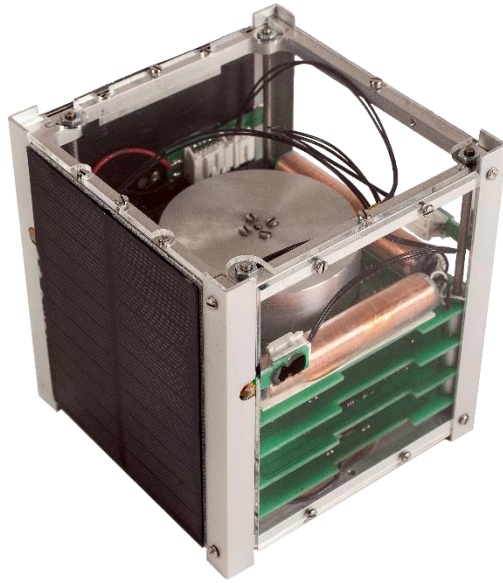


ESAT, The Hands-On Training Satellite



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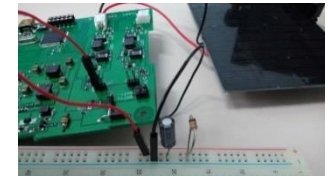
- Theia Space
- ESAT Objectives
- ESAT Subsystems
- ESAT EGSE and MCS
- ESAT Data Management
- Potential ESAT users

Theia Space



ESAT Objectives

- Teach space systems engineering, **from design to operations.**
- Teach how the different subsystems and architectures work and interact with each other.
- Teach how the integration and validation tests are performed.
- Possibility to work with the subsystems **stand-alone or integrated.**
- Easy to use and robust.
- **Community oriented.**
- Easy to build on it:
 - **Open Source SW**
 - Easy programming interface
 - **Bus Interface**



```
OBC_AdcsDan | Energia 010E0016M
File Edit Sketch Tools Help
OBC_AdcsDan g
/*
 *This function is only called once at the beginning of the execution.
 *It starts the communication interfaces as well as all the peripherals.
 */
void setup() {
  /*
   *Initialization of the USB interface
   */
  mySerial.begin();
  /*
   *Initialization of the I2C interface for communication with peripherals
   *and the EPS subsystem
   */
  Wire.begin();
  /*
   *Initialization of the wifi interface via Serial library
   */
  Serial.begin(115200); // (9600);
  /*
   *ADCS initialization function.
   *Sensors and actuators initialization.
   *When startup sequence exits the sequence bip-bipbip-bipbipbip-biiip
   */
  ADCS_init();
}
```

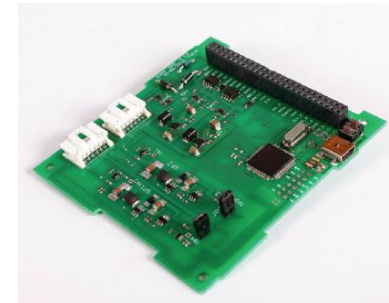
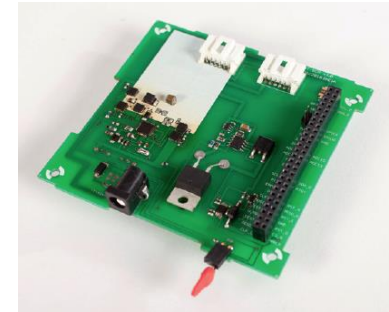
ESAT Subsystems (I)

EPS

- 2 solar panels
- 2 solar panel regulators: MPPT/DET
- Voltage/current telemetry
- 5V, 3.3V DC/DC converters and switches
- Battery management module with overcurrent/overvoltage/undervoltage protection
- Integrated battery charger
- **Fully programmable MCU** (preprogrammed with open source base software)

OBC

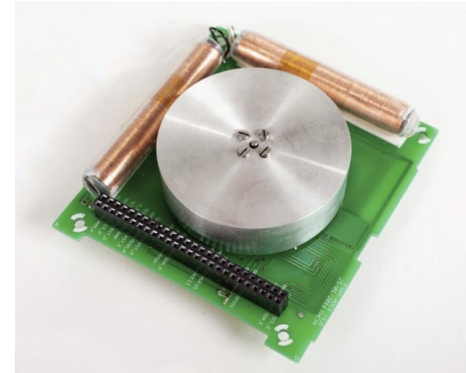
- **Fully programmable MCU** (preprogrammed with open source base software)
- Micro-SD card
- Real Time clock
- Wireless communication via **WiFi module**



ESAT Subsystems (II)

ADCS

- One reaction wheel
- Two magnetorquers
- One IMU with 9 degrees of freedom (3 accelerations, 3 gyros, 3 magnetic axis)
- 4 sun sensors
- Wheel tachometer
- **Customizable control algorithms**



STR

- 2 Aluminium frames
- 4 Aluminium rails
- 4 methacrylate side panels
- 2 Solar panels
- Spacers between the electronic boards



ESAT EGSE and MCS

EGSE

- Magnets to provide a useful magnetic field
- Turning table
- Sun simulator

MCS

- Telemetry visualization:
 - Raw
 - Plots
 - Subsystems displays
 - Replay
- Allow to send TC with sanity checks
- TM/TC reports (csv format) for postprocessing.

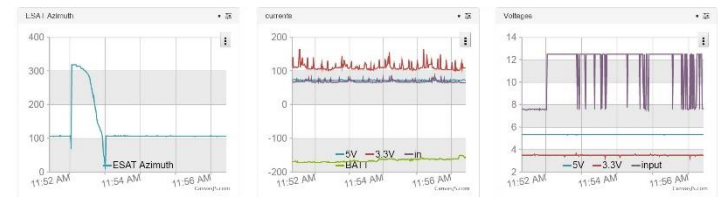


my manager Theia

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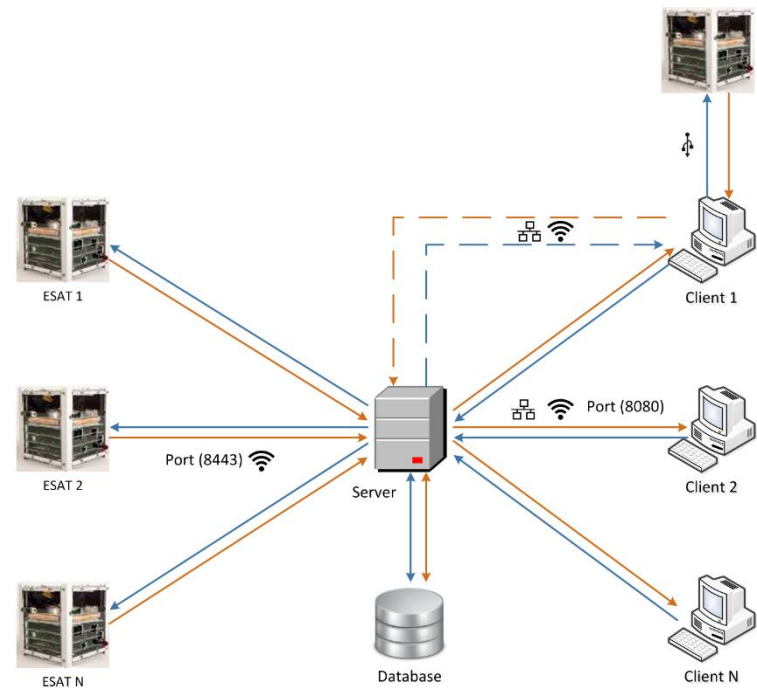
EPS Telemetry

#	ID	Name	Formatted value	Plotted	Error
0	Flags	Flags (binary)	0		
1	Flags2	Flags2 (binary)	110011001111		
2	I5	5V DCDC output current	72.29		
3	V5	5V DCDC voltage	5.33		
4	I3	3.3V DCDC output current	110.11		
5	V3	3.3V DCDC voltage	3.52		
6	Iin	Input Current to power stage	71.56		
7	Vin	Input voltage (Bat/USB)	7.58		
8	Ip1out	Output current, solar panel 1	1.53	✓	
9	Vp1	Solar panel 1 voltage	0		
10	Ip1in	Input current, solar panel 1	1.22		
11	Vp2	Solar panel 2 voltage	0.01		
12	Ip2in	Input current, solar panel 2	1.22	✓	



ESAT Data Management

- A central server handles the TM sent by all the satellites and broadcasts it to the corresponding connected users (clients).
- The server forwards commands from the users to the corresponding satellites.
- The client interface helps the user interpreting the TM and sending TCs.
- **Open-source code.**



Potential Users

- STEM education
- Universities
 - Space Vehicles Design courses.
 - New space programs.
 - New students/teachers in the team.
 - Long projects where students do not get to see all the phases.
 - Low funding cases.
- Space Companies
 - Staff training.
 - Different kinds of courses.
- Student competitions
- Reach out activities
- Fast prototyping





Thank you!
Come visit our booth!

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