

# IGOSat Project

Internship Proposal - Spring 2020

## Flight Software Engineering for IGOSat: Attitude Control System

**Skills, Keywords** : space engineering, space mechanics, instrumentation, C programming language, Matlab Simulink, debugging, software engineering, system programming and testing, AVR micro controller, communication protocols

**Desired Level:** 4th year, master degree, programming experience **Duration** : 4 to 6 months **Stipend** : > 500 € / month

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### Project Description :

The Laboratory of Excellence (LabEx) UnivEarthS, set up by laboratories AIM (Astrophysique et Interactions Multi-Echelles), APC (AstroParticule et Cosmologie) and IPGP (Institut de Physique du Globe de Paris) from Paris Diderot University, is carrying carrying transverse projects between those 3 laboratories.

Using the strong involvement of those laboratories in numerous space experiments and instrumentation, an educational nanosatellite project has begun in 2013, with the financial and technical support from CNES (Centre National d'Etudes Spatiales) and the Space Campus of Paris Diderot University.

More specifically, the project is to develop a scientific 3U CubeSat, and launch it in 2021. The satellite will carry 2 payloads, one to study the Ionosphere and one to study the radiation belt.

### Internship Description :

The Attitude Control System is composed of the magnetorquer, magnetometers, a reaction wheel and an embedded software. The purpose of the internship is to work on the integration of the different parts of the system and to develop the ACS flight software to be embedded in the satellite, generated from an existing Matlab/Simulink simulation.

The AOCS software is embedded in its own microcontroller. This requires to develop two main parts: The first consists to use the internal components (timers, PWM, SPI, I2C, etc.) to implement all low level functionalities needed. For example, to command the magnetorquers or communicate with the On-Board Computer. The second part consists to implement the control loop. To do so, we start from a Matlab Simulink simulation to generate a C code and then integrate it within the micro controller. The development will be done with a Linux toolchain, knowledge about Linux will be a plus but not necessary.

It is good to note that we use several tools to generate the desired software, therefore feeling comfortable with new tools quickly is a real plus!

When the software is generated, embedded in the microcontroller and tested, we will perform tests on the whole ACS bench and ensure its good functionality.

Within a team of students, engineers and scientists, the student need to be able to work autonomously as well as part of a team, have a sense of rigor especially in writing presentation, and already a global vision of information transmission.

This internship is a good opportunity to address numerous points of space engineering.

**Website:** <http://www.igosat.fr>