LSF
SLIDE 1

QUBIK

The unplanned mission of an unbuilt satellite to be integrated into a deployer that does not exist

It was a quiet summer evening

(somewhere)

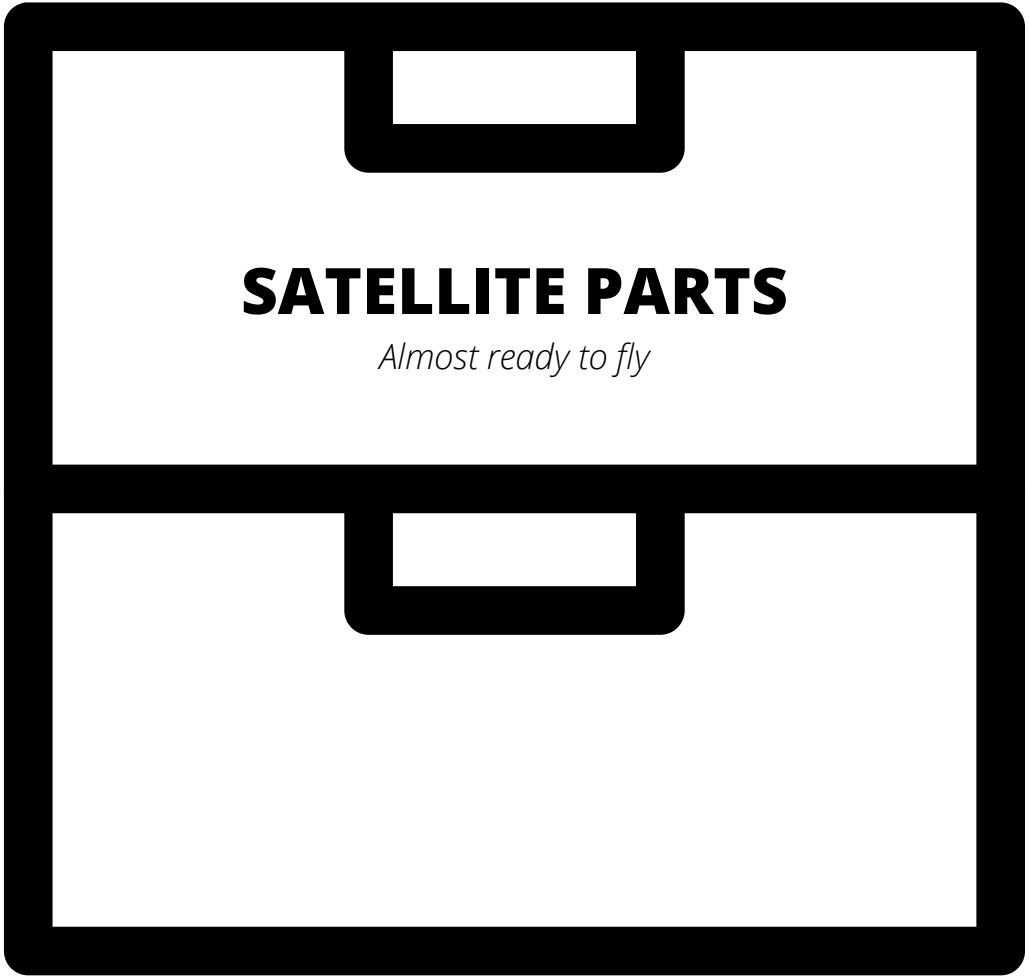
We got a phone call

(it was an email)

- *We have a 1p slot available for a PocketQube, are you interested?*

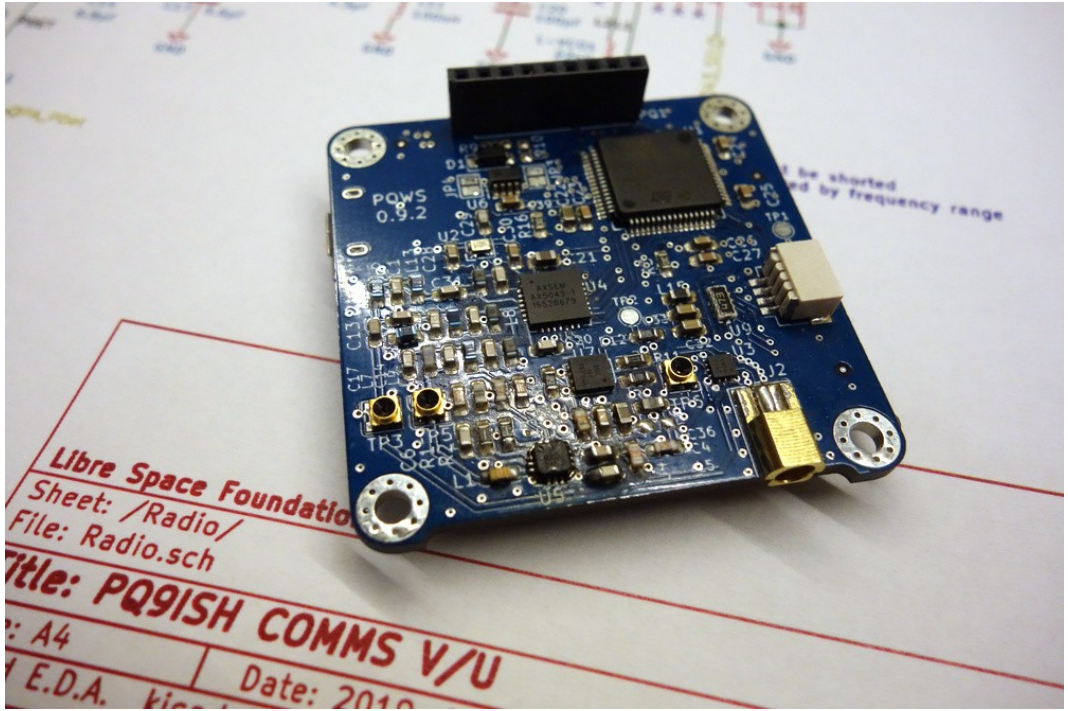
...

- Great have it ready to go to space by December. BYE



Clipart by Jasfart from the Noun Project

There is a COMMS available



aaaand that's it..

The Plan

HARDWARE

1. Test COMMS
2. Add power
3. Add PV panels
4. Add structure
5. Bolt everything on a plate
6. Bakeout
7. Protoflight campaign
8. Send it to be integrated to the deployer
9. Have pizza

SOFTWARE

1. Find a purpose for the mission
2. Write some code that at least transmits what needed by mission
3. Flash the firmware
4. Have pizza

The experiment

A LEOP satellite identification and orbit determination experiment

1. Unambiguously identify satellites as soon as possible after deployment

2. Generate or update existing orbital elements based on Doppler curve tracking of satellite transmissions

https://librespacefoundation.gitlab.io/qubik/qubik-docs/

Identification via:

- Beacon preamble/post-amble
- Beacon decoding
- Beacon length
- Beacon cadence
- Spread spectrum low power beacon

Tracking:

- Modulation
- Beacon preamble/post-amble
- Residual carrier

Meanwhile on the hardware department

Power system

- Power budget
- Design solar panel circuits
  Built around SPV1040
- Design power management board
  Using MAX17261

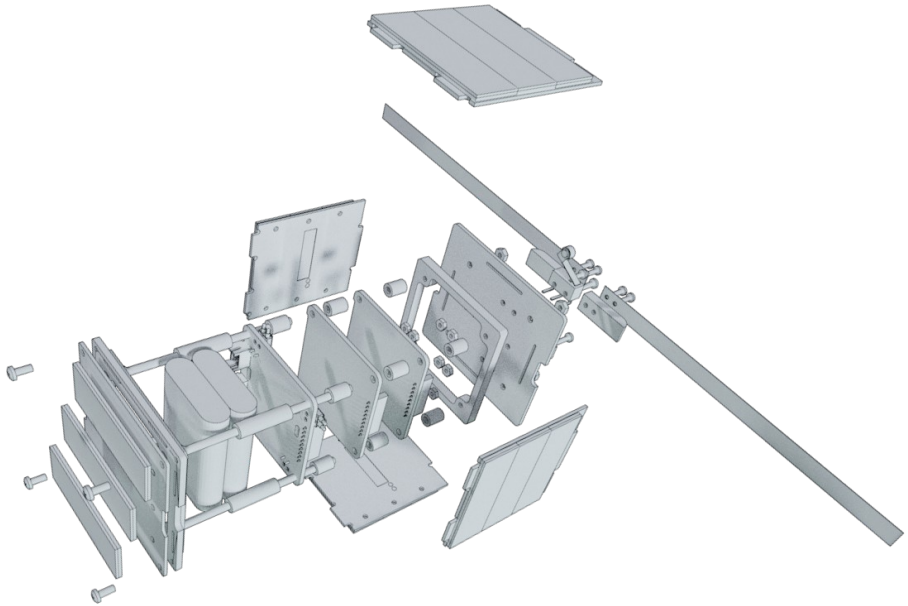
COMMS

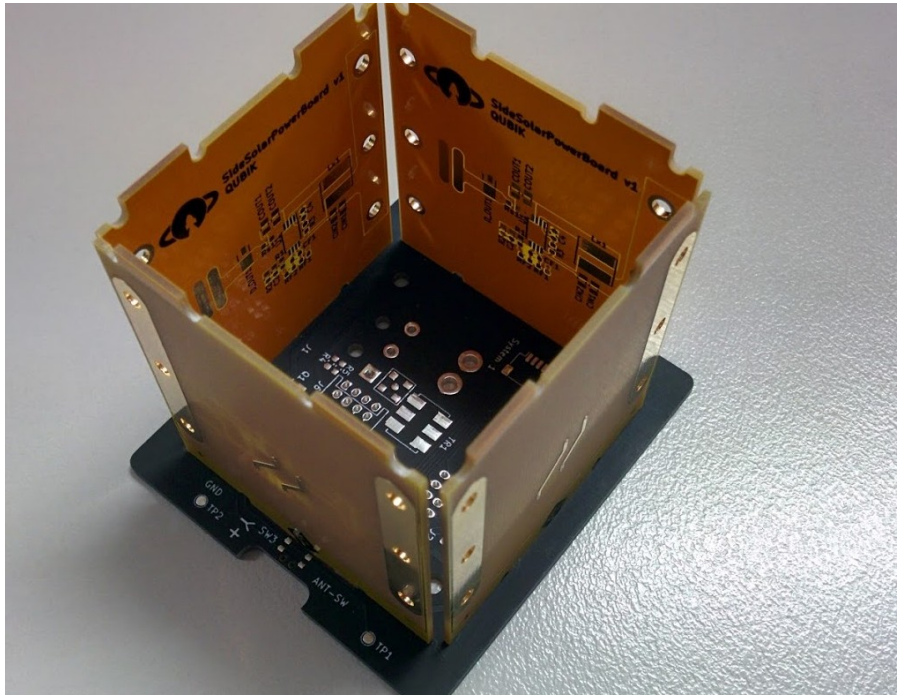
- Minor modifications to suit mission

Mechanical

- Design bottom plate to fit deployer
- Antenna release mechanism
- Structural design

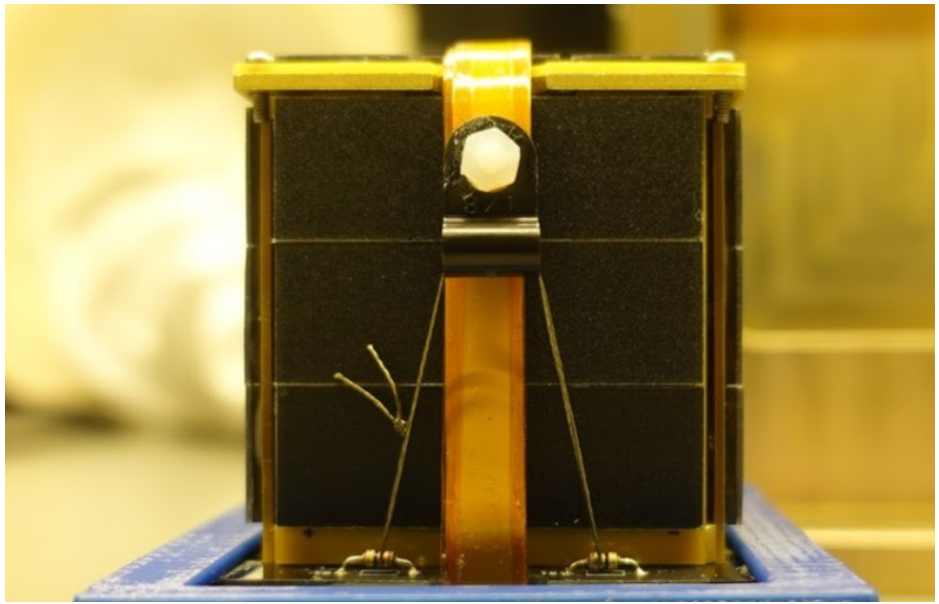
PCBs as a structural element





Antenna

- Dipole antenna
- Release by dual thermal knife



Good news everyone...

- There is an extra slot available on the deployer if you want it

Sure, we'll just build 2 of them

- Oh and the deployer, well it's more of a concept, so could you...?

...

- Great, have a mass simulator for everything ready by next week. BYE

The Revised Plan

HARDWARE

1. Test COMMS
2. Add power
3. Add PV panels
4. Add structure
5. Bolt everything on a plate
6. Bakeout
7. Protoflight campaign
8. Send it to be integrated to the deployer
9. Have pizza

SOFTWARE

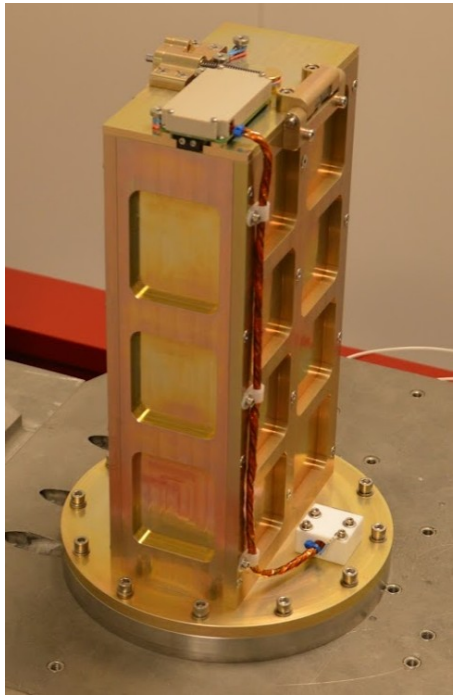
1. Find a purpose for the mission
2. Write some code that at least transmits what needed by mission
3. Flash the firmware
4. Have pizza

DEPLOYER

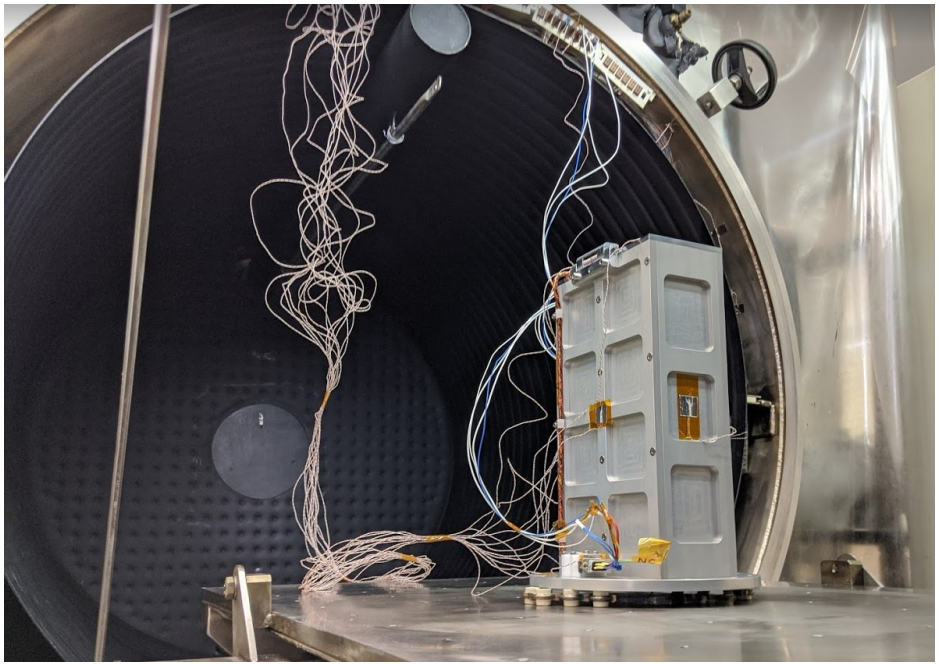
1) Design the deployer
2) Design mass simulator
3) Build mass simulator
4) Build qualification deployer
5) Qualify qualification deployer (TVAC/Vibration)
6) Build Flight deployer
7) Protoflight campaign for all payload
8) Integrate payload
9) Have pizza

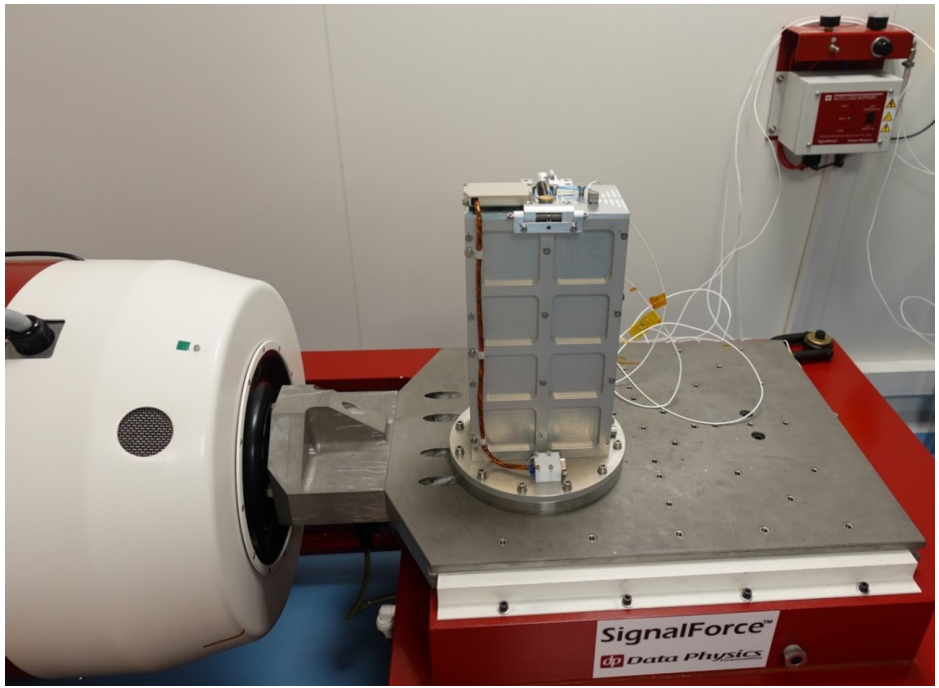
The birth of PICOBUS

- 2 x 4p Rails
- Constant force springs
- Dual thermal knife release
- Becomes an actual service by LSF

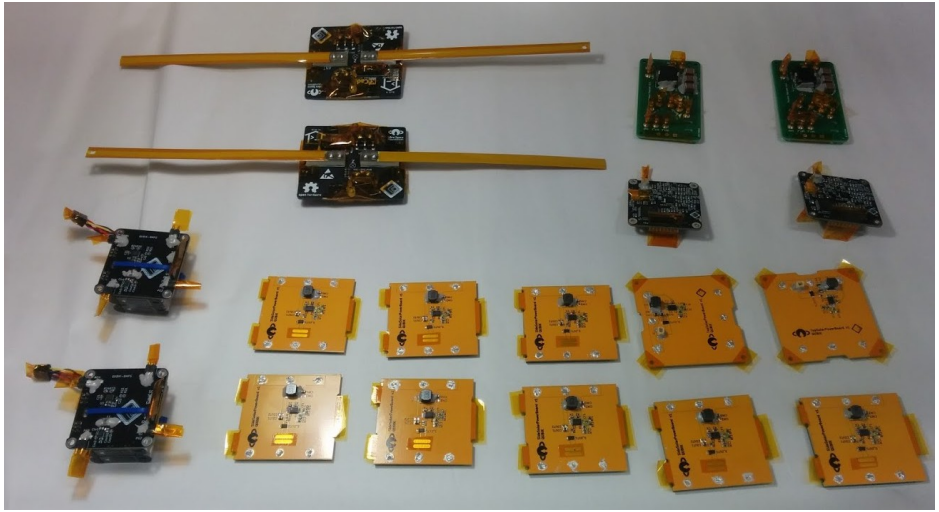


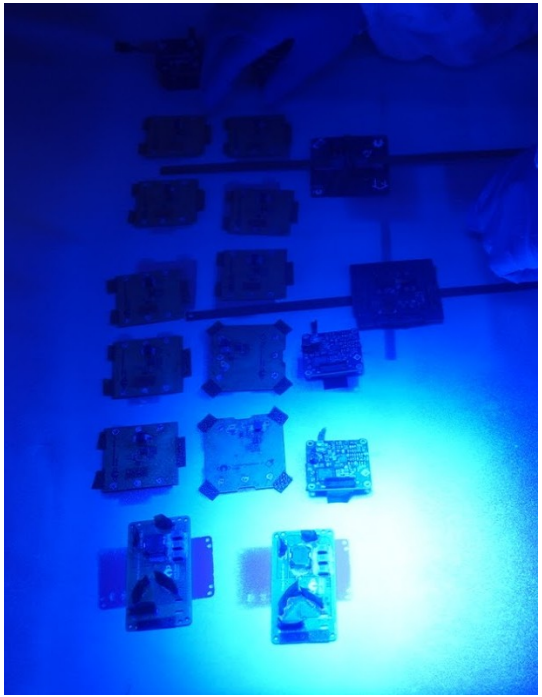
TVAC and Vibration

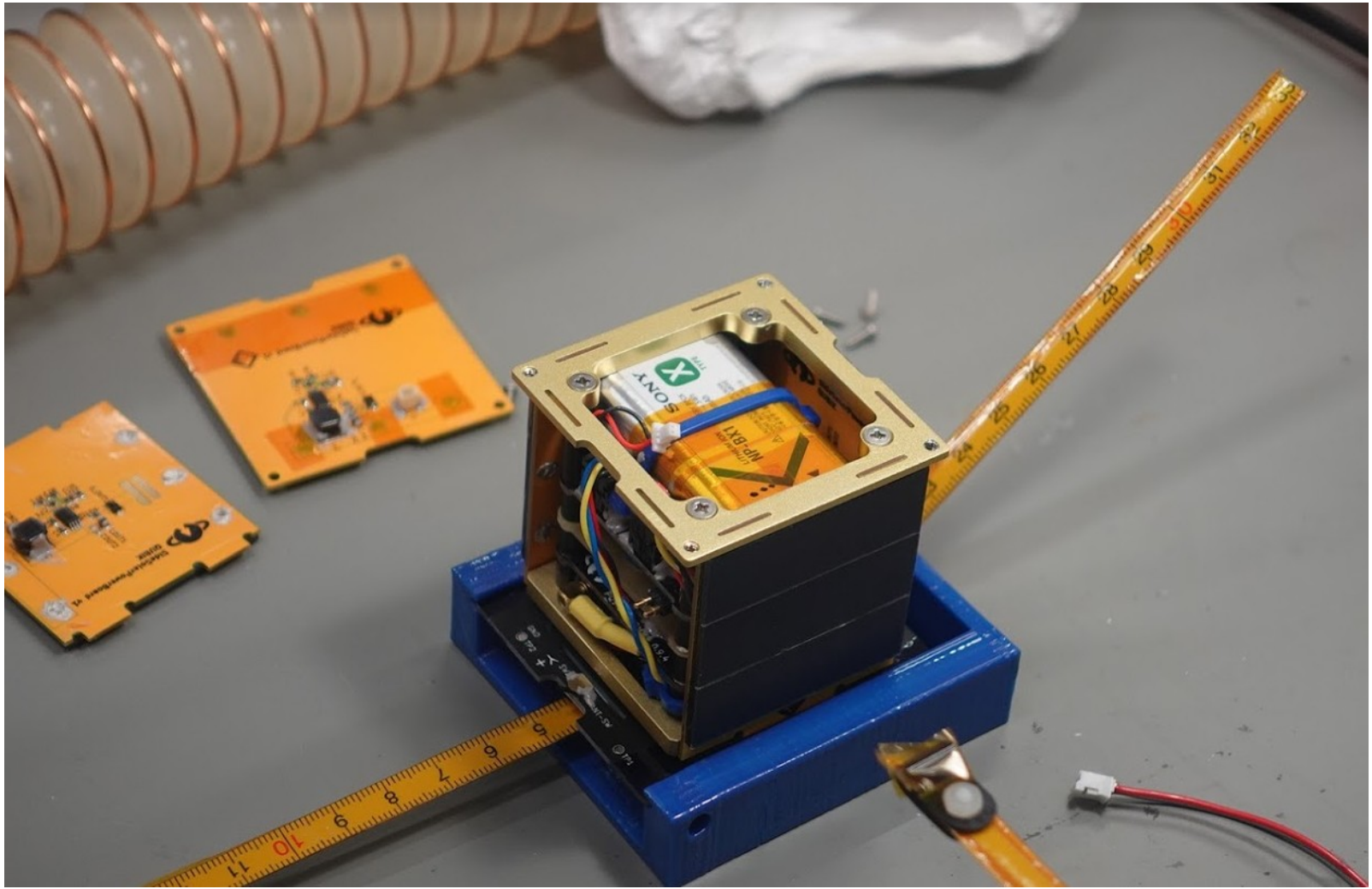




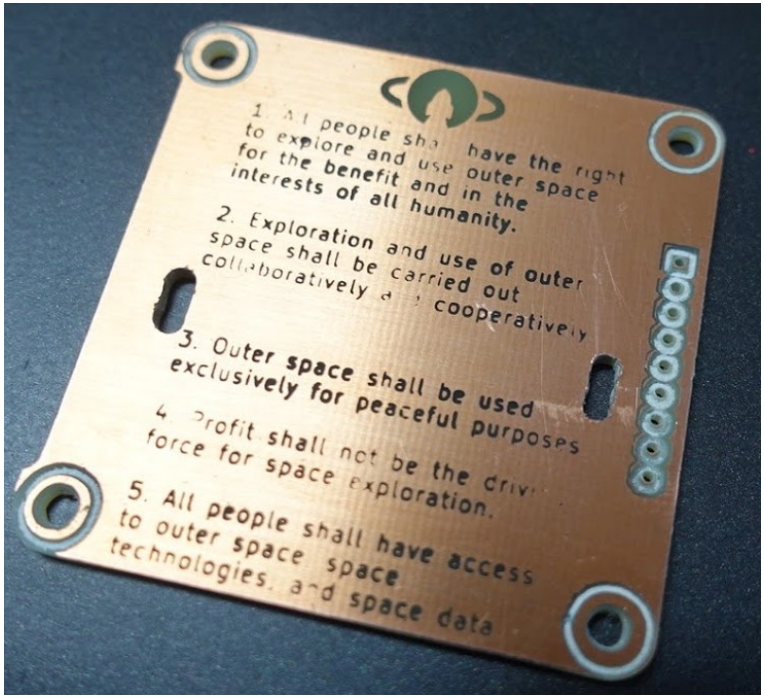
Conformal coating



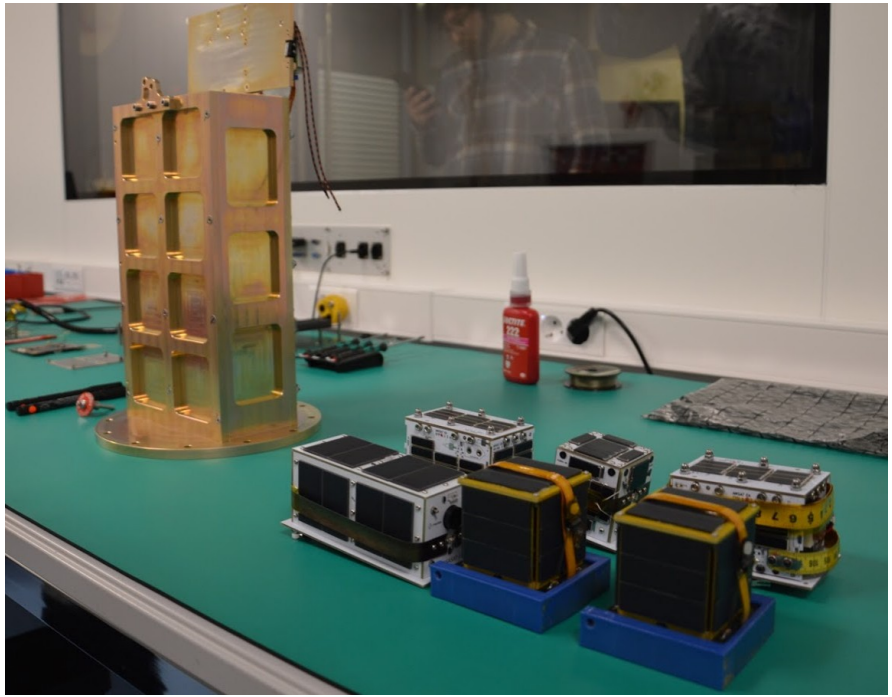


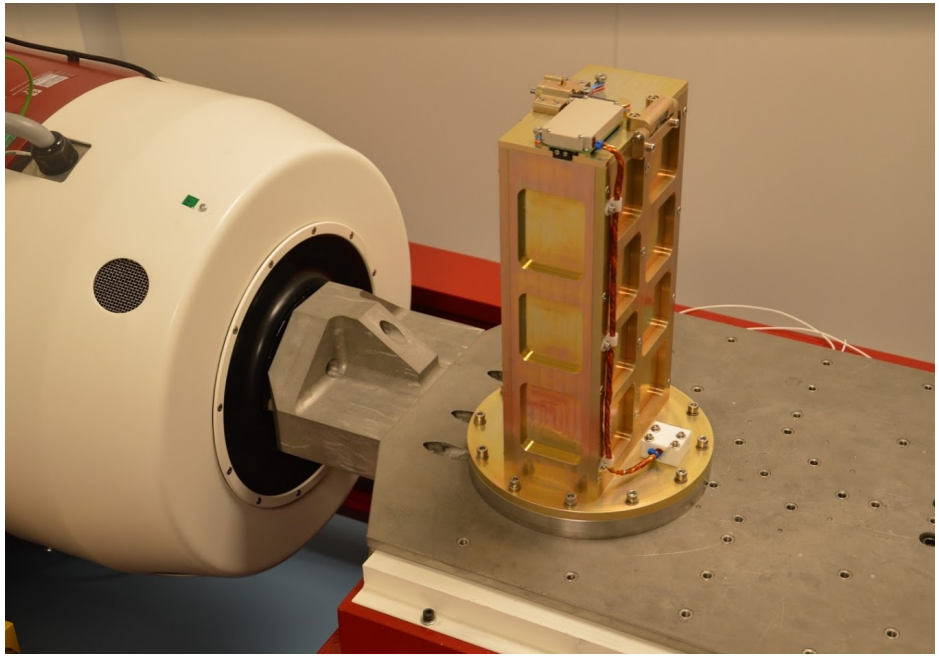

SONY
NP-BX1

Send ideas to space



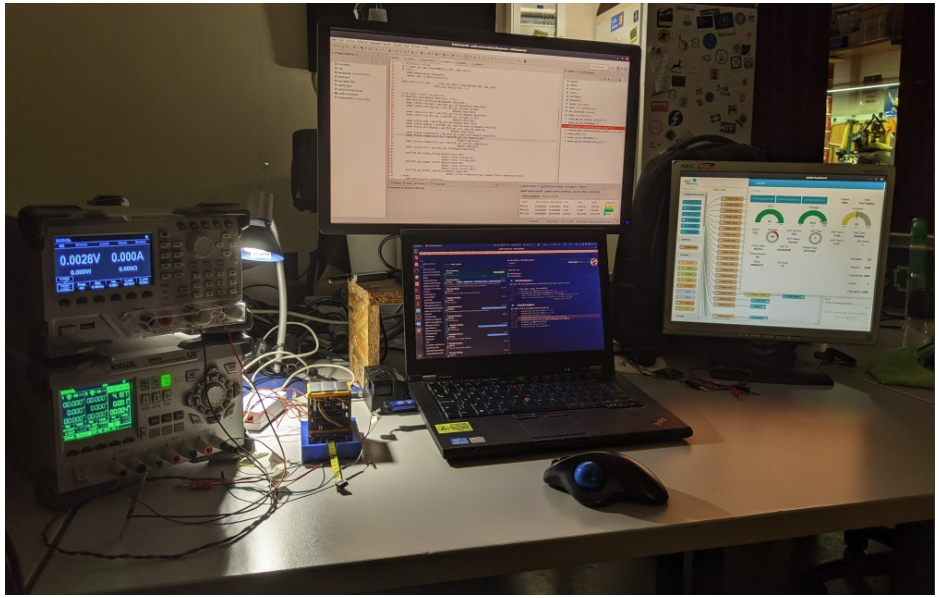
Protoflight



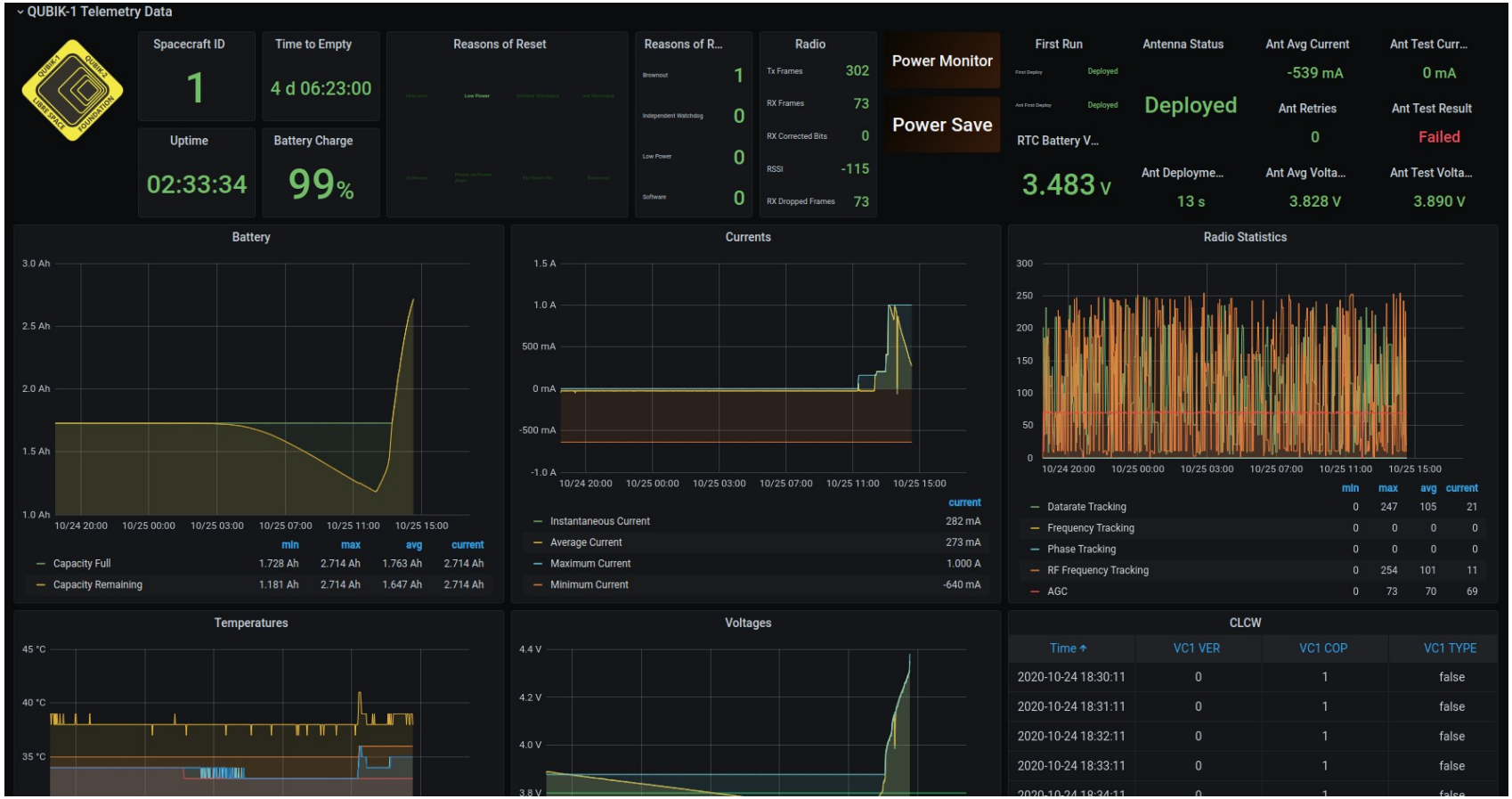


On the software side

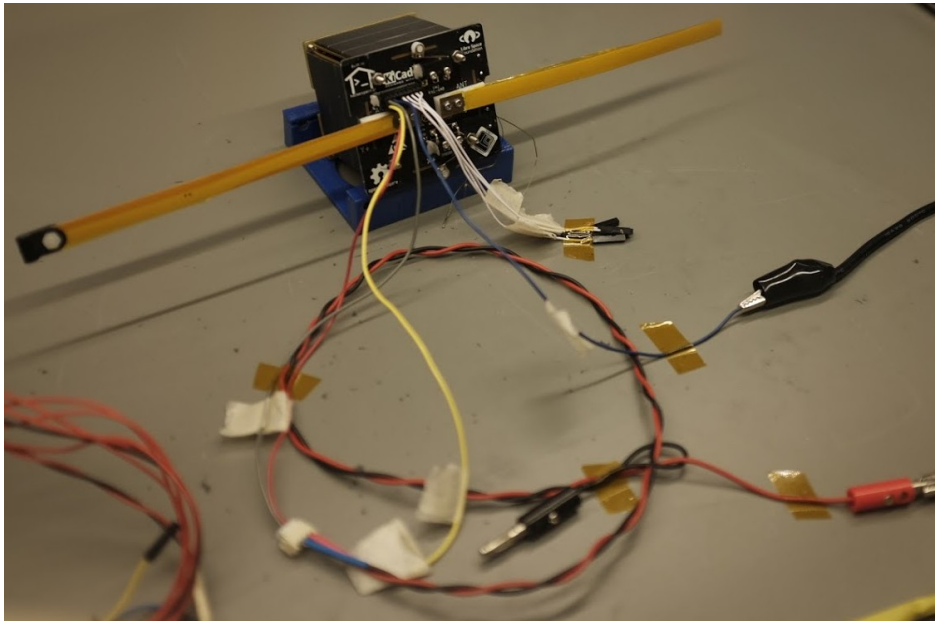
- Implemented fully functional AX5043 driver
- Telemetry and Telecommand
- FSM Control
- New project - Open Space Data Link Protocol
  - CCSDS Space Packet
  - CCSDS TM Space Data Link Protocol
  - CCSDS TC Space Data Link Protocol
  - Communications Operation Procedure-1
- MAX17261 Power supervisor driver
- GS Telecommand software

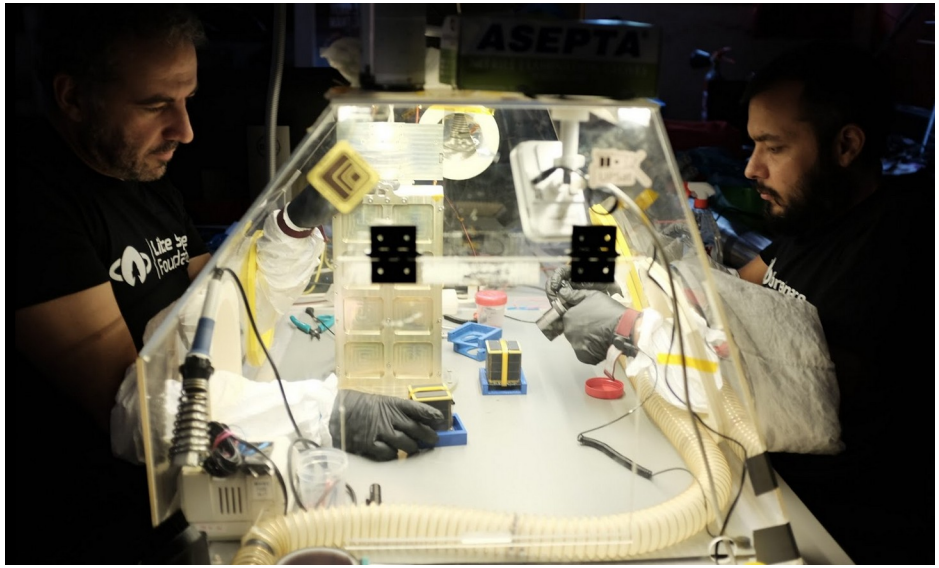


SatNOGS Integration during development



Integration





About the launch

- Part of DREAM payload
- Organized by FOSSA Systems
- Firefly ALPHA

The unplanned mission of an unbuilt satellite to be integrated into a deployer that does not exist **on a rocket that has never launched before**

People

QUBIK Team

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Vasilis Tsiligiannis

Photos

Manthos Papamattheou

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Ilias Daradimos

Aris Nikas

Facilities

TVAC at Instituto Nacional Técnica Aeroespacial, Madrid arranged by FOSSA Systems

Vibration test at Universitat Politècnica de Catalunya,Barcelona arranged by FOSSA Systems

Bake-out at IESL, FORTH

Repos under https://gitlab.com/librespacefoundation/qubik

PIZZA