

Internship / Thesis Proposal – 4 to 6 months

Title:

Development of IonSat Interfaces and Electrical Architecture

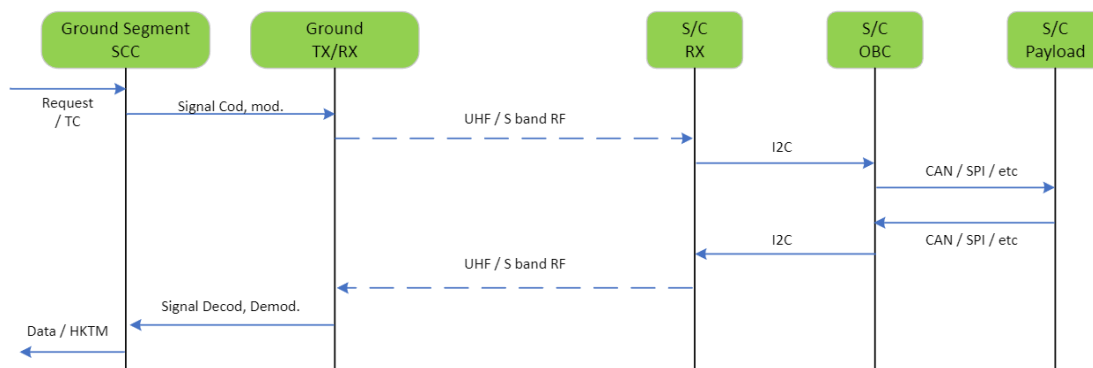
Context of the internship

The Centre Spatial de l'École polytechnique (Space center of École polytechnique, CSEP), created in 2010, proposes and supervises space projects for École polytechnique students. It is at the origin of one of the first French student nanosatellites, X-CubeSat, launched into orbit in 2017. The CSEP brings together and coordinates, through its projects, students, teacher-researchers, industrialists and French and European space agencies. It is financially and operationally supported by the education patronage program *Espace, science et défis du Spatial* (Space, Science and Challenges), led by Professor Pascal Chabert.

IonSat is a 6U nanosatellite project equipped with an electric propulsion engine, dedicated to demonstrating the feasibility of nanosatellite missions in very low orbit (300km). It is at the frontier of space applications, with a strong educational vocation, the project is currently led by twenty students, supported by numerous space actors: industries (Thalès Alenia Space), agencies (CNES, Onera).

Internship description

The objective of this internship is to participate in the development of the IonSat electronic architecture and communication buses. The IonSat Platform receives commands from the ground via a RF link in two bands, then it is transmitted through the common bus to the main on-board computer (OBC) that will execute the command and request information to they payloads to send it back to the ground control.



Message Sequence Diagram

As most subsystems in the satellite are COTS from different providers, some work needs to be done to make each of them communicate with each other through the common interface, furthermore, the electrical interfaces, such as data bus or power lines from some boards need an interface board to make them

compatible with the rest of the subsystems. Since the CubeSat components come from different manufacturers, it is also necessary to ensure the electronic cards can “talk” with each other.

In concrete terms, the tasks will consist of designing, developing, integrating and validating the VHDL IPs required for the flight software and test equipment, developing the low layers of the drivers associated with the VHDL IPs, developing the application software layers specific to the mission and participating in the validation of the flight software. Particular attention will be paid to documentation, testing and validation.

The focus of this internship will consist of:

- Develop, implement and validation of electrical interfaces in the satellite.
- Design and build prototypes of interface boards to test IonSat functionalities and software implementation.
- Develop, implement and validate of the communications between the on-board computer (OBC) and the different sub-systems, implementing a communication protocol with the other cards with communication on a specific port.
- Ensure the sustainability of all the work for upcoming phases of the nanosatellite project.

Notions of software development and space systems engineering will prevail. The intern will work with one full time engineer of the CSEP, and can use the help of the space team of the Laboratory of Plasmas Physics, specialized in conception of space-ready magnetometers and on-board electronics. There are also frequent contacts with experts from the French aerospace agencies (CNES, ONERA) and companies (Thalès Alenia Space, ThrustMe) partners of the IonSat Project.

Technical Requirements

- M1 or M2 level in electrical/electronic engineering, software engineering, or related domains.
- Experience in C/C++ or FPGA (VHL) programming.
- Knowledge of communication buses (I2C, CAN, RS422, etc.).
- Knowledge of Xilinx design tools.
- Knowledge in CubeSat subsystems.
- Knowledge in UNIX like systems.
- Good English profficiency.

Behavioural Requirements

- Self Motivation and autonomy.
- Communication and teamwork.

Internship duration: between 4 and 6 months, from February 2023.

If you are interested, send your CV and a cover letter, clearly indicating your motivation and availability dates.

Contacts:

Ricardo Colpari colpari@lpp.polytechnique.fr