

# Internship / Thesis Proposal – 4 to 6 months

## Title:

### Development of IonSat Flight Software

## 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 on May 17, 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, and is positioned in the NewSpace philosophy. With a strong educational vocation, the project is currently led by twenty students, supported by numerous space actors: startup (ThrustMe), industries (Thalès Alenia Space), agencies (CNES, Onera).

## Internship description

The objective of this internship is to participate in the development of the IonSat Flight Software (FS). This software is responsible for managing all the IonSat satellite platform subsystems and contributes to guarantee the proper functioning of the associated payload.

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.

Notions of software development and space systems engineering will prevail. The mission will focus on:

- The development, implementation, and validation of main modes of the FS.
- The development, implementation, and validation of the communications between the on-board computer (OBC) and the different sub-systems, considering creating new mission partitions.
- Specify the data constraints, responsiveness with each component and functionality. Thus, precisely define the performance of the system (reactivity, throughput, data, etc.)
- Manage system errors and failures effectively with well-established scenarios and intelligent safety protocols.

The intern will work with two full time engineers 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 informatics and programming, electrical engineering, or related domains.
- Experience in C/C++ or FPGA (VHL) programming.
- Knowledge of communication buses (I2C, CAN, RS422, etc.)
- Knowledge in UNIX like systems,
- Knowledge of Xilinx design tools
- Good English level
- Knowledge in aerospace systems is a plus
- Experience on the Zynq target is a plus
- Experience on the XtratuM hypervisor is a big plus

## Behavioural Requirements

- Self Motivation and autonomy
- Communication and teamwork

**Internship duration:** between 4 and 6 months, from September 2022, only presential mode in Palaiseau, France. If you are interested, send your CV and a cover letter, clearly indicating your motivation and availability dates.

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