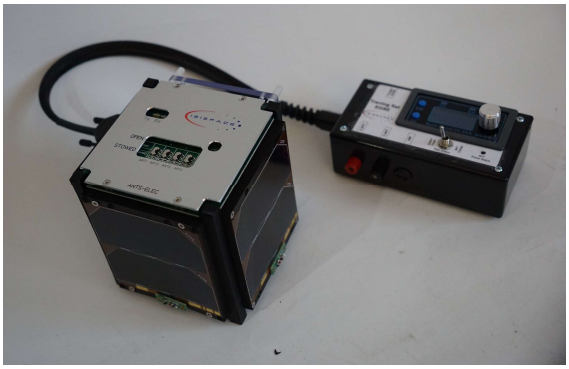
TRAINING PLATFORM

CAPACITY BUILDING PROGRAMME

"With the help of the ISISPACE team, our first generation of space operations officers got the knowledge they needed to setup our new operations center and prepare for the launch and operations of our first satellite. We are extremely satisfied with the dedication and professionalism of the ISISPACE team and grateful for their contribution to the development of our satellite program"



Over the last decade, ISISPACE has built strong heritage and experience in providing full knowledge transfer programs to its customers through the development of turnkey nanosatellite missions. To kickstart your small satellite program, we have developed a cost-effective Training Platform to support hands-on training and education for small satellite design and engineering. The Training Platform enables students and/or trainees to learn subsystem fundamentals, gain experience in satellite integration and testing, and hands-on subsystem operation. The Training platform comes with a set of basic exercises that can be incorporated into a space engineering course.
Optionally, we can provide a dedicated workshop, consisting of a combination of lectures and practical hands-on training activities (see example furtheron). During the workshop, the students will learn how a typical satellite is divided into different subsystems, how to integrate and verify these different subsystems into a fully functioning system, and to build applications with the payload. The program is supported by ISISPACE engineers and can be tailored to an audience with a wide range of engineering backgrounds.

FEATURES

- Complete Training Platform for training in classrooms and laboratories, including all the major subsystems of a typical satellite:
  - Battery systems including power activation, regulation, monitoring, switching and control
  - Software development on central computing module
  - Communications via integrated communication module
  - Data Handling via interconnected data bus
  - Attitude Determination and control using integrated sensors
  - ISISPACE Electrical Antenna system as COTS subsystem example
  - Ground support equipment
  - Optional payload development by students using pluggable connectors

- Software exercises included for both new and more experimented students
- Provides functional hardware solutions for Structure, Power, On-board computer (C&DH), ADCS, COMMS and development / debug systems in a single commercial off-the-shelf (COTS) package
- Connection options accept user-developed payloads and/or optional CSKB modules as payloads on standardized stacking connectors.
- Optional: each student can be provided with a pluggable processor module for hands-on self-study and code development

SPECIFICATIONS

- Powered from included 2S battery (6-8.4V)
- Electronic Ground Support Equipment (EGSE) supports external power
- USB interfaces for control of existing example software or development and uploading of new software developed by students etc.,
- Central controller acting as a central node on the distributed communication bus,
- Accepts up to four 104-pin stackable CubeSat Kit Bus modules to connect user-developed modules,
- Representative 3D printed structure with integrated electrical activation switches Includes the following:
    - Structure,
    - One functional solar panel and additional aluminum covers,
    - Electrical model of ISISPACE deployable antenna system,
    - Integrated controller housing wireless communication modules,
    - Power interface: Battery management and switchable power lines to subsystems and payloads
    - Distributed thermal sensors,
    - ADCS sensors: 6x Photodiodes (as coarse sun sensors), 3-axis gyroscopes, 3-axis accelerometers,
    - Interface to ADCS actuators: single-axis magnetic coil, single-axis reaction wheel.

ACCESSORIES

- Apply before flight (ABF) connector for wireless operation from batteries
- Condensed "getting started guide" to allow students to explore functionality quickly
- Detailed User manual for self-study and exercises using commonly available tools like mobile phone and laptop, and with enough detail to allow the optional development of own payloads,
- Software Development environment with example code for various modules,
- EGSE interface system including USB interface cable, power source, battery charger and control switches.

TRAINING WORKSHOP

In addition to our Training Platform, we can also offer a multiple-day workshop to give up to 10 trainees a tailored introduction to CubeSat engineering and basic satellite design. The focus will be on demonstrations and hands-on experience, e.g. by creating software code to operate the different subsystems and to demonstrate different operating principles. After this workshop each trainee should have a basic understanding of the main subsystems and their operating principles and will leave with hands-on experience on satellite hardware and ground support equipment. This training is suited for trainees with a basic understanding of engineering principles and/or are enrolled in a higher-level STEM education program. It also provides a solid basis for the development of an actual flight-ready satellite mission using the ISISPACE CubeSat Development Platform or small satellite platforms.

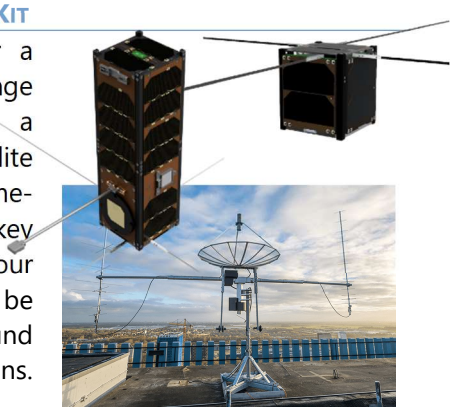
This training is also perfectly suited as part of a student competition where the trainees need to develop a software code to operate a payload (send commands, receive data and telemetry), and where the winner is selected for further development to fly on an actual satellite mission.

CUBESAT DEVELOPMENT PLATFORM

Our CubeSat Development Platform (CDP) uses the same subsystems as our flight model platforms, and therefore serves as a perfect tool for hands-on satellite AIT training, payload development and flight software.

PLATFORMS & GROUND STATION KIT

Our standard platforms offer a complete solution for a wide range of applications and provides a stable and agile nanosatellite platform. With our reduced time-to-orbit, these platforms play a key role to ensure the success of your mission, and can be complemented with our ground station kits for satellite operations.



EXAMPLE OF SMALL SATELLITE DEVELOPMENT TRAINING COURSE (MAY BE TAILORED TO USER NEEDS)

Structure

- Introduction to CubeSat structures and the use of standard CSKB interfacing
- Introduction to the possibilities of housing own payload(s)
- Hands-on training in satellite structure integration, where the trainees will assemble and disassemble a CubeSat structure, including integration of wired separation switches and solar panels.

Power System

- Introduction to electrical power systems for satellites.
- Introduction to power control via EGSE interfacing and umbilical.
- Hands-on training where the trainee will write a software module that can perform battery management and power line switching. The software shall demonstrate monitoring, and charge and discharge cycles on a representative battery pack.

On-board Computer

- Introduction to satellite control using an onboard computer.
- Hands-on training, where the trainee will create an interface with the satellite via UART/USB using electrical ground support equipment. Using a logic analyser, the trainee will be introduced to I^2C control using a master/slave architecture.
- Hands-on training in writing software code, using the demo code menu accessible via Putty. The trainees shall create a software module that can do the following (based on functional example code):
    - Power line control
    - ADC monitoring for battery voltage, bus current and temperatures
    - CSS interfacing for panels
    - Interfacing to antenna system
    - Optional payload development
- Note: Trainees can build on their code using modules connected to their own laptop USB port and then verify their code by operating the satellite platform when ready

Communication

- Introduction to satellite communication principles and RF engineering.
- Demonstration of a communication interface from a mobile device, using remote control (integrated BLE module).
- Hands-on training where the trainees create a remote interface with an ISISPACE antenna (emulating FM antenna) to provide power and communication. They will demonstrate the interface by reading out telemetry (temperature, switch status) and sending commands (arm, deploy, auto-deploy) to the antenna.

Attitude Determination & Control System (ADCS)

- Introduction to the basic principles of attitude determination and control of a satellite
    - Demonstration of a CSS sensor interface to show values of 5 distributed photodiodes.
    - Demonstration of a 3-axis magnetometer
    - Demonstration of a 3-axis accelerometer
    - Demonstration of a single-axis magnetic and motor control
- Advanced exercise where the trainee sets up the (coarse) sun sensor interface with the ability to detect the location of a ‘sun’ in free space and implement a basic control system attempting to follow the ‘sun’ with the model suspended from a string and operated wirelessly from internal battery power.

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