

CLTP15 · NIHON UNIVERSITY · JAPAN

From Aircraft Control to CubeSat Missions

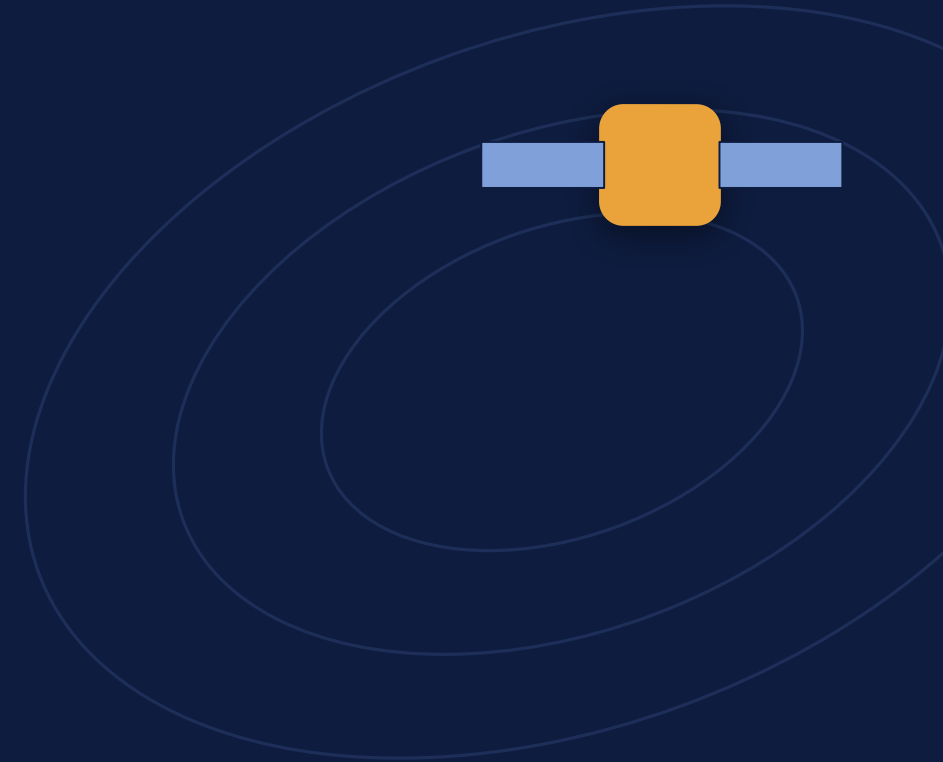
A personal account of the CLTP15 workshop — building a CubeSat from scratch, and what it means for my research, my university and the space industry.

PRESENTED BY

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An Aerospace Engineer Working on Control

My work sits in guidance, navigation and control — until CLTP15, almost entirely inside the atmosphere.



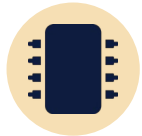
Aircraft Guidance, Navigation & Control

Flight dynamics, sensor suites and control laws for atmospheric flight.



Aerodynamic Control & Stability

Control surfaces, moments, and the aerodynamics that generate them.



Autonomy & Estimation

Sensor fusion, state estimation and autonomous decision-making on board.

One control problem, four platforms

Aircraft



UAV



Spacecraft



CubeSat

CLTP15 took me across the last two steps.

CLTP15 at Nihon University — What It Actually Was



Hands-on, not lecture-led

Learning happened at the bench: subsystems, wiring, code, integration and test.



Our own mission, end to end

Each team defined its own mission and carried it through to a working satellite.



An international cohort

Engineers and academics from several countries working in one laboratory.



Training delivered to industry

Participants also delivered technical training to corporate space-industry engineers.

ADCS: From Aircraft to Satellite



Aircraft

- Aerodynamic control surfaces
- IMU, air-data and navigation sensors
- Flight-control computer
- Moments from airflow
- Continuous, forgiving environment



CubeSat

- Reaction wheels and magnetorquers
- Sun, magnetic and rate sensors
- On-board computer, tight power budget
- Torques in micro-gravity
- No air, no maintenance, no second chance

The control principles carry over. The actuators, the environment and the margin for error do not.

Building a CubeSat From Scratch

The most valuable part of CLTP15 was not what was explained to me — it was what I had to build, break, fix and prove myself.

- Starting from a blank sheet rather than a finished design
- Making subsystem trade-offs with real power, mass and volume limits
- Discovering that integration exposes problems no analysis predicted
- Verifying by test — the only evidence that actually counts

“Learning by doing” stopped being a slogan and became a method.



Design

01



Build

02



Integrate

03



Test

04

One cycle, repeated until it worked.

From an Idea to a Mission



Design starts with the mission — not with the components.



Every requirement has to be traced, tested and defended.

From Participant to Trainer

One of the most rewarding parts of CLTP15 was standing on the other side of the room — delivering hands-on technical training to working engineers from the space industry.

Why it mattered to me

- Teaching a subsystem is the fastest way to find the gaps in your own understanding.
- Industry engineers ask about cost, schedule and reliability — not about elegance.
- It proved the training model works for professionals, not only for students.

“Aerospace education should not stop at the classroom.”



Structured delivery

Clear objectives, sequenced content, measurable outcomes.



Problem-based practice

Exercises built around real hardware and real failures.



Industry-relevant framing

Reliability, requirements and mission assurance first.

Intelligent & Autonomous ADCS for Small Satellites



Attitude determination

Estimation from sun, magnetic and rate sensors.



Sensor fusion

Filtering strategies under CubeSat compute limits.



Robust attitude control

Performance under disturbance and model error.



Autonomous operation

On-board decision-making without ground contact.



Fault-tolerant ADCS

Detection, isolation and graceful degradation.



Hardware-in-the-loop

Testbed validation before any flight commitment.

RESEARCH PATHWAY

Theory



Simulation



Hardware



Flight mission

Teaching, Student Projects & Industry Links



In the classroom

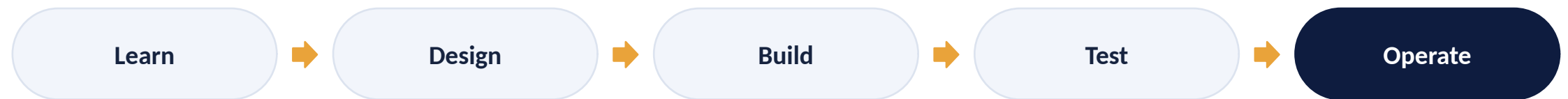
- Spacecraft dynamics and ADCS
- Guidance, navigation and control
- CubeSat technology and systems engineering
- Laboratory sessions built on real hardware



In the laboratory

- Student-led CubeSat projects
- ADCS testbeds and air-bearing experiments
- Hardware-in-the-loop simulation
- Joint projects with industry partners

THE STUDENT JOURNEY I WANT TO BUILD



Building a University CubeSat & ADCS Programme

NEAR TERM

Year 1

MID TERM

Years 2-3

LONG TERM

Years 4+

1

ADCS simulation & modelling

Dynamics, estimation and control models.

2

Sensor & actuator testbeds

Characterising real components.

3

Hardware-in-the-loop ADCS

Closed-loop testing with flight-like hardware.

4

Student CubeSat development

A full mission cycle, student-led.

5

University-industry collaboration

Shared testbeds and joint training.

6

An actual flight mission

From laboratory result to orbit.

Before, During and After CLTP15



I no longer see aircraft control and satellite ADCS as separate fields — they are the same discipline meeting different physics.

What CLTP15 Gave Me

LEARN

Spacecraft and CubeSat engineering from first principles.

BUILD

A satellite made by my own hands, from scratch.

CONNECT

Aircraft control tied directly to satellite ADCS.

TEACH

A training model proven on industry professionals.

APPLY

A concrete research and teaching agenda to take home.

ENVISION

A university CubeSat and ADCS programme with a flight horizon.

“CLTP15 was not only a training programme — it was a bridge from what I knew about flight to what I can now build, teach and fly.”



Thank You

Questions and collaboration are very welcome.

With sincere thanks to Nihon University, the CLTP15 organisers, instructors and my fellow participants.

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