Architecture of educational OUFTI-1 nanosatellite of University of Liège, as tested in preparation for space flight

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We present an overview of the OUFTI-1 nanosatellite space segment. The OUFTI-1 project was initiated in September 2007. The nanosatellite is a one-unit (1U) CubeSat. Its main payload is - in essence - a D-STAR repeater in space, potentially the first one ever. D-STAR is an amateur-radio ("ham"), digital radio communication - protocol (with associated equipment) allowing the simultaneous transmission of voice and data, such as GPS coordinates and call-signs.

The satellite's electronics mainly consists in five boards: electrical power supply (EPS); main radio-communication system (COM); main, homemade on-board computer (OBC); backup, commercial, off-the-shelf OBC with flight history (from Pumpkin); (emergency) beacon (BCN).

The complete COM subsystem provides three capabilities: D-STAR voice and data communications, AX.25 telecommand and telemetry (TC/TM), and on-off-keying (OOK) (emergency) beacon transmissions. The satellite simultaneously receives and decodes potential D-STAR and AX.25 communications, but transmits in only one of these modes at any one time. To make the beacon maximally reliable, we implemented it as two parallel chains that operate in alternation, each sending 12 vital parameters to the ground, four (4) of which are common.

The OBC manages the different subsystems and ensures the communication between them. To avoid losing the satellite in case of failure of the OBC, we use two redundant OBCs. One OBC was designed by students and is intended to handle the satellite throughout its mission. The other OBC was made by Pumpkin and is intended to take over if the homemade OBC fails.

The main functionalities of the EPS are to: collect energy from the solar cells; store it in batteries; dissipate excessive power; protect the batteries in voltage and temperature; provide currents to the thermal cutters used for antenna deployment; provide the required currents at appropriate voltages to the client subsystems; protect the switching converters and clients (mainly COM, pair of OBCs, and analog-to-digital converters); acquire several measurements (voltages, currents, and temperatures); and allow monitoring and recharging of the batteries on the ground. The EPS also includes the remove-before-flight switch and the deployment switch.

The satellite was tested within the ESA's Education Office *Fly Your Satellite! (FYS)* project, and is now fully qualified and ready for launch and operation in space.

After a brief review of the educational aim of the OUFTI-1 project, we will describe the current architecture of the satellite (space segment) and the long series of decisions that led to this final design.

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