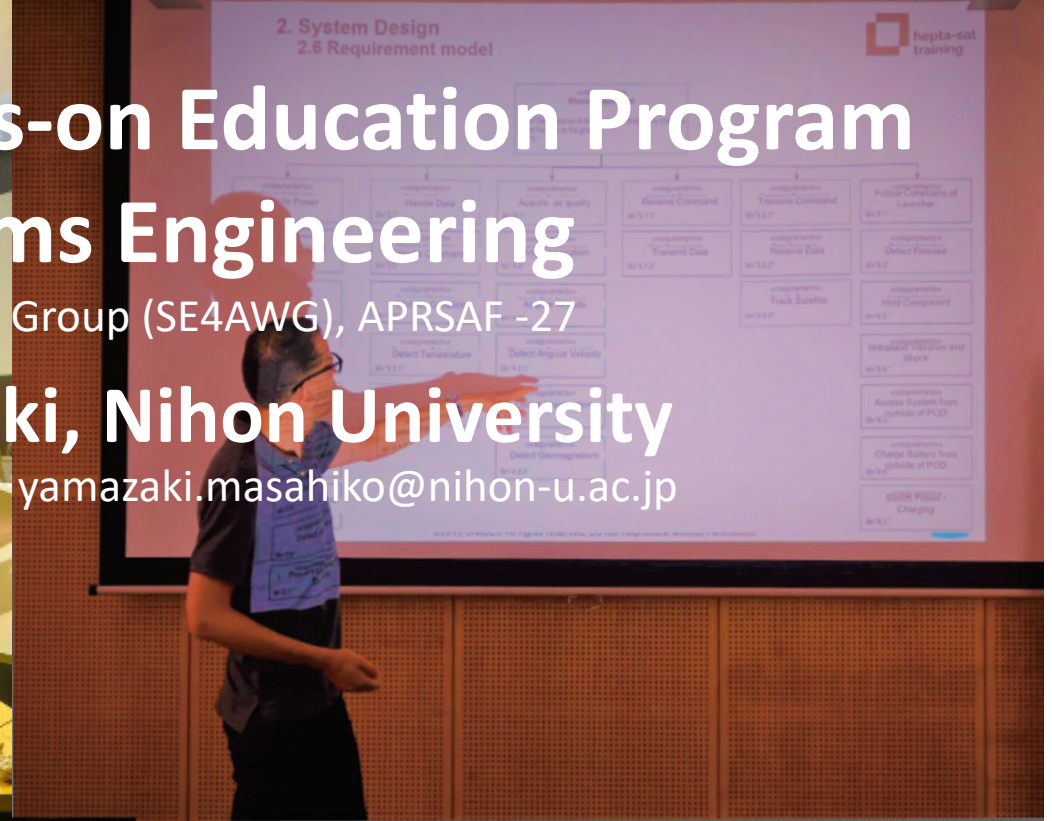# CubeSat Kit Based Hands-on Education Program for Space Systems Engineering

Space Education for All Working Group (SE4AWG), APRSAF -27

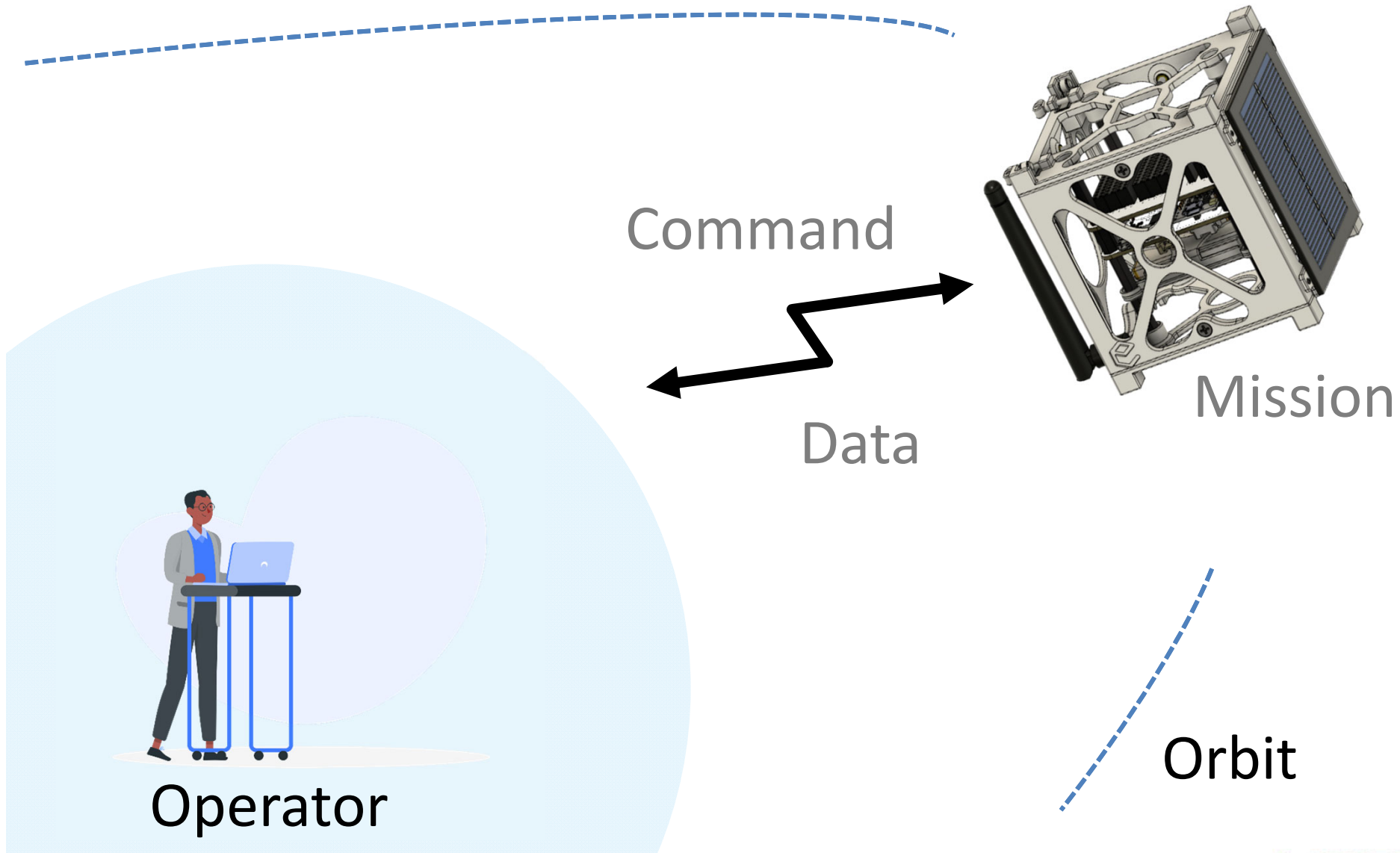## Masahiko Yamazaki, Nihon University

yamazaki.masahiko@nihon-u.ac.jp

It can be used for space systems engineering education in a short period of time.
So the learning experience(It include the component, Subsystem, System Architecture level) can be re-use for the advanced problem-solving project (CanSat, CubeSat, etc.).
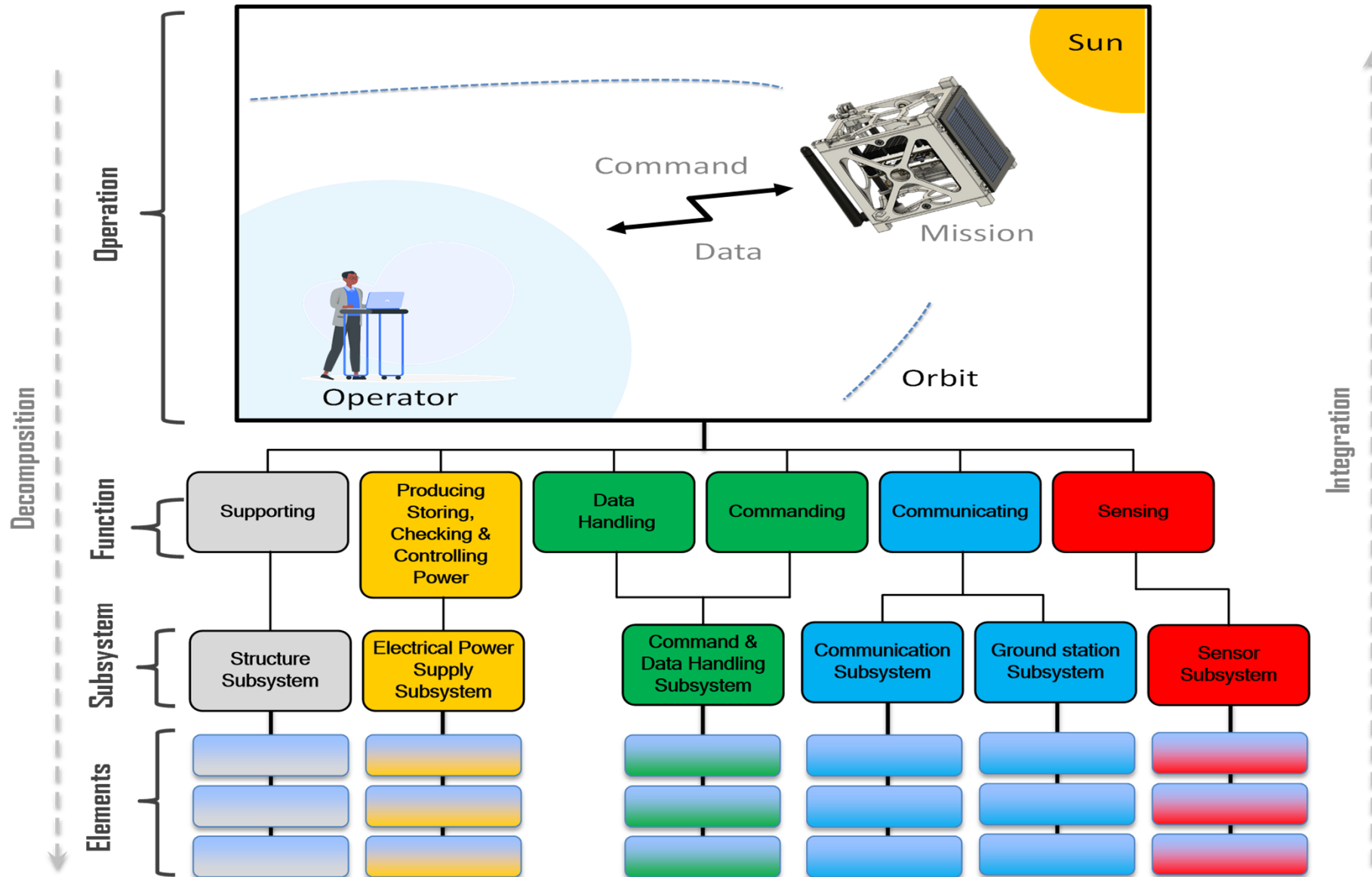
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Experience actual satellite operations

◈ Simulates the actual satellite-to-ground station communication experience.

Sun

Command

Data

Mission

Orbit

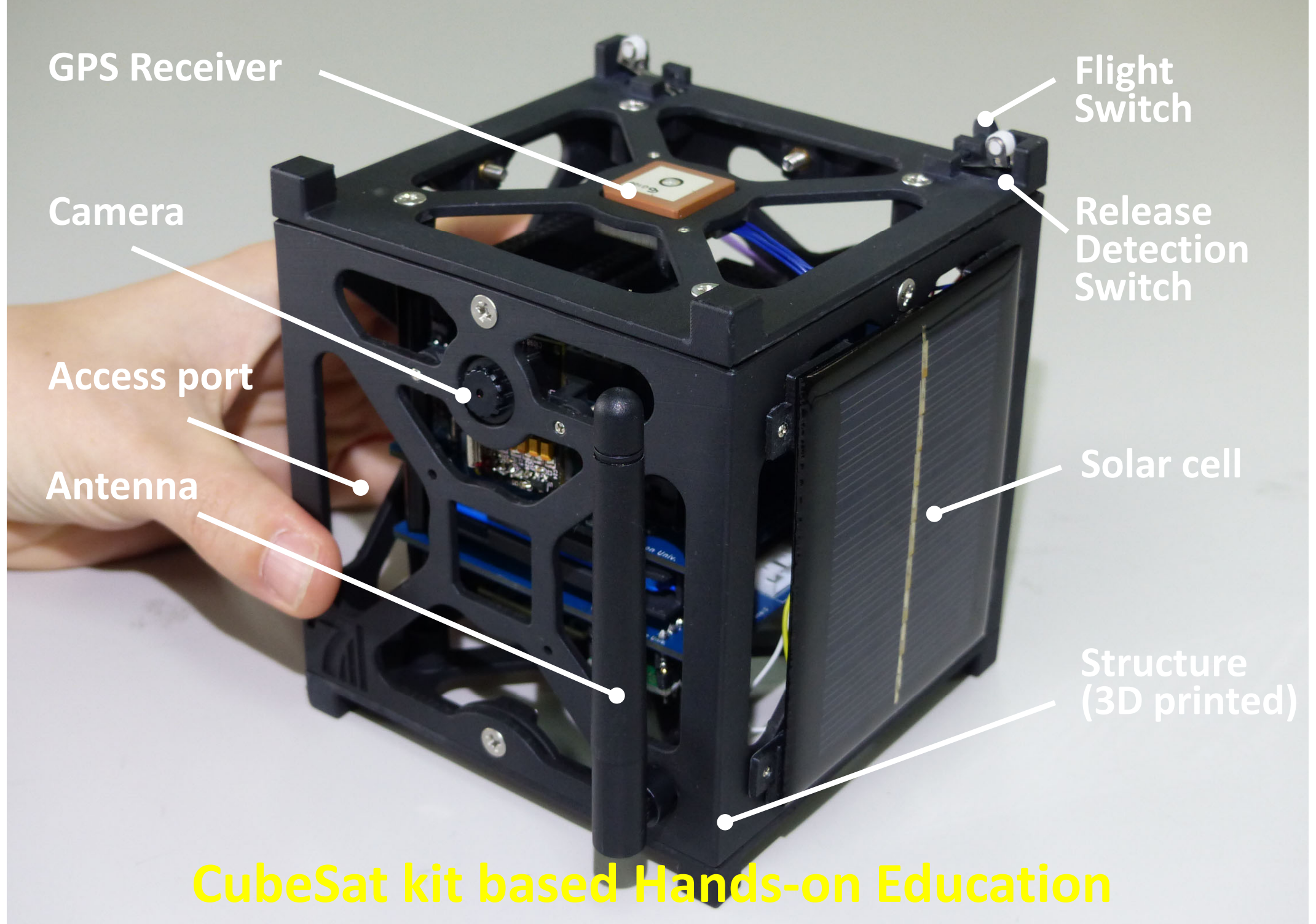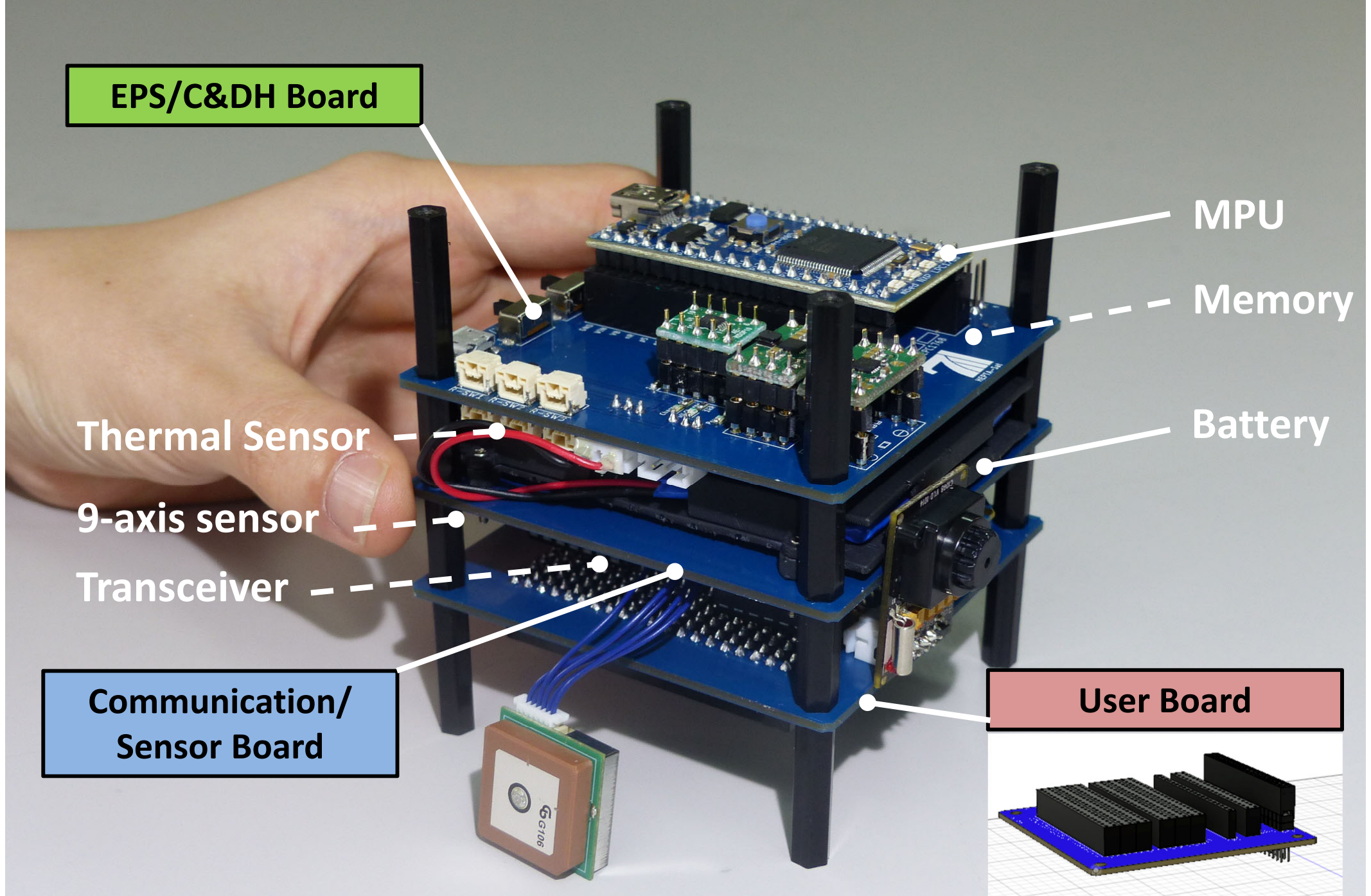Operator

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Experience actual satellite operations

Participants experience how a system is composed of elements and sub-elements (understand the relationship between the whole system and the elements.)
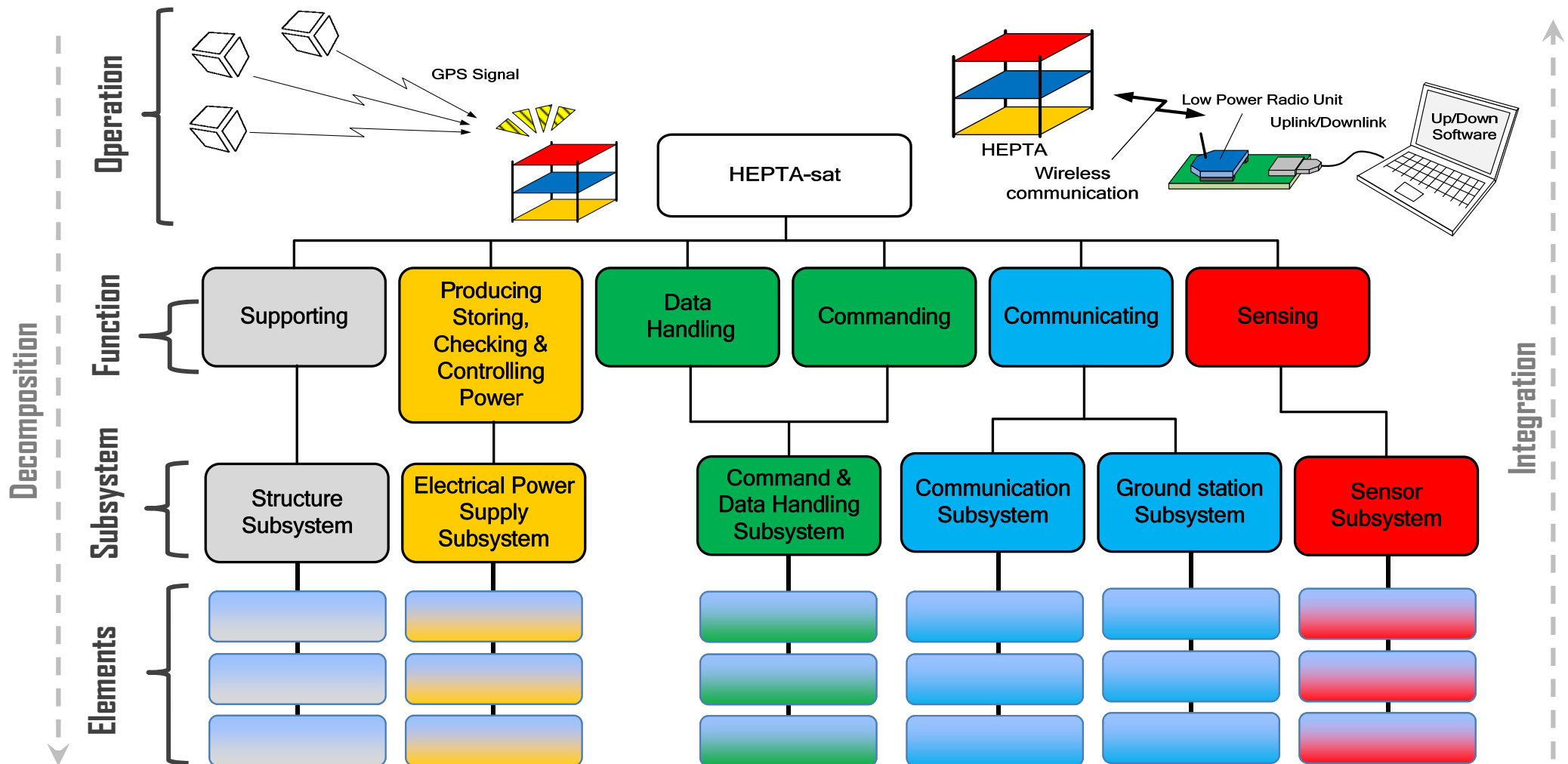
GPS Receiver

Flight Switch

Camera

Release Detection Switch

Access port

Antenna

Solar cell

Structure (3D printed)

CubeSat kit based Hands-on Education

EPS/C&DH Board

MPU

Memory

Thermal Sensor

Battery

9-axis sensor

Transceiver

Communication/
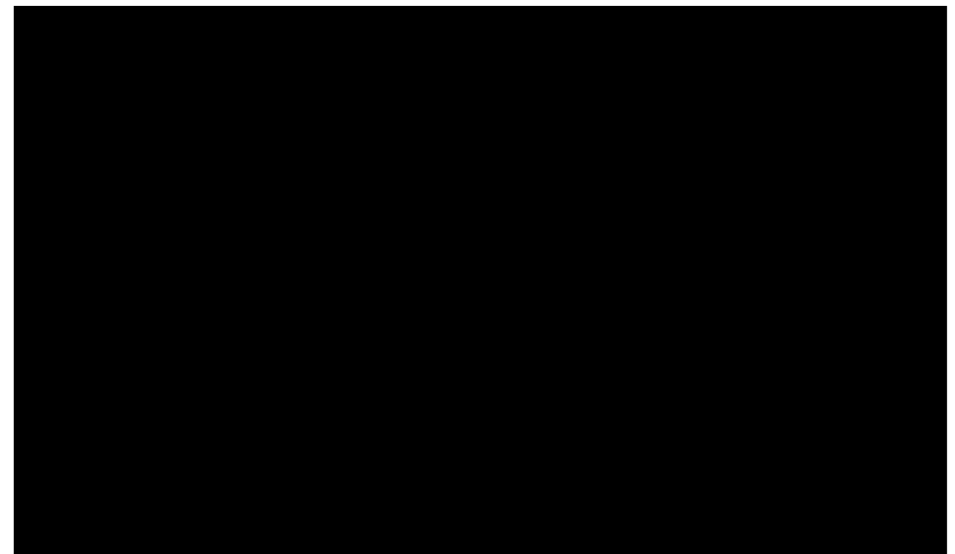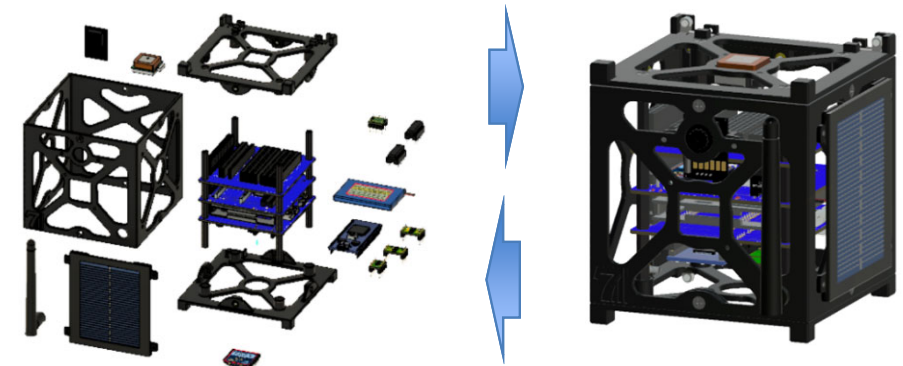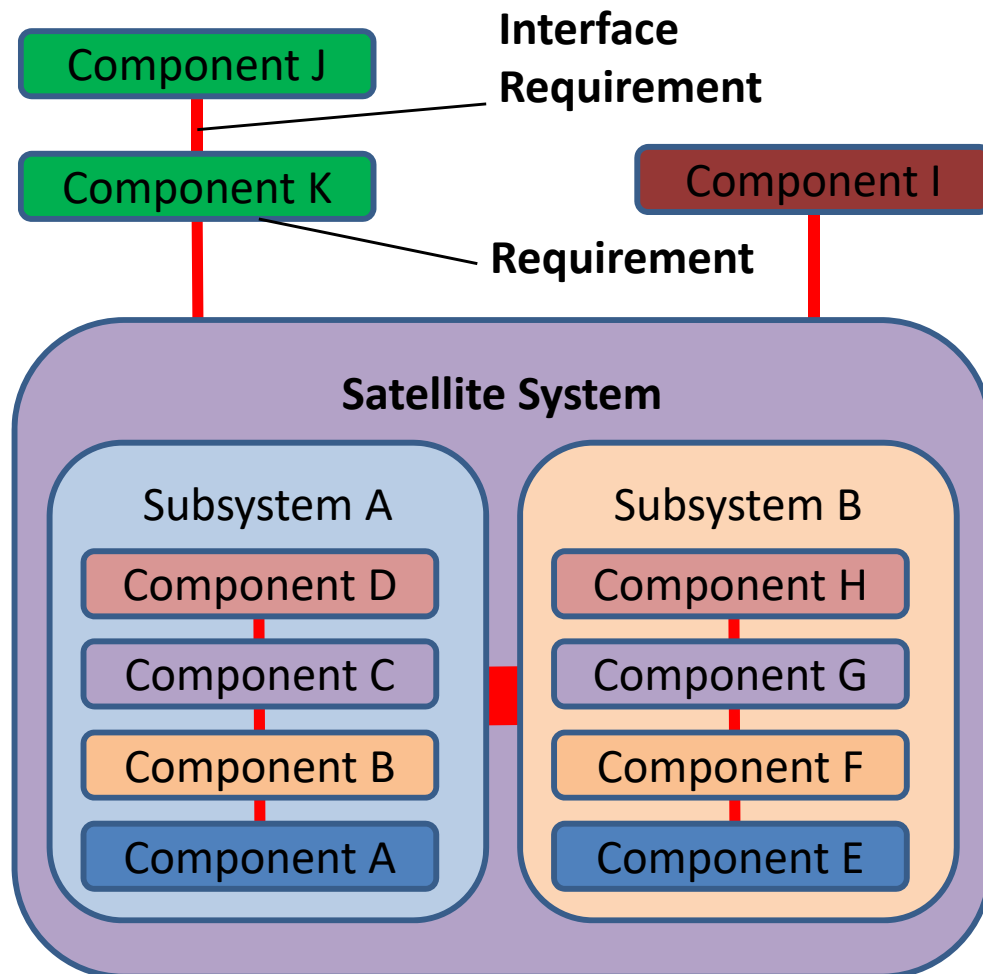Sensor Board

User Board

CubeSat kit based Hands-on Education

CubeSat kit based Hands-on Education

- Composed of 6 function and 6 primary sub-systems.
- You can learn how each subsystem functions and how to integrate subsystems into a satellite through experiencing the process of assembly, integration and test.
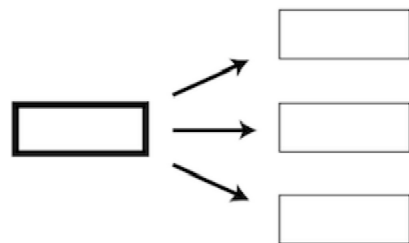
From Scratch to System Level

⬢ Focuses mainly on understanding, assembling, integrating, and testing the function of the CubeSat Kit and carrying out it in a hands-on manner step by step form components level to the system level.
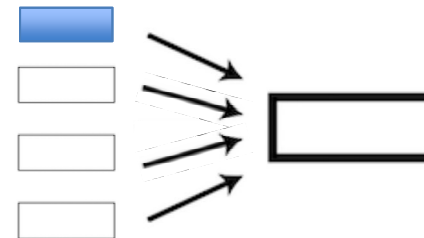

Assembly videos without testing or understanding process

Analysis experience to Synthesis experience

- Experience of understanding the basics using CubeSat kit and experience of designing and developing subsystems(part of the overall system) using user boards.
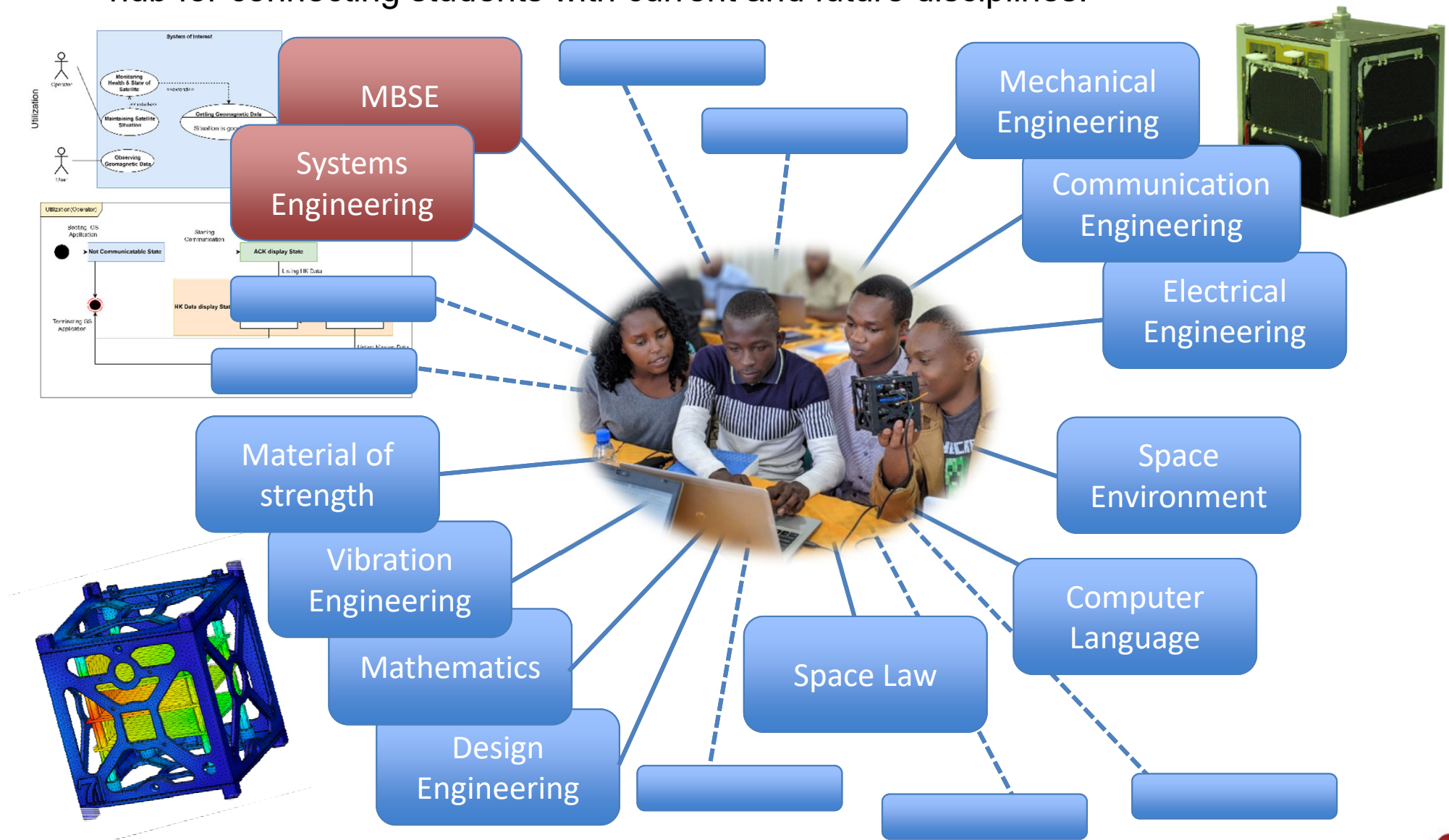

Step. 0 Application from webpage

Step. 2 Learning

Step. 4 Hardware & Software Integration

Step. 6 Implementation & Test

Congratulations!

Step. 1 Lecture

Step. 3 Assembly

Step. 5 Mission Design

Step. 7 Presentation & Review

Analysis experience

Synthesis experience(Problem-solving)
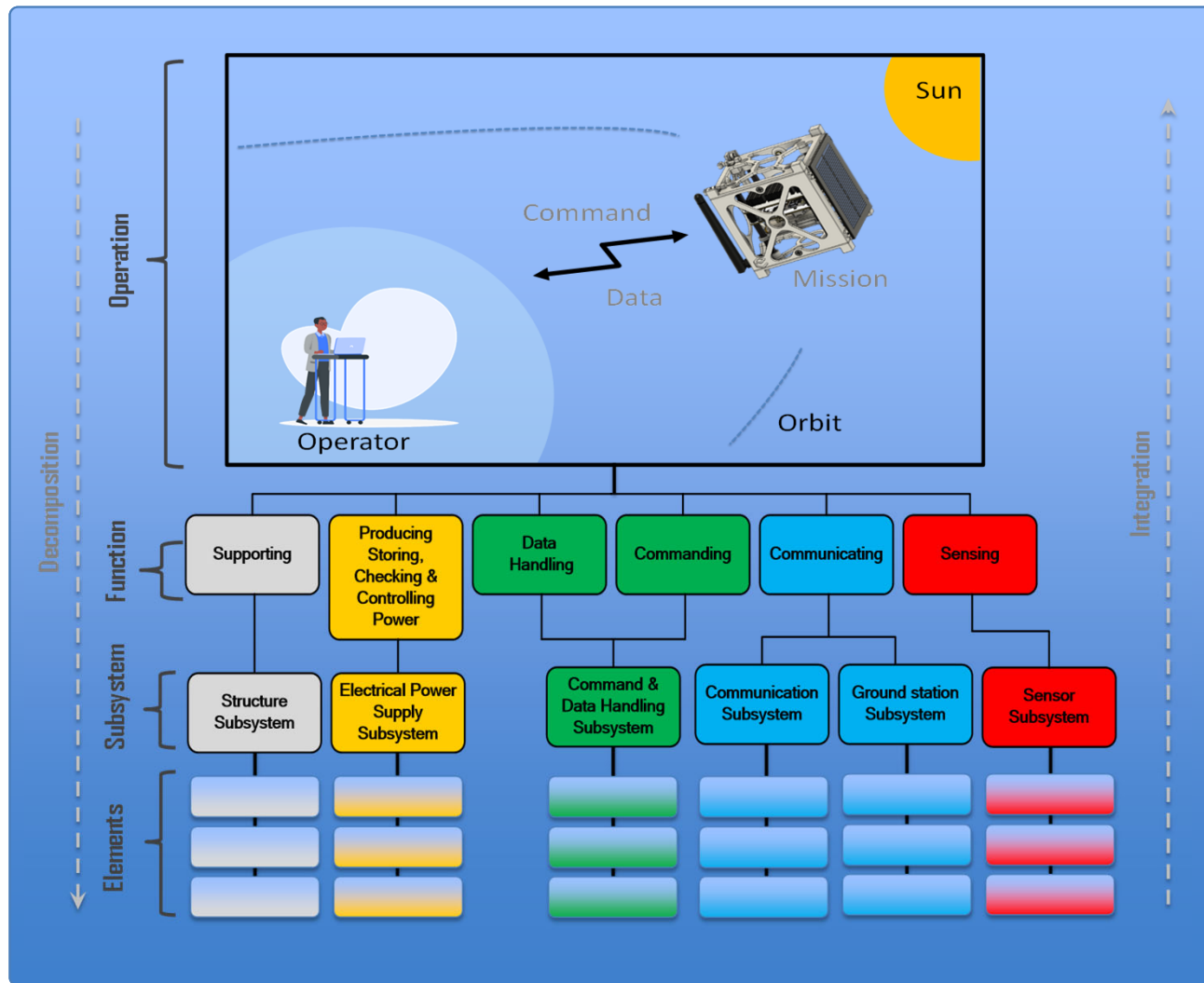
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Hands-on experience becomes a hub for learnings

- A hands-on experience with some level of complexity and expansibility is a good hub for connecting students with current and future disciplines.

MBSE

Systems Engineering

Mechanical Engineering

Communication Engineering

Electrical Engineering

Space Environment

Computer Language

Space Law

Material of strength

Vibration Engineering

Mathematics

Design Engineering

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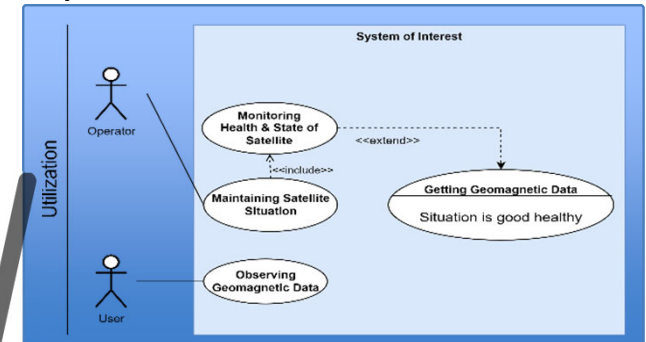University Space Engineering Consortium
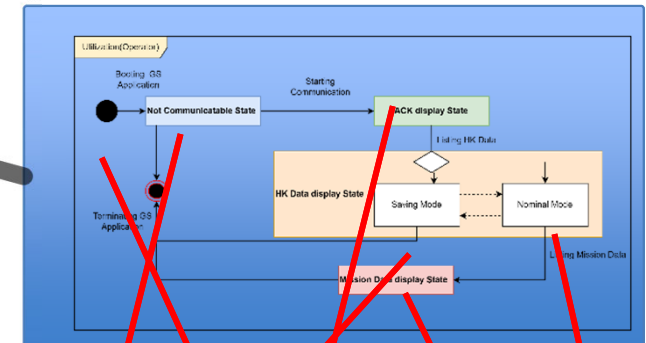
Model Based Systems Engineering Education

⬢ Understand multi point of view model and connect logically for design and development of Space Systems.
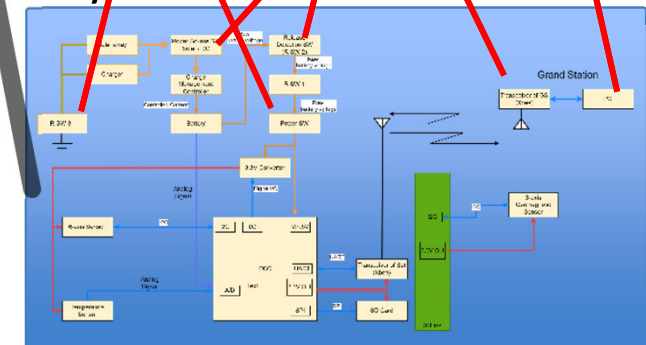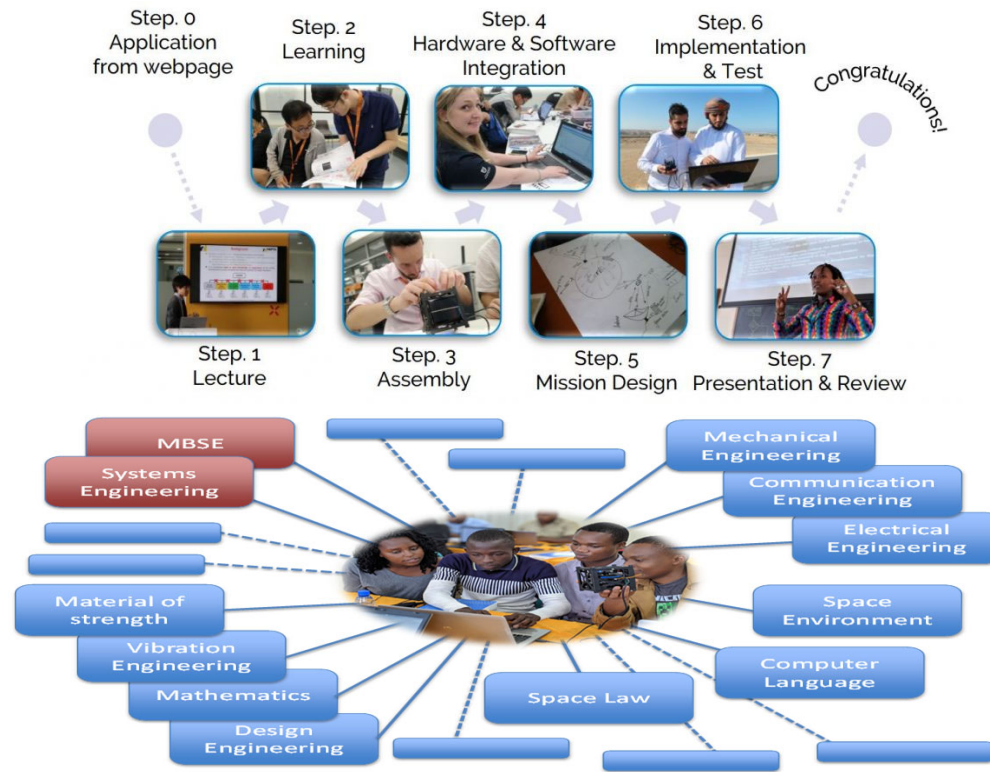

Operational view
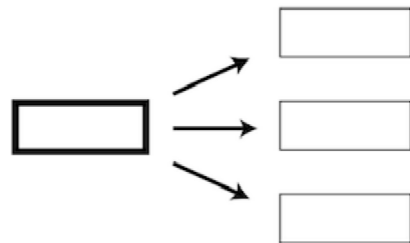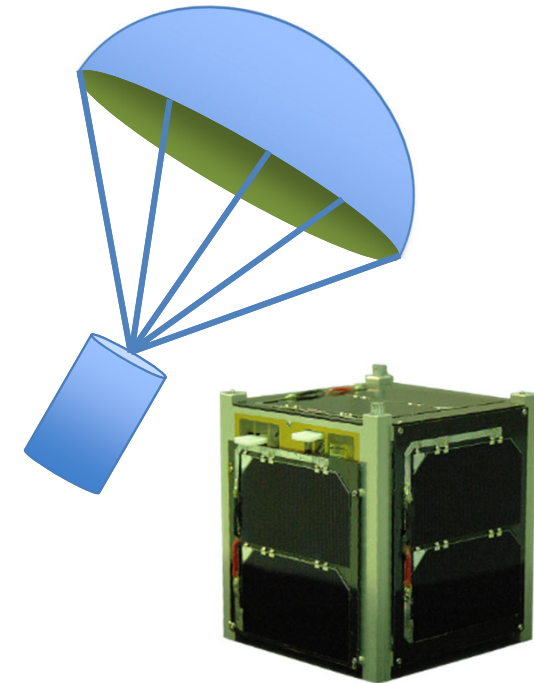
Functional view

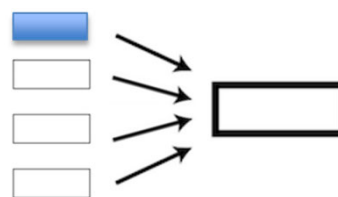Physical view

Analysis and Synthesis experience

- Creating an effective and efficient learning experience by taking over the elements.
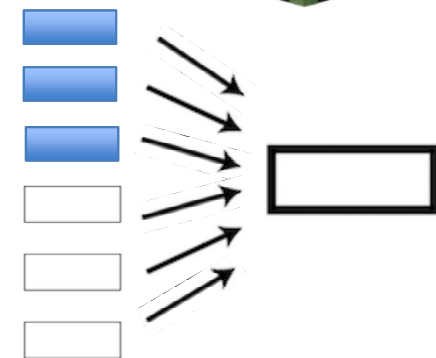

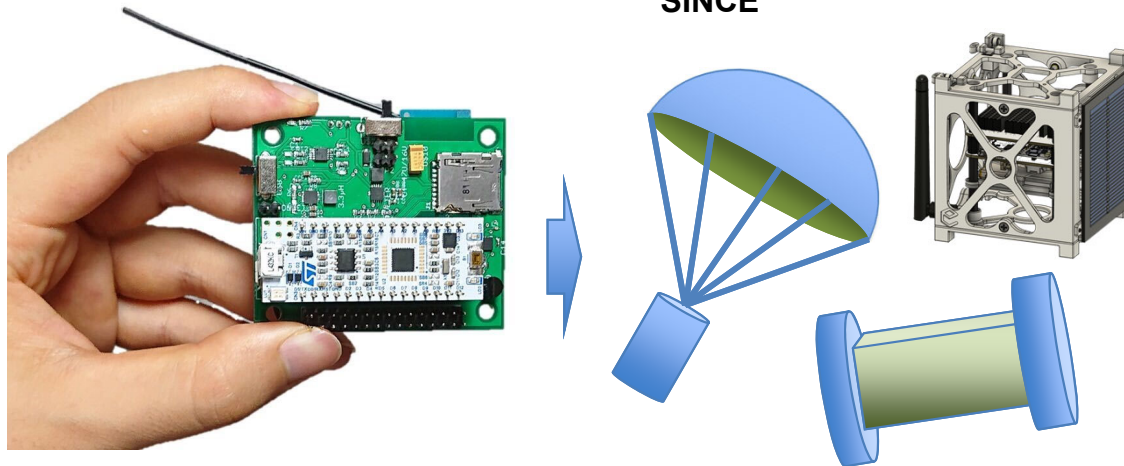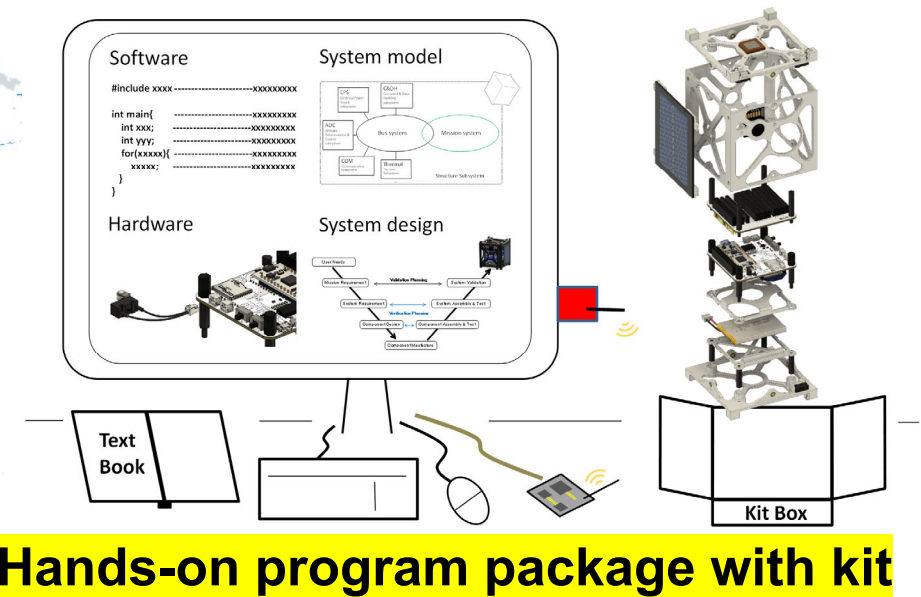**Elements / Architectures / skills**

Analysis experience

Synthesis experience

Synthesis experience

Summary

- More than 600 people from over 50 countries participated in the educational program.

600+ TRAINEES

53 DERIVERD COUNTRIES

10 HOST COUNTRIES

2012 SINCE

Software
System model
Hardware
System design

Text Book

Kit Box

Hands-on program package with kit

HEPTA-Sat Lite(One Chip Satellite Board)

- In addition, the one chip satellite board was developed.

- It will be easy to realize HEPTA-Sat-like CanSat/Cubesat education around the world.

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