Initial architecture of OUFTI-2, the new educational CubeSat of the University of Liège, featuring D-STAR radiocommunications

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OUFTI-2 is the new educational CubeSat (1 kg, 1 liter, 1 Watt) of the University of Liège that will allow D-STAR amateur-radio telecommunications, just as for OUFTI-1. The new nanosatellite and its subsystems will be designed totally from scratch, using the experience gained, and lessons learned, through OUFTI-1, now in orbit around the Earth. The main modifications envisioned are given below.

Radio-communications (COMM)

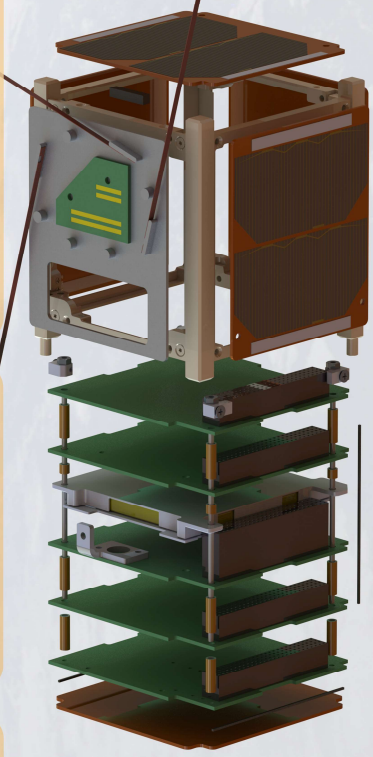
- Separation of beacon (BCN) and telecommand/telemetry (TC/TM) channels to maximize robustness, with following 3 consequences
- Removal of radiofrequency (RF) combiner, also leading to 3dB gain in link budget
- Dedicated (VHF) antenna for each of these channels
- New antenna support allowing storage and deployment of 3 antennas (vs 2 for OUFTI-1), also adapted to new structure
- RF shielding to avoid electromagnetic interference between VHF and UHF transmitters (Tx) & receivers (Rx)
- Addition of beacon mode in D-STAR Tx, sending periodically in D-STAR voice mode the audio message "Hi from OUFTI-2"
- AX.25 TC/TM data rate adjustable from 2400 to 9600 baud.

Electrical power supply (EPS)

- Increased number of 3.3V supplies (3 vs 2)
- No 5V supply (vs 1)
- Batteries meeting requirements of International Space Station (ISS)
- New power dissipation electronics, in particular to permit the continuous elimination of the complete power generated, as required when satellite is (nearly) always in the Sun (as is the case for OUFTI-1), thus allowing operation in all low-earth orbits.

Watchdog

- Use of an external (vs internal) hardware watchdog to help recover in case of software deadlock, via electrical reset of all electronics aboard satellite.



Beacon (BCN)

- Continuous transmission (vs with duty cycle)
- Increased power efficiency (vs 15%)
- Increased number of measurements transmitted (46 vs 12), each with an ID
- Alternating high and low speed transmissions, resulting in all measurements being sent at both high speed and low speed in each one cycle, to increase robustness in case of link budget degradation
- High speed (2400 baud): all 46 measurements at once
- Low speed (Morse code at 12 words/min, thus audibly decodable): a single of these measurements (with ID) between successive high speed bursts
- Shielding of BCN electronics to avoid producing electromagnetic interference within satellite
- New radiofrequency (RF) electronics
- Dedicated Tx antenna (vs shared with AX.25 & D-STAR)
- Use of global, external hardware watchdog for resetting BCN processors/micro-controllers (MSP430)
- Addition of a beacon mode in D-STAR transmitter (Tx).

Structure (STRU)

- Structure likely obtained from ClydeSpace or ISIS Space
- Screwing/bolting (vs gluing) of solar cells to allow disassembly and access to interior of satellite
- Use of 4 (vs 1) kill switches for ISS compliance.

On-board computer (OBC)

- Simplified architecture using a single electronic board with 2 redundant processors/micro-controllers MSP430F1611 (so that the backup FM-430 processor board of OUFTI-1 is no longer used)
- Redundancy through dedicated inputs & outputs (vs I^2C).

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