Interreg Sudoe

EUROPEAN UNION

NANOSTAR

European Regional Development Fund

Research and innovation

Design of a nanosatellite grounding architecture

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www.interreg-sudoe.eu

http://nanostarproject.eu

NANOSTAR consortium

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APPLICABLE AND REFERENCE DOCUMENTS

List of all references used or mentioned in the main text, and may include a list of the acronyms used in the report. A change record table, like the one reported below, should be added in this section.

TABLE 1: Change log record table

Edition/Revision	Date	Description of the change
V0.0.1	18/12/2019	Initial version of the document

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INTRODUCTION

On Earth, electrical grounding is usually considered a trivial matter, as the Earth itself is used as a reference potential. In space, it's another matter entirely, for obvious – and arguably some far less obvious – reasons!

The satellite's mechanical structure may be used as a reference point, but many considerations have to be taken into account as soon as the design stage. The objective of this challenge is to study, design, and justify a grounding architecture for a generic nanosatellite.

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STATE-OF-THE-ART

This challenge gives students of the NANOSTAR programme a better understanding of grounding related issues and how to implement good practices in a complex system. 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.

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SPECIFIC CHALLENGE OBJECTIVES

The challenge is divided in 5 different objectives:

- OBJ1: Establish a bibliographic study of grounding architectures of Big satellites (>2t) VS "Medium" satellites (>200kg) VS "Small" satellites (<200kg), in order to establish general satellite grounding good practices. Identify the standard proposed schematic concepts. This work shall include definitions of used terms and concepts (grounding, ground plane, chassis, reference…). The study could then be extended to the cases of CubeSats and nanosatellites when documentation is available.

- OBJ2: Apply this study to a specific case of a generic nanosatellite (<20kg), comprised of the following subsystems: OBDH, EPS, TT&C, ADCS, Payload. The TT&C and Payload are fitted with uplink and downlink RF, which needs to be taken into account in the design. The objective is to propose and justify a grounding architecture for this nanosatellite, taking into account the rules and good practices found in OBJ1.

- OBJ3: Realize a complete trade off of grounding architectures summarizing assets, drawbacks, risks, and constraints for implementing these architectures.

- To go further, more specific cases may be studied for nanosatellite missions' analysis and design. One or several of these effects may be looked into:

    - BON1: The potential effects on satellite grounding of surrounding plasmas in orbit (LEO, MEO, GEO, or even further)
    - BON2: The impact of incoming new technologies for small spacecrafts, such as ionic or plasma propulsion thrusters
    - BON3: Base on work of OBJ2, propose a mechanical/electrical design using an isolated structure made out of hard anodized aluminium.

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 a lot of 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.

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