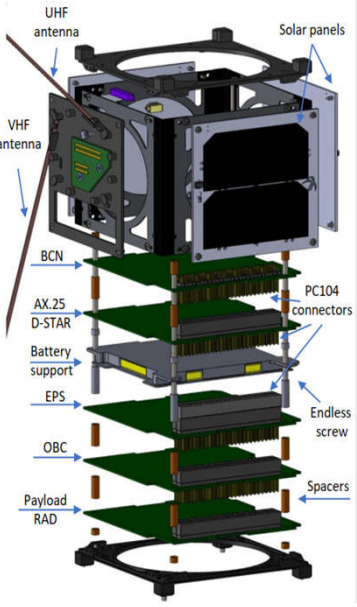
Status of educational OUFTI-2 1U CubeSat as of May 2019

Valéry Broun[1-3], François Grosjean[1], François Piron[1], Guillaume Martin[2], Sebastien De Dijcker[2], Jacques G. Verly[1]

[1] University of Liège, Dept. of Electrical Engineering and Computer Science, Liège, Belgium
[2] Haute Ecole de la Province de Liège, Engineering Department, Liège, Belgium
[3] University of Liège, Department of Aerospace and Mechanics, Liège, Belgium

Summary :

We describe the current status of the educational OUFTI-2 1U CubeSat. This satellite is a successor to the OUFTI-1 satellite, which became silent after 12 days in orbit, in May 2016. A thorough analysis of the possible reasons of failure of OUFTI-2 led to a significant re-design.

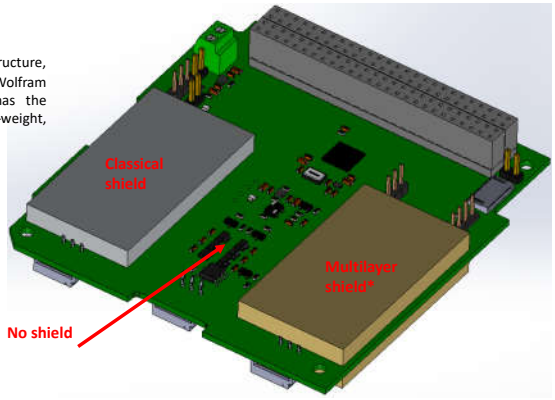


CAD model of OUFTI-2

The primary mission of both satellites is identical, namely a home-made space repeater for D-STAR amateur radiocommunications. The freeing-up of some space on-board, in major part due to a new design philosophy for the on-board processor (**OBC**), allowed us to embark new secondary payloads: one for testing the performance of a new type of electronics-shielding (**RAD**), multilayer material with small size & weight, and the other – designed by high-school students – to perform inertial measurements.

RAD subsystem:

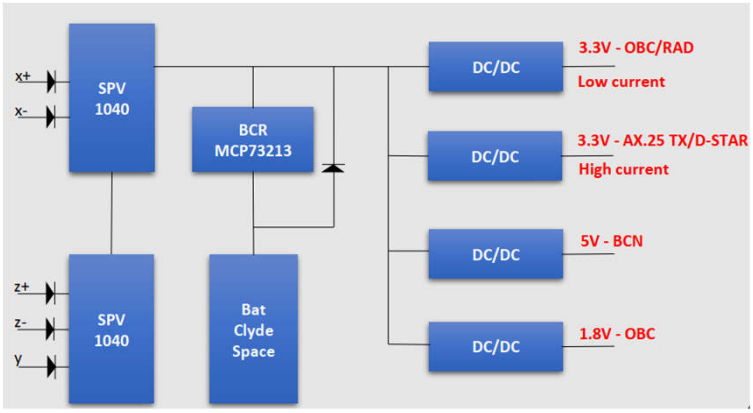
* multilayer laminate structure, combining doped resin and Wolfram (tungsten) heavy alloy. It has the advantage of being light-weight, robust, and reliable.



Three identical electronic circuits, resp. without any shield, with a classical 2-mm aluminum shield, and with the new multilayer shield.
Measurements of electronic parameters (ΔV and T°) on Radfet and op-amp-base circuits.

- Use of ΔV and $T°$ to deduce D at each sampling time.
- Correlation with ESA SPENVIS.
- Compare offset and noise voltage in the three cases
- Compare the protection provided by both types of shields

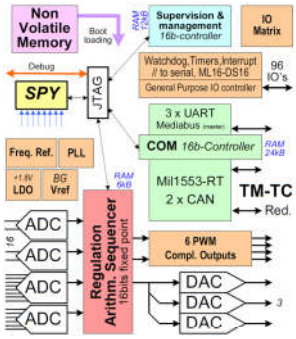
EPS subsystem:



Electrical Power System (EPS) uses a semi-regulated bus, rather than an unregulated one, leading to a better control of the charge of the two batteries, thus improving their life duration. For OUFTI-2, we switched to a structure and solar panels from ClydeSpace.

OBC subsystem:

Use of the Digital Programmable Controller (DPC) from Thales Alenia Space, Belgium. A main feature of the DPC is the fact that it is very highly resistant to space radiation. It also features 3 separate core processors, each with a distinct function.



COMM subsystem:

The radiocommunication (COMM) system of OUFTI-2 continues to provide D-STAR voice & data user communication, AX.25 telecommand & telemetry, and automatic, periodic beacon (BCN) Morse-code transmissions. However, now, the D-STAR system also provides a beacon mode, and the BCN a higher power efficiency and, in addition to the transmission capability at 12 words/min, a high-speed data transmission capability at 2400 bits/sec. The discovery of a previously-unnoticed "sync word" in the D-STAR frames received by the COMM led to a huge reduction of the number of interruptions to the OBC.

Status: The design of the BCN, COMM, and OBC is complete. The same holds for the EPS, except for the circuitry between the solar panels and batteries, which is being finalized. The four electronic boards are at various stage of completion, and prototypes have been built. For the OBC board, we use a temporary, test piggy-back system so that we could easily change the DPC if this proved necessary. The architecture of the OBC software is essentially complete. The on-ground BCN decoding software is operational. We are also designing and constructing a solar lighting system and the electrical ground support equipment (EGSE).

oufti1cubesat ISILELECTRO **Contact** : valery.broun@hepl.be