KiboCUBE Academy

Introduction to KiboCUBE Academy
On-demand Pre-recorded Lectures

Tohoku University

Department of Aerospace Engineering

Associate Professor Dr. –Ing. Toshinori Kuwahara

This lecture is NOT specifically about KiboCUBE and covers GENERAL engineering topics of space development and utilization for CubeSats.
The specific information and requirements for applying to KiboCUBE can be found at:
https://www.unoosa.org/oosa/en/ourwork/psa/hsti/kibocube.html

JAXA

UNISEC University Space Engineering Consortium JAPAN

United Nations Office for Outer Space Affairs ★ Japan Aerospace Exploration Agency
Kibo CUBE

Contents

1. Introduction to KiboCUBE Program

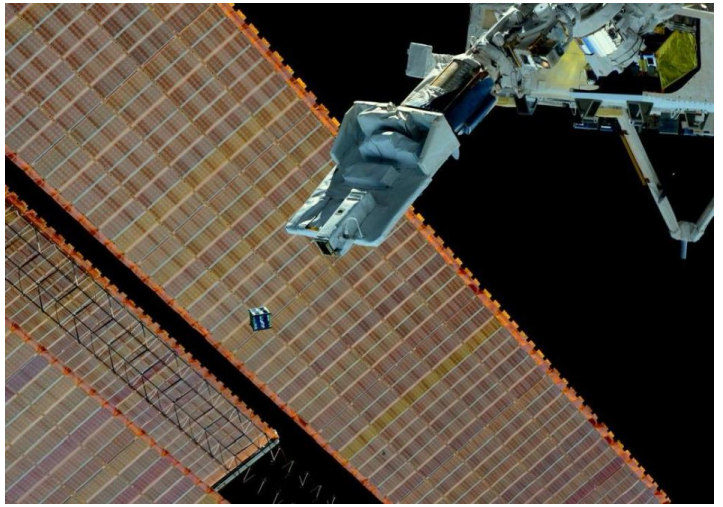
1.1. KiboCUBE Program

KiboCUBE Program:

The cooperation program between the United Nations Office for Outer Space Affairs (UNOOSA) and the Japan Aerospace Exploration Agency (JAXA) on CubeSat deployment from the International Space Station (ISS) Japanese Experiment Module (Kibo).

The KiboCUBE program aims to provide educational and research institutions of developing countries holding United Nations membership, with nano-satellite (CubeSats) deployment opportunities from the ISS Kibo, which they develop and manufacture.

ISS Japanese Experiment Module Kibo. © JAXA



Deployment of a CubeSat from the ISS. © NASA/JAXA

1. Introduction to KiboCUBE Program

1.2. Japanese Experiment Module “Kibo”

“Kibo” is ...

one of the modules to deploy CubeSats from the ISS. Kibo's unique capability is comprised of an airlock system and a robotic arm. Since the first orbital deployment of CubeSats from Kibo in 2012, nano-satellites and CubeSats from various countries around the world have been deployed from Kibo.

“KiboCUBE” can…

lower the threshold for space activities and can contribute to building national capacity in spacecraft engineering, design and construction. The deployment of CubeSats from the ISS is easier than direct deployment by a launch vehicle thanks to a milder mechanical environment during launch, as well as a higher frequency of access to space.

First CubeSats deployment from the ISS. © JAXA

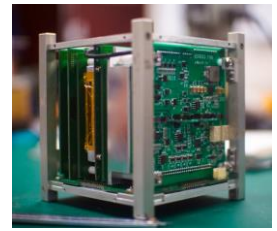
Deployment of the first KiboCUBE CubeSat 1KUNS-PF (Kenya) from the ISS. © JAXA

2. Introduction to KiboCUBE Academy

2.1. Objectives

The objectives of the KiboCUBE Academy are to provide a series of fundamental knowledge to achieve the goals of the KiboCUBE program, which can be summarized as follows:

- Introduction to space systems and advantages of space technologies development and utilization.
- Introduction to engineering aspects of CubeSat system, their capabilities, and application examples.
- Management knowledge about the development process of CubeSats, and engineering knowledge about how to make reliable satellite systems.
- Engineering knowledge about satellite testing and verification.
- Information about leveraging CubeSat projects as a sustainable capacity building program.
- Engineering knowledge about satellite operation and related regulations.



1U CubeSat Model

Hands-on Training of Satellite Engineering

CubeSat Operation

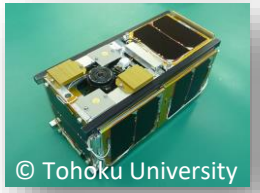
3. Introduction to On-demand Pre-recorded Lectures

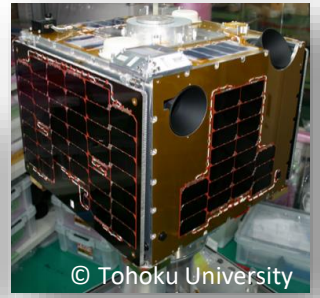
3.1. Curriculum

#	Title	Lecturer
01	Introduction to Small Satellite Mission and Utilization	Associate Professor, Dr. –Ing. Toshinori Kuwahara
02	CubeSats for Capacity Building	Professor, Ph. D. Mengu Cho
03	Overview of Project Management of Satellite Development	Professor, Ph. D. Shinichi Nakasuka
04	Systems Engineering for Micro/nano/pico-satellites	Professor, Ph. D. Shinichi Nakasuka
05	Introduction of Safety Review Process	Ms. Yasuko Shibano, JAXA
06	CubeSat Design for Safety Requirements	Associate Professor, Dr. –Ing. Toshinori Kuwahara
07	Introduction to CubeSat Technologies	Associate Professor, Dr. –Ing. Toshinori Kuwahara
08	Subsystem Lecture for CubeSat: Power Control System	Lecturer, Ph. D. Yoshihiro Tsuruda
09	Subsystem Lecture for CubeSat: Communication System	Lecturer, Ph. D. Yoshihiro Tsuruda
10	Subsystem Lecture for CubeSat: Command and Data Handling System	Associate Professor, Dr. –Ing. Toshinori Kuwahara
11	Subsystem Lecture for CubeSat: Structure System	Associate Professor, Ph. D. Hiraku Sakamoto
12	Subsystem Lecture for CubeSat: Mechanism System	Associate Professor, Ph. D. Hiraku Sakamoto
13	Subsystem Lecture for CubeSat: Thermal Control System	Associate Professor, Ph. D. Yuji Sakamoto
14	Subsystem Lecture for CubeSat: Attitude Control System	Associate Professor, Dr. –Ing. Toshinori Kuwahara
15	Introduction to CubeSat Environmental Testing	Professor, Ph. D. Mengu Cho
16	Introduction to Orbital Mechanics for Microsatellites	Professor, Ph. D. Hironori Sahara
17	Introduction to CubeSat Operation and Ground Systems	Associate Professor, Ph. D. Yuji Sakamoto
18	Introduction to CubeSat Payload Systems	Associate Professor, Ph. D. Masahiro Yamazaki
19	CubeSat System Integration and Electrical Testing	Associate Professor, Dr. Eng. Kikuko Miyata
20	Introduction to Space Debris Problem and Countermeasures	Professor, Dr. Eng. Toshiya Hanada
21	Lessons Learned of CubeSat Missions	Professor, Ph. D. Mengu Cho

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #01, #06, #07, #10, #14





Toshinori Kuwahara, Dr. –Ing.

Position:

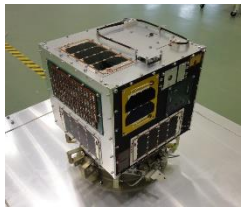
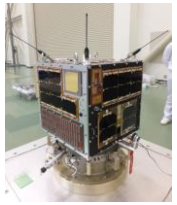
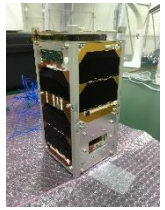
2015 - Associate Professor, Department of Aerospace Engineering, Tohoku University
2017 - Technical Advisor, Nakashimada Engineering Works, Ltd.
2017 - Technical Advisor, ALE Co., Ltd.
2020 - Chairperson, University Space Engineering Consortium Japan (UNISEC)
2021 - Co-founder/CTO, ElevationSpace Inc.

Research Topics:

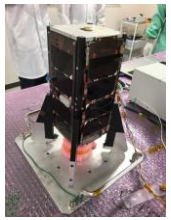
Space Development, Utilization, and Exploration by Small Spacecraft Technologies

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #02, #15, #21



Mengu Cho, Ph.D.

(*since 2018)
(**since 2020)

Position:

2004 - Professor, Department of Space Systems Engineering*
Director, Laboratory of Lean Satellite Enterprises and In-Orbit Experiments **
Kyushu Institute of Technology, Japan
2021 – Visiting Researcher, Chiba Institute of Technology, Japan
2014 - Visiting Professor, Nanyang Technological University, Singapore
2013 - Coordinator, Nations/Japan Long-term Fellowship Programme, Post-graduate study on Nano-Satellite Technologies (PNST)

Research Topics:

Lean Satellite, Spacecraft Environment Interaction

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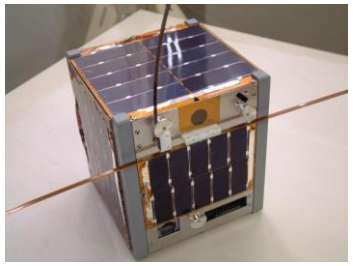
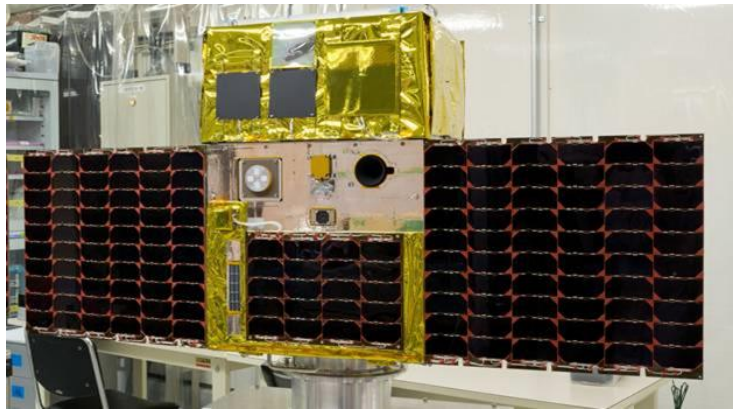
3.2. Lecturer Introduction: #03, #04





Shinichi Nakasuka, Ph.D.

Position:

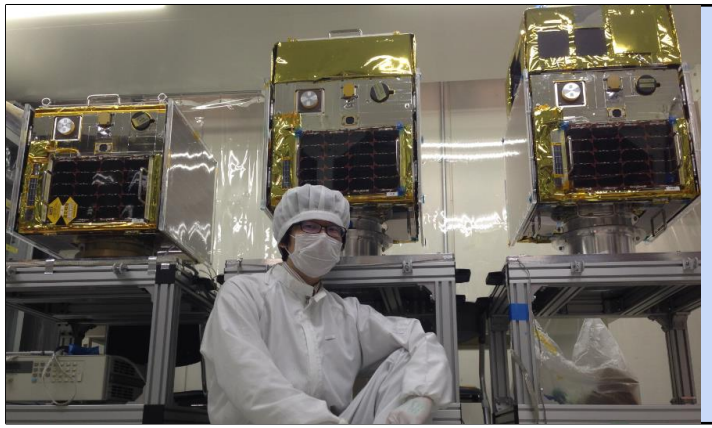
1990 - Lecturer, Department of Aeronautics and Astronautics, University of Tokyo
1993 - Associate Professor, University of Tokyo
2004 - Professor, University of Tokyo
2012 - Member of Space Policy Committee, Cabinet Office
2013 - Chairperson, UNISEC-GLOBAL

Research Topics:

Micro/nano/pico-satellites, Novel Space Systems, Guidance, Navigation and Control
Autonomy and Intelligence for Space Systems

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #08, #09



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(from Left) **UNIFORM-1, HODOYOSHI-3, HODOYOSHI-4**
Fight model picture before shipping, April 2014

Yoshihiro Tsuruda, Ph.D.

Position:

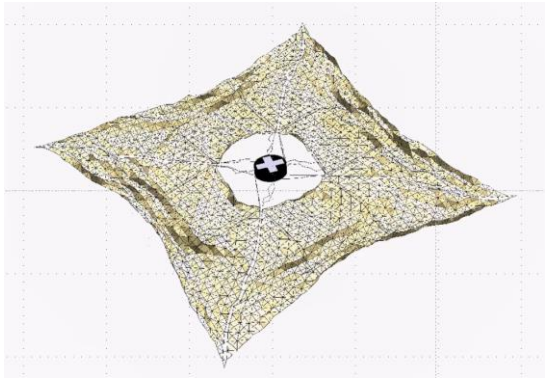
2010 - Ph.D. Degree in Kyushu University
2010 - Project Researcher, Kyushu University – QSAT-EOS Project
2011 - Project Researcher, Tokyo University – UNIFORM-1 & Hodoyoshi-3/4 Project, TRICOM Project
2017 - Project Lecturer, Tokyo University – AQT-D/RWASAT-1 Project, MicroDragon Project
2020 - Lecturer, Teikyo University – TeikyoSat-4 Project

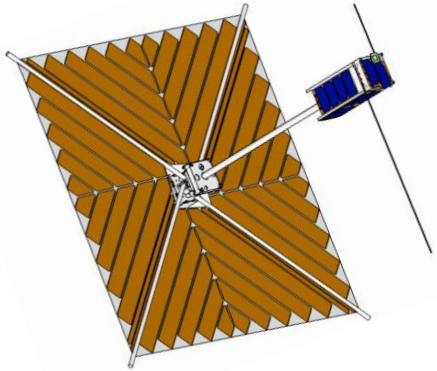
Research Topics:

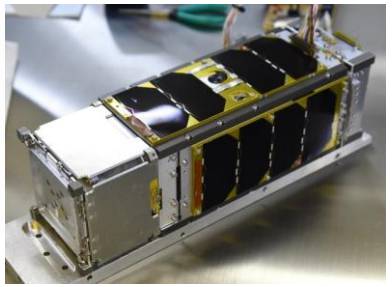
Micro/Nano/Pico-Satellite System Design and Electrical Components Design, Ground Station Development

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #11, #12







Hiraku SAKAMOTO, Ph.D.

Position:

2015 - Associate Professor

Department of Mechanical Engineering, Tokyo Institute of Technology, Japan.

2015 - Board Member, University Space Engineering Consortium Japan (UNISEC)

2015-2019 - Principal Investigator, 3U CubeSat **OrigamiSat-1/FO-98**

Research Topics:

Space deployable structures, Systems engineering for small spacecraft development and utilization

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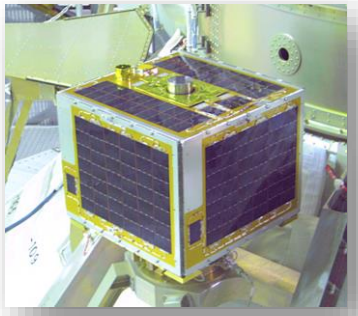
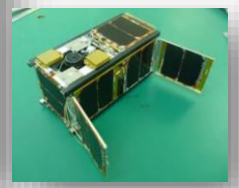
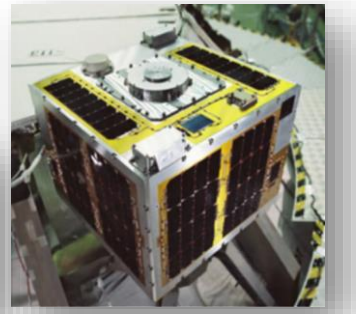
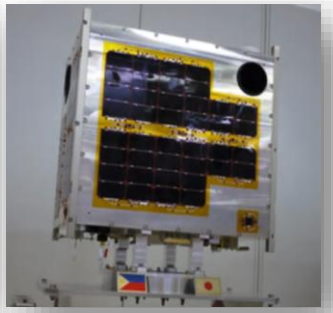
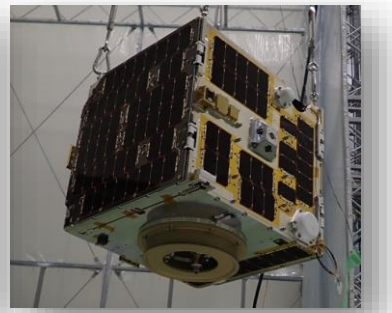
3.2. Lecturer Introduction: #13, #17











Yuji Sakamoto, Dr.

Position:

2006 - Assistant Professor (-2015), Associate Professor (2015-)
Department of Aerospace Engineering, Tohoku University

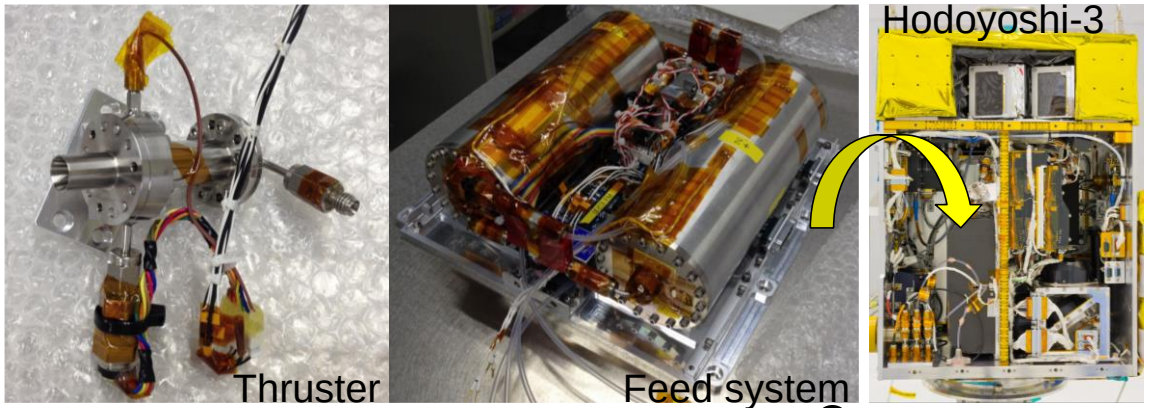
2021 - Associate Professor
Division of Mechanical and Space Engineering, Hokkaido University

Research Topics:

Design, Assembly, and Evaluation of Micro and Nano Satellites
Satellite Operation and Ground Station Management

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #16



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SAHARA, Hironori, Ph.D.

Position:

1994	Graduated from Faculty of Engineering, Kyoto University
1996	Master's degree in Engineering from Graduate School of Engineering, Kyoto University
1999	Ph. D from School of Engineering, University of Tokyo
2000 – 2003	Research Fellow, National Aerospace Laboratory of Japan (currently part of JAXA)
2004 – 2007	Research Associate in University of Tokyo
2008 – 2015	Associate Professor in Tokyo Metropolitan University
2016 – present	Professor in Tokyo Metropolitan University

Research Topics:

Development of innovative space systems as propulsion, system architecture, orbit cultivation, and their applications including artificial meteor.

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3.2. Lecturer Introduction: #18

Education

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Tech. Demo.

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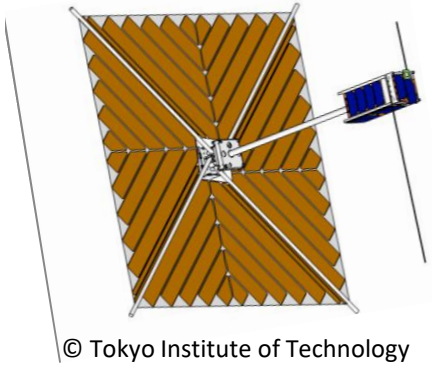
Tech. Demo.



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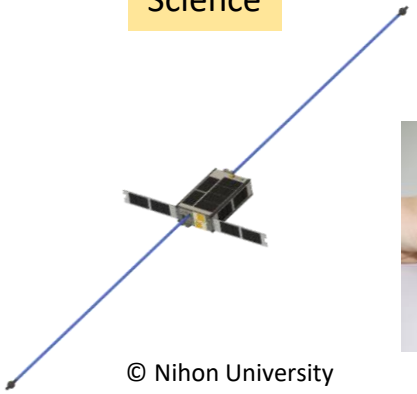
Science



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Education

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Masahiko YAMAZAKI, Ph.D.

Position:

2017 - Chairperson, University Space Engineering Consortium Japan (UNISEC)
2017 - Program Manager, CubeSat Hands-on Education Program HEPTA-Sat, UNISEC
2019 - Associate Professor, Department of Aerospace Engineering, Nihon University
2019 - Project Manager, 6U Earthquake Precursor Study CubeSat Prelude-Sat : Prelude

Research Topics:

Systems engineering for small spacecraft development and utilization

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3.2. Lecturer Introduction: #19

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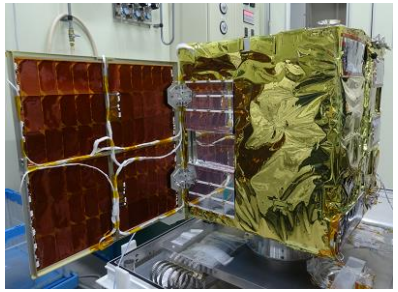

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Kikuko Miyata, Dr. Eng.

Major Positions:

2011 - Researcher, Next generation Space system Technology Research Association(NESTRA).

2014 - Postdoctoral fellow(-2016 Jul.). Designated assistant professor(2016 Aug.-Nov.), Assistant professor(2016 Dec.- 2020 Mar), Nagoya University.

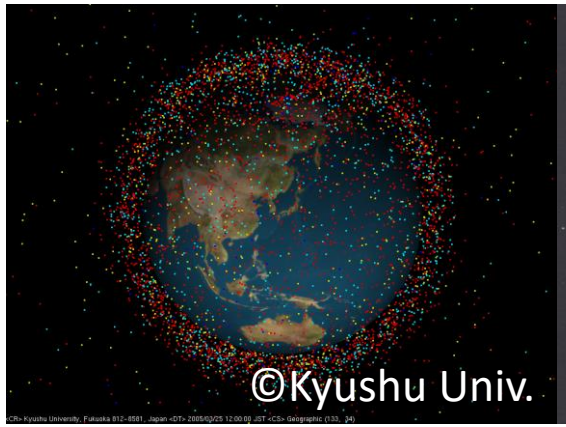
2020 - Associate professor, Meijo University.

Research Topics:

Small spacecraft system and related technology

3. Introduction to On-demand Pre-recorded Lectures

3.2. Lecturer Introduction: #20



Toshiya HANADA, Dr. Eng.

Position:

2022 - Vice Director (add.) at the International Center for Space and Planetary Environmental Science, Kyushu University

2011 - Professor (full) at the Department of Aeronautics and Astronautics, Faculty of Engineering, Kyushu University

Research Topics:

Long-term Sustainability of Outer Space Activities, Space Debris Modeling, Space Situational Awareness

4. Conclusion

The KiboCUBE program provides educational and research institutions of emerging countries holding United Nations membership, with critical support to build national capacity in spacecraft engineering, design and construction, through CubeSat deployment opportunities from the ISS Kibo.

The KiboCUBE Academy aims to provide fundamental knowledge for applicants to achieve their goals through KiboCUBE, including various aspects such as management and engineering expertise.

JAXA and UNOOSA hope that the knowledge and information shared through KiboCUBE Academy will lead to successful space missions for the participants.

Thank you very much.

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