

- New resistojet water propulsion system
- Non-toxic, easy to handle



XTRP for CubeSats

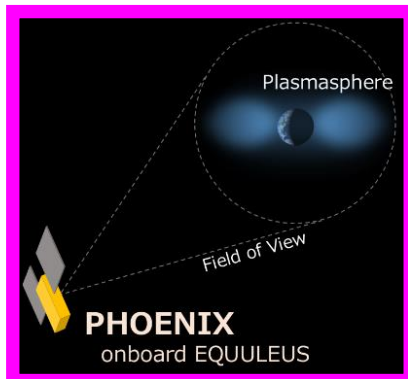
Miniaturization of the deep space communication transponder for CubeSats



Science

PHOENIX

Observation of the Earth's plasmasphere



CLOTH

Measurement of dust in cis-lunar region



DELPHINUS

Observation of Lunar Impact Flash

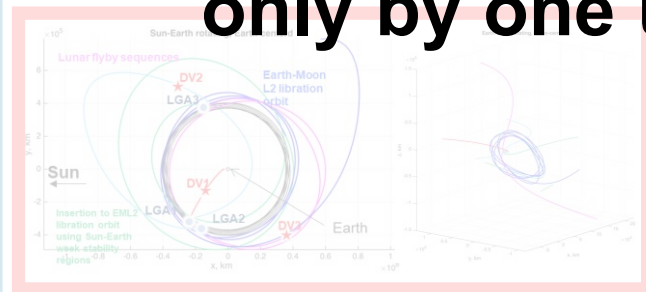


Mission of EQUULEUS

Technology

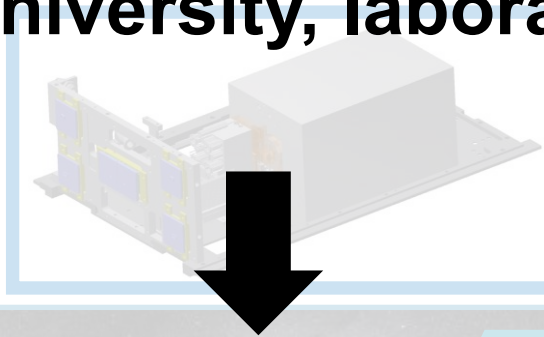
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XTRP for CubeSats

- Miniaturization of the deep space communication transponder for CubeSats

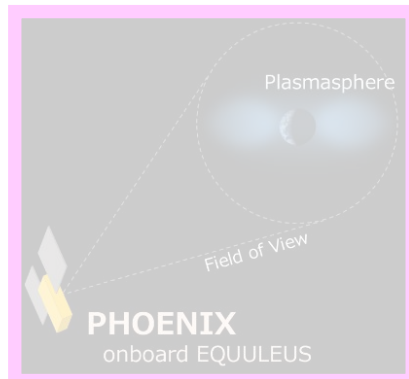


It is difficult to achieve challenge projects only by one university, laboratory, ...

Science

PHOENIX

• Observation of the Earth's plasmasphere



CLOTH

• Observation of the Earth's plasmasphere in cis-lunar region



DELPHINUS

• Observation of Lunar Impact Flash



Cooperation is indispensable!

Conclusion

► From CanSats to CubeSats

Motivating CanSat events

- Noshiro Space Event
- ARLISS

Knowledge and Experience
acquired through CanSat activities

► Innovative and challenging CubeSat missions

but, it is difficult to do them alone...(even for students who experienced CanSat development.)

Cooperation among universities, companies, ...is indispensable

UNISEC Global Community

