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European Regional Development Fund

Research and innovation

Conception of a center of gravity test bench for CubeSat

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NANOSTAR consortium

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APPLICABLE AND REFERENCE DOCUMENTS

[RD1] CubeSat Design Specification (CDS) Rev 9

TABLE 1: Change log record table

Edition/Revision	Date	Description of the change
V0.0.1	15/01/2019	Initial version of the document

INTRODUCTION

The development of a CubeSat is composed of several phases. One of them consists in conducting numerous ambient tests on engineering models as the mechanical or electronic tests.

One of them is the center of gravity test. It consists in measuring the location of the center of gravity of the full integrated CubeSat. The test is considered as successful if the criteria given by the CDS (CubeSat Design Specification) standard [RD1] is respected. This criteria depends on the size of the CubeSat (1U, 2U, 3U…).

The test requires a test bench which shall provide accurate measures and allow to minimize manipulations of the CubeSat.
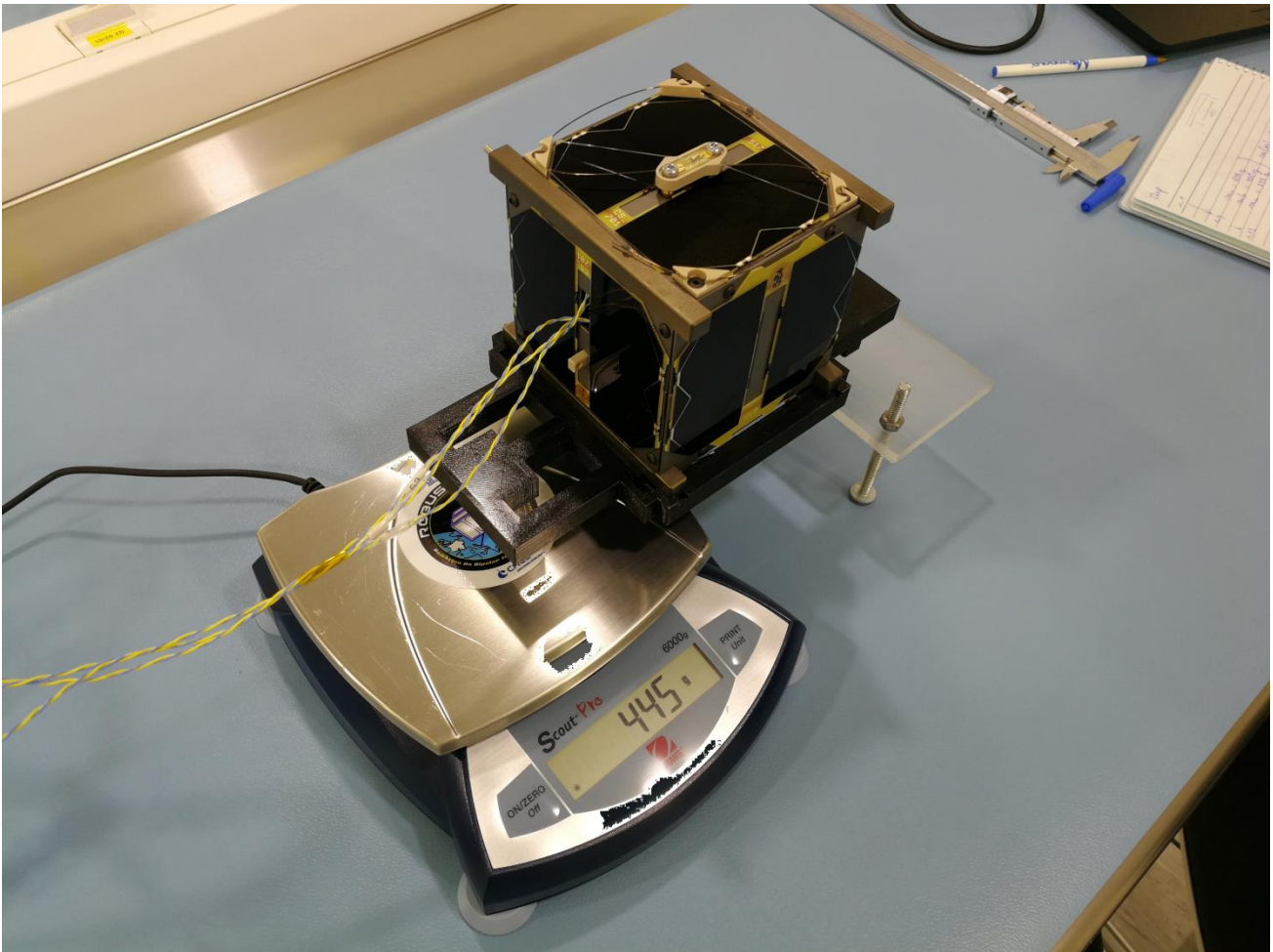

FIGURE 1: CSUM' ROBUSTA 1C MTCUBE DURING CENTER OF GRAVITY TEST

STATE-OF-THE-ART

This challenge gives students of the NANOSTAR program an overview of the AIT engineer work in satellite engineering. It also gives an experience in development of nanosatellite's ground support equipment. It is proposed by the University Space Center of Montpellier (CSUM).

CENTRE SPATIAL UNIVERSITAIRE DE MONTPELLIER

CSUM is an educational platform of Montpellier University for Science and Technology through nanosatellite engineering.

In France, the CSUM is one of the leaders in the development of student nanosatellites. It is also a European center of reference devoted to bring together equipment and skills for the development, production, testing and operation of nanosatellites. These projects involve student interns and encourage regional economic development.

To do this, the CSUM has facilities and equipment dedicated to nanosatellite engineering:

- A control center including a transceiver radio station and antennas in UHF and S-Band;
- A dedicated CIC room (concurrent engineering center);
- AIT facilities (Assembly, Integration and Testing) including a clean room and multiple workshops;

The CSUM develops its own nanosatellite technology producing 1U and 3U CubeSats.

SPECIFIC CHALLENGE OBJECTIVES

The challenge is divided in different objectives:

- Establish a bibliographic study about the requirements given by the CubeSat Design Specification in the aim to determinate the test success criteria.
- Study the theory of the center of gravity measure and propose a mathematical solution.
- Conceive a center of gravity test bench compatible with 1U, 2U and 3U CubeSats.
- Design the test bench with a CAD software.
- Perform simulation analyses of the test bench with a Finite Element Analysis software.
- Write the associated step by step procedure to conduct the test.
- Manufacture the test bench with a 3D printer after choosing the appropriate material.
- Conduct the test on a 1U CubeSat model and write an AS RUN of the step by step procedure.

Duration of the challenge: 5 months

Deliverables: A report, in English, describing the activities carried out, the original goals and the achieved ones, with the NanoStar Template and a presentation of the challenge.

Composition of the team: One or more students from the Universities of the NanoStar project. If possible as much women as men and from different countries.

Rewards: A diploma of participation, a visit and goodies from the University Space Center of Montpellier (CSUM), the University of Montpellier (UM) and NanoStar project and others rewards for the most innovative team.

If you are interested in this challenge, contact us at nanostar-projet@umontpellier.fr or on the NanoStar website.