

LSF



SLIDE 1



QUBIK

Architecture, development, testing and mission update

Mission

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:

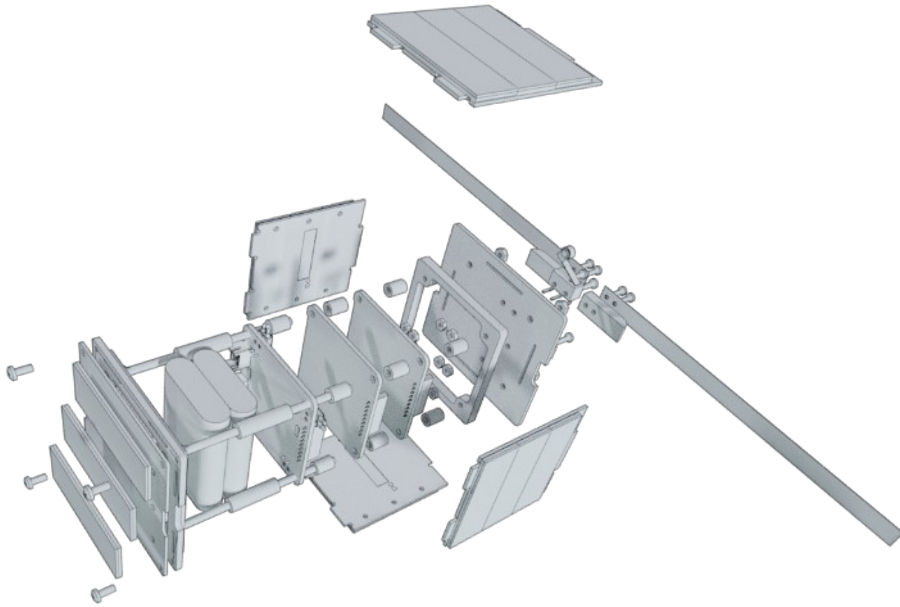
- Beacon preamble/post-amble
- Beacon decoding
- Beacon length
- Beacon cadence
- Spread spectrum low power beacon

Tracking:

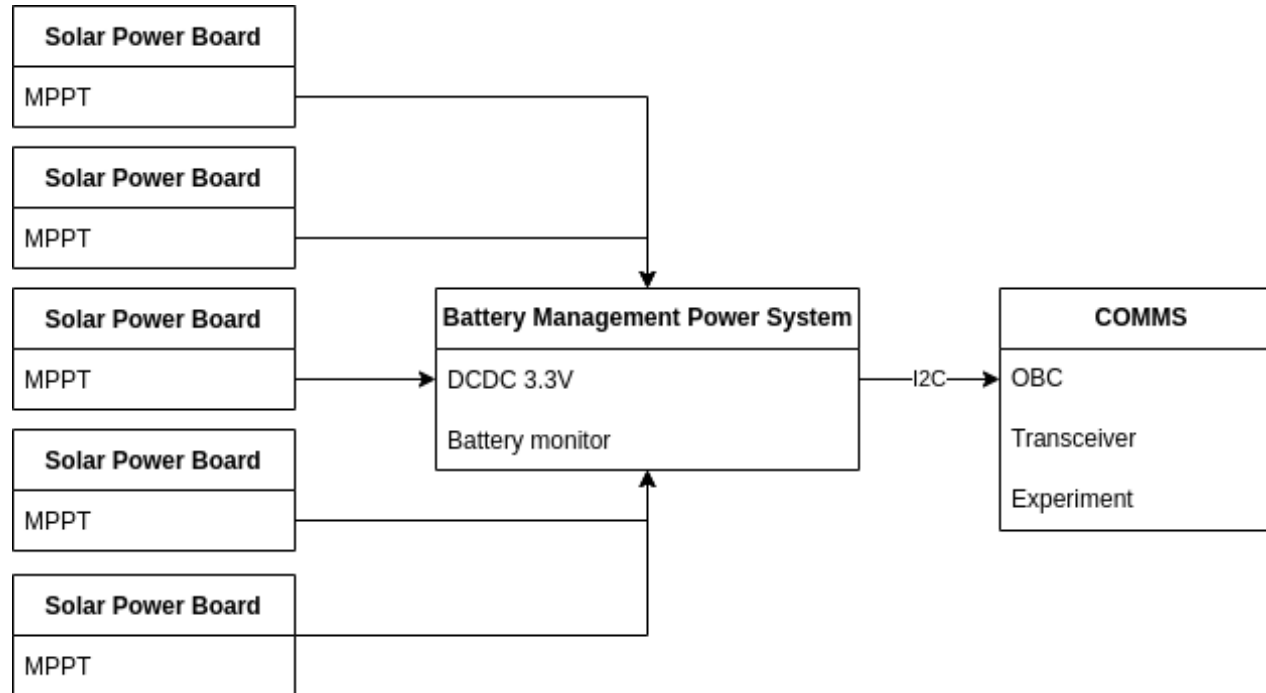
- Modulation
- Beacon preamble/post-amble
- Residual carrier



QUBIK 1,2,...



System overview

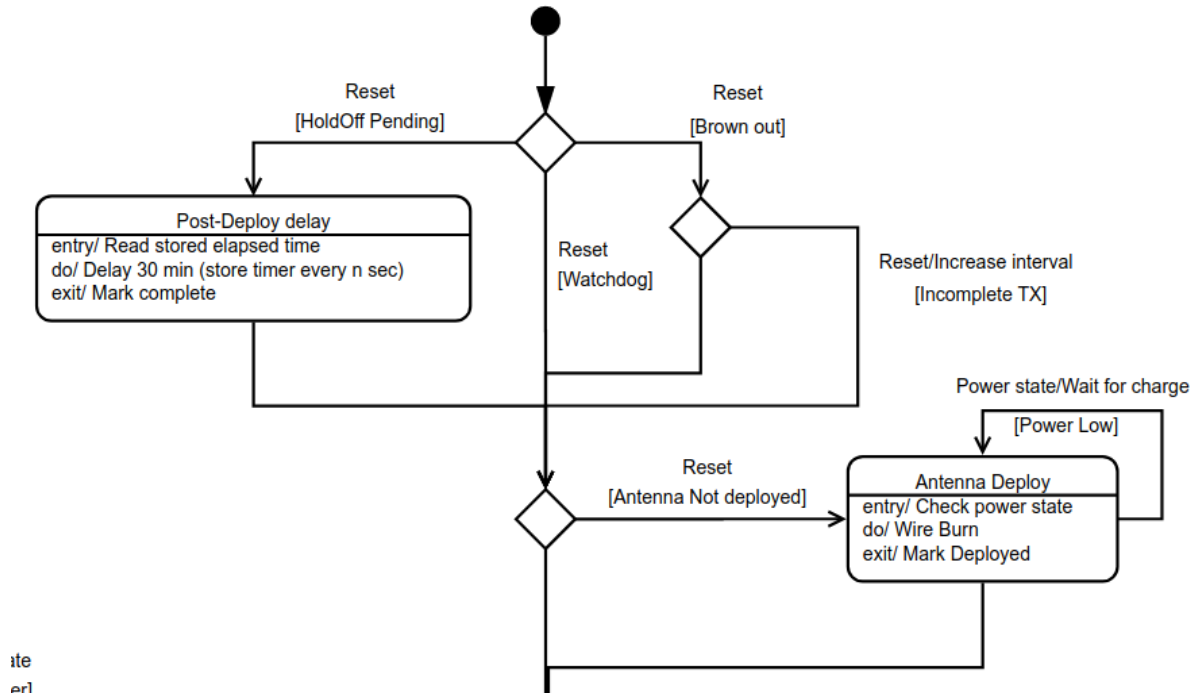


Software

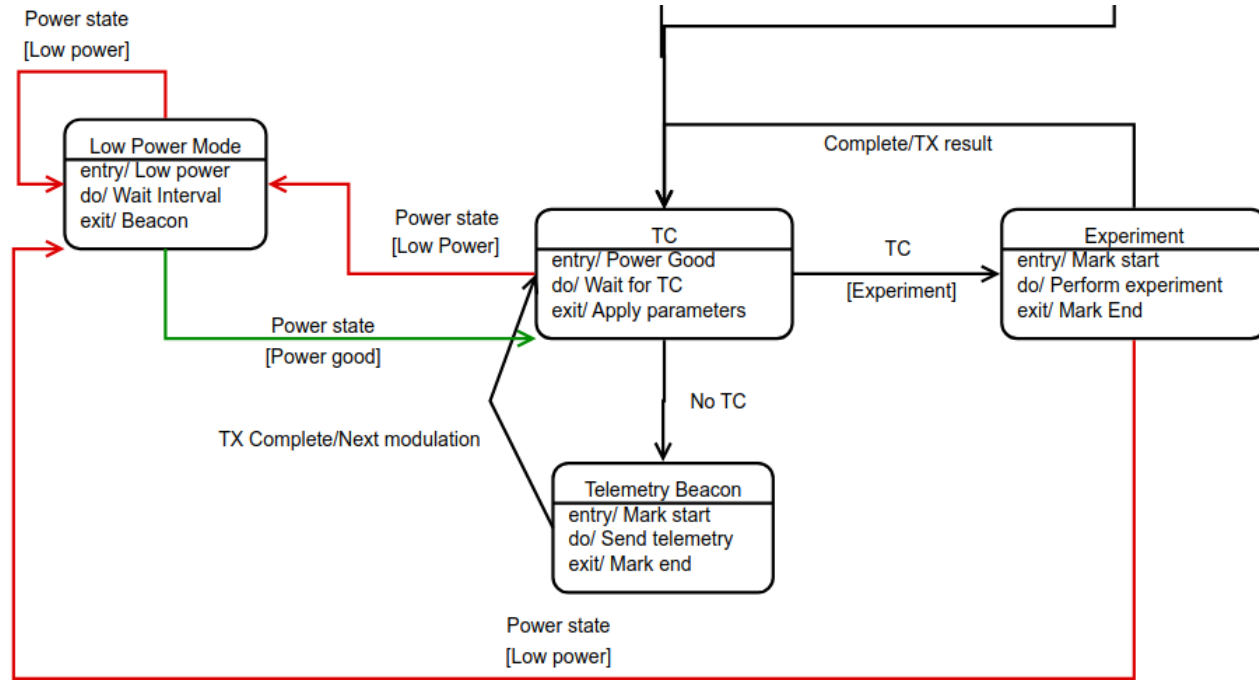
- Implemented fully functional AX5043 driver
- Telemetry and Telecommand
- FSM Control
- New project - Open Space Data Link Protocol
 - CCSDS Space Packet
 - CCSDS TM Space Data Link Protocol
 - CCSDS TC Space Data Link Protocol
 - Communications Operation Procedure-1
- MAX17261 Power supervisor driver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



FSM (Deployment)



FSM (operation)



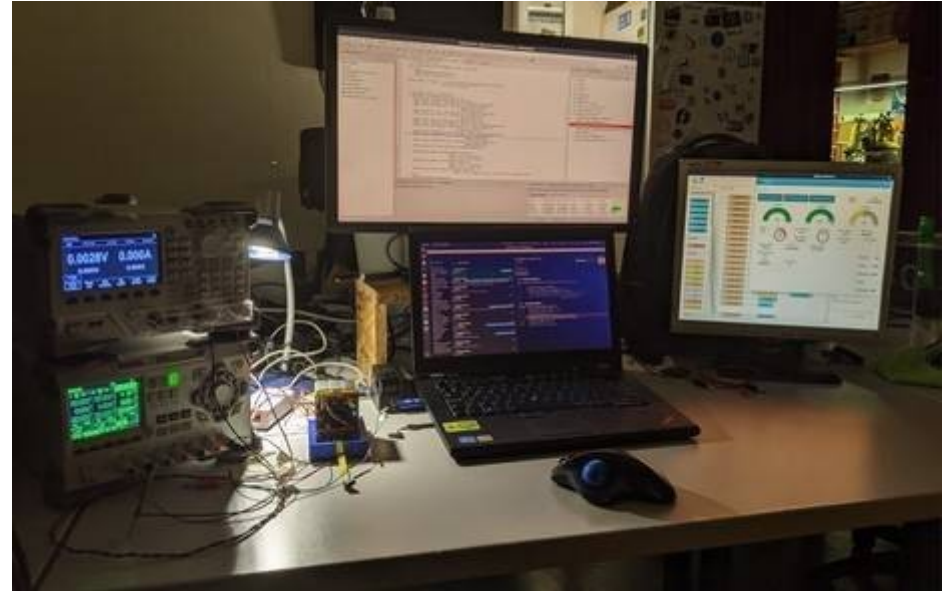
Telemetry beacon

	PA	Power	Telemetry Type	Modulation	Encoding	Baud	ms	sec delay
1	1	-2	Basic	GFSK	RS	9600	220	30
2	1	-2	Basic	BPSK-RES	CC12RS	9600	1300	30
3	1	-2	Basic	GFSK	RS	9600	220	30
4	1	-2	Basic	GFSK	CC12RS	9600	400	30
5	1	-2	Basic	GFSK	RS	9600	220	30
6	1	-2	Basic	BPSK-RES	CC12RS	9600	1300	30
7	1	-2	Basic	GFSK	RS	9600	220	30
8	1	-2	Basic	GFSK	CC12RS	9600	400	30
9	1	-2	Basic	GFSK	RS	9600	220	30
10	1	-2	Basic	BPSK-RES	CC12RS	9600	1300	30
11	1	-2	Basic	GFSK	RS	9600	220	30
12	0	15	Basic	RILDOS	RAW	125000	2500	30

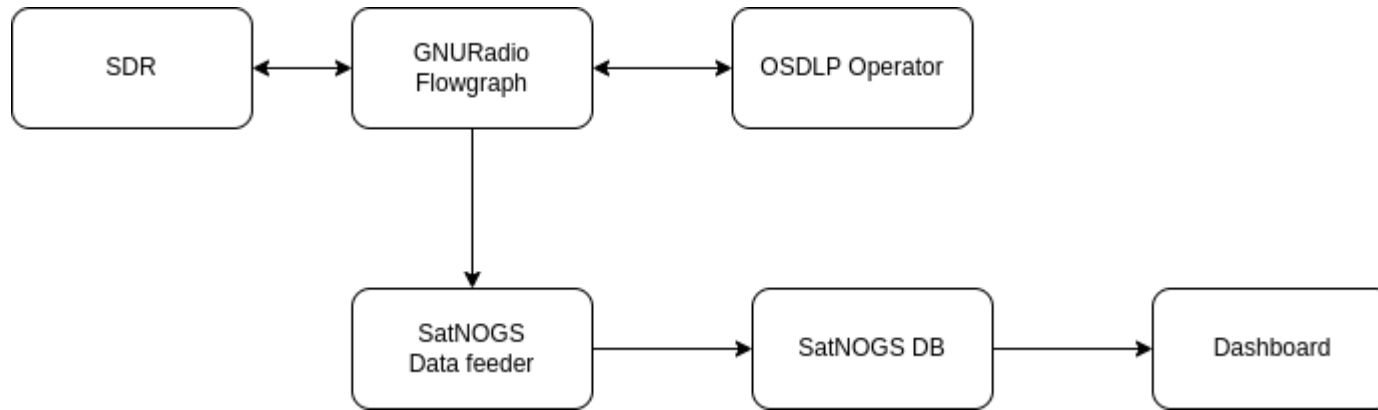
- 3 Modulation types
- 2 Encoding schemes + RAW
- 12 Telemetry slots
- Configurable from ground
- TX from RX path

Development

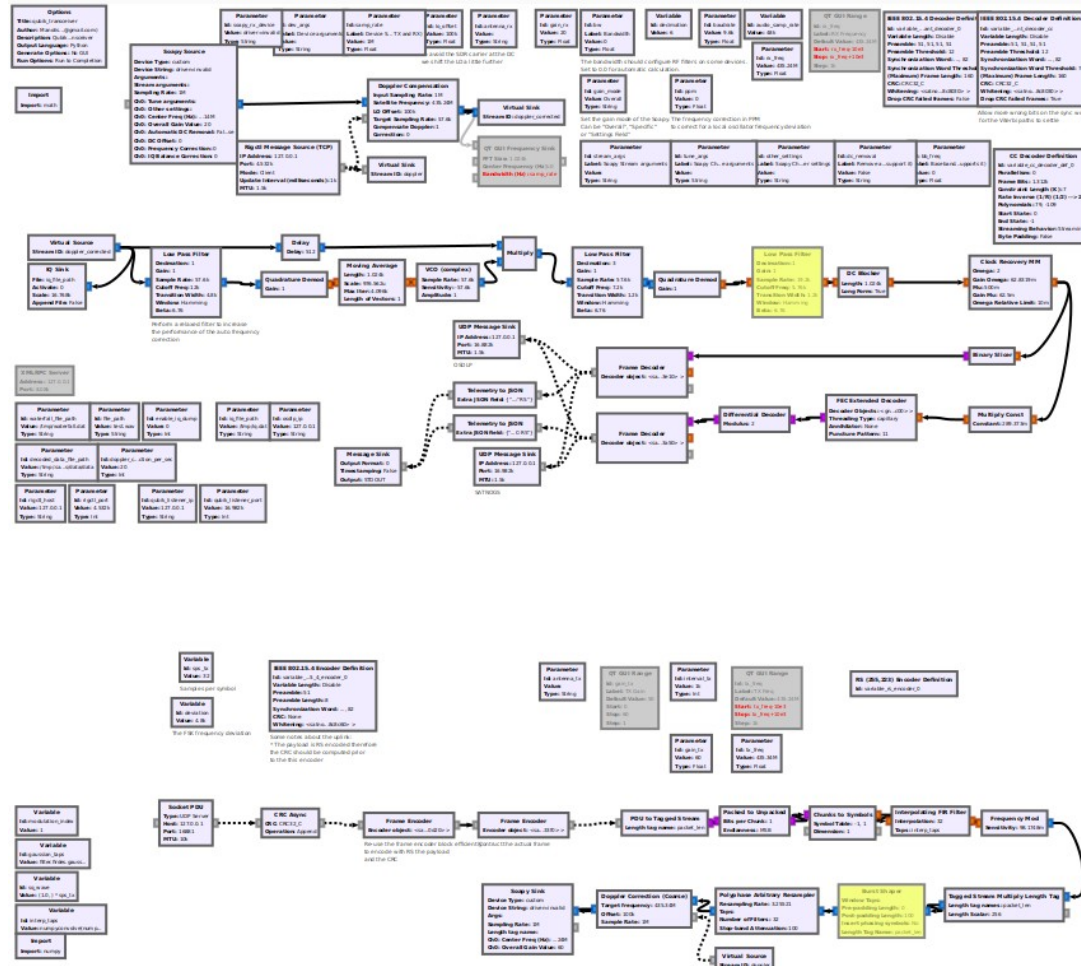
- STM32 HAL
- FreeRTOS
- Hardware drivers as git sub-modules
- Monitor operation via
 - STM32CubeMonitor
 - SatNOGS in the loop



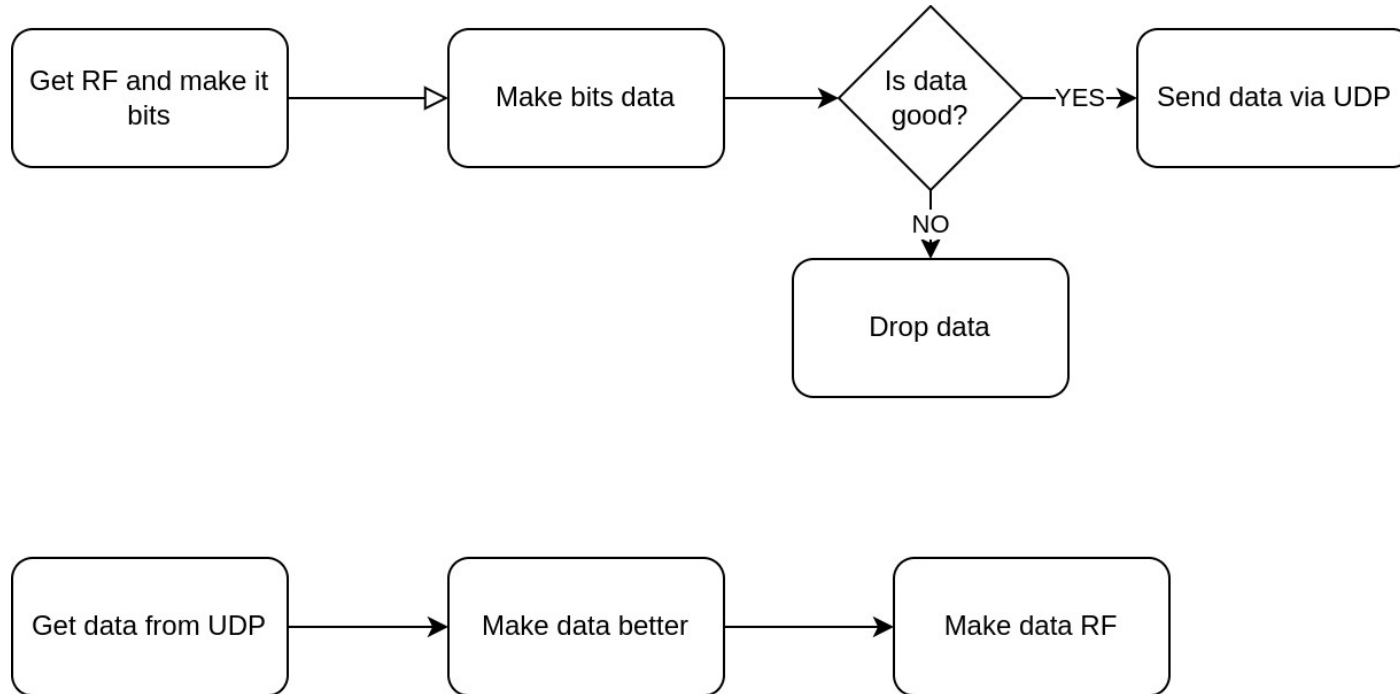
SatNOGS in the loop



TCC Flowgraph



TCC Flowgraph (Oversimplified)



SatNOGS in the loop



SatNOGS in the loop advantages

- Monitor telemetry data in an intuitive UI
- Verify end to end data reception
- Ground segment ready for operations

About the launch

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

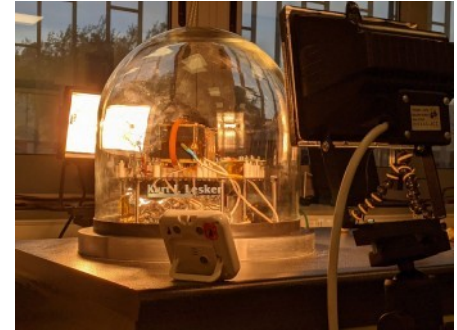
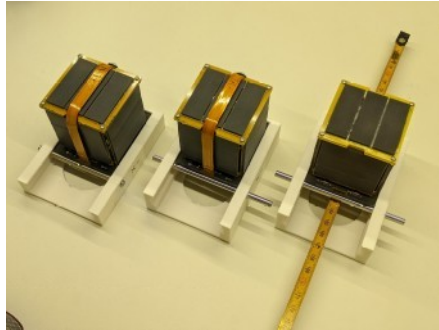
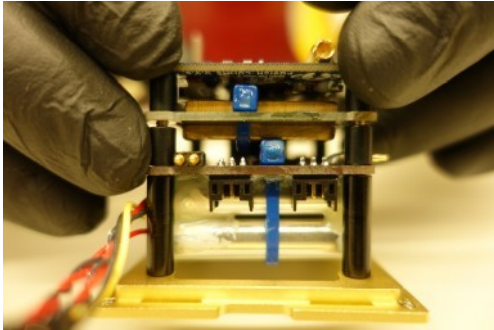
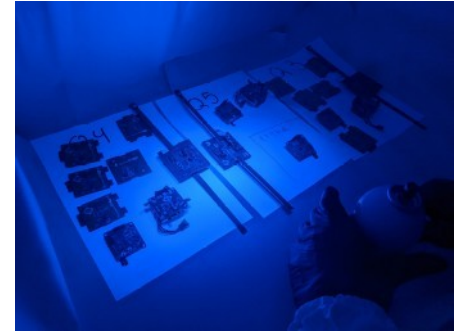
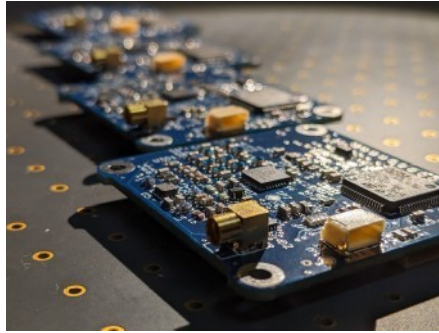


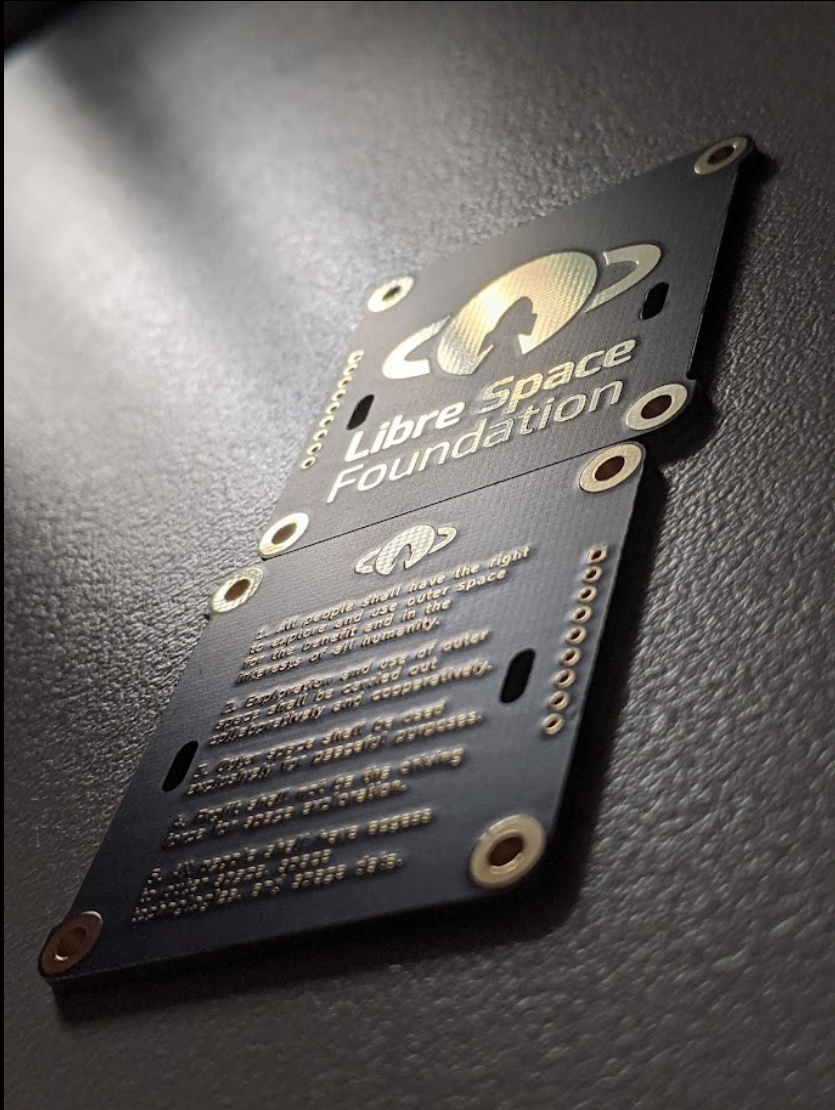
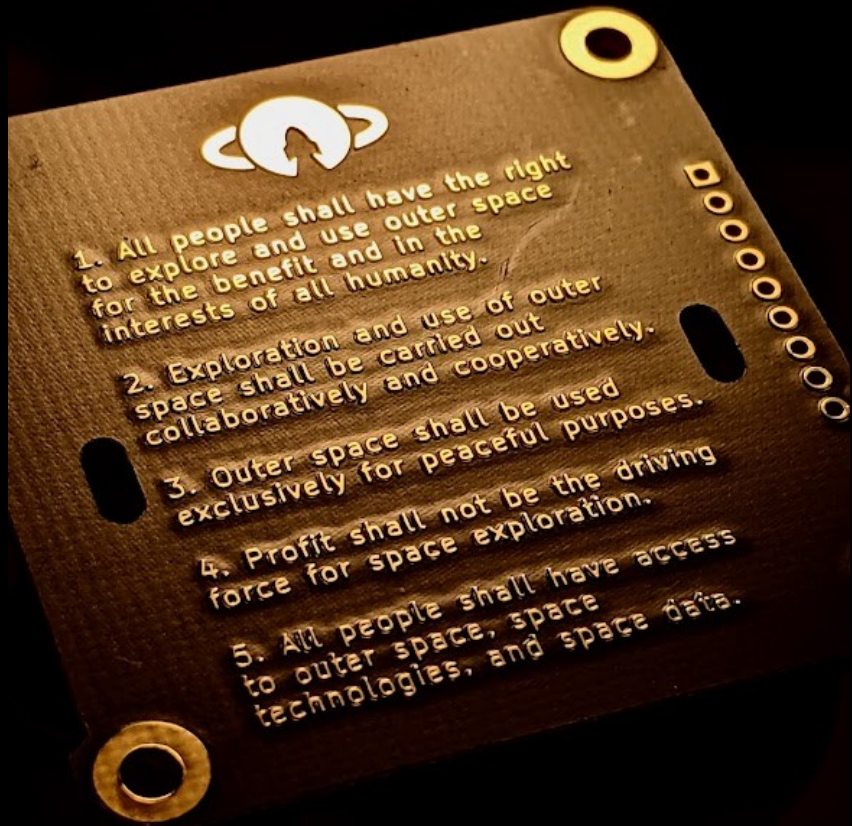




Space is hard

So we build more





What's new in QUBIK 3 and more

- Cosmetic upgrade of manifest
- Use COMMS v0.9.6
- Integrate battery models in battery management
- Improve software stability

People

QUBIK Team

Agis Zisimatos
Alfredos-Panagiotis Damkalis
Andreas Ampatzoglou
Aris Nikas
Cees Bassa
Fabian P. Schmidt
George Tsagakarelis
George Vardakis
Ilias Daradimos
Kostis Triantafyllakis
Manolis Surligas
Manthos Papamattheou
Mike Biniaris
Panagiotis Chatzidakis
Patrick Dohmen
Pierros Papadeas
Thanos Patsas
Vasilis Tsiligiannis

Photos

Manthos Papamattheou
Julian Fernandez
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, and EDML, University of West Attika

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