Call for Proposals

The IEEE Geoscience and Remote Sensing Society (GRSS) is announcing the **2nd GRSS Student Grand Challenge** which will allow student teams to develop Earth Observation payloads for a small satellite. The winning payloads will be considered for integration into a CubeSat that will be developed at the National Space Science and Technology Center (NSSTC), Al Ain, United Arab Emirates (UAE) in collaboration with the YahSat Space Lab at Khalifa University, Abu Dhabi, UAE.

CubeSats are cube-shaped spacecraft (satellites) that are sized in units or U's, where a unit U is defined as a volume of about 10 cm x 10 cm x 10 cm and a typical weight of less than 1.33 kg. CubeSats have been utilized in numerous science investigation missions to study the Earth's land, atmosphere and oceans and other missions that explored near Earth objects, space weather and biological sciences as well.

Objectives of the Competition

The **2nd GRSS Student Grand Challenge** targets university students and young professionals. The challenge provides the opportunity for students interested in the relevant fields of engineering to develop Earth Observation technology applications and experiments. The goal is to foster creativity, collaboration, and critical thinking among young innovators bridging the application of technology and the unique environment of space for the advancement of engineering research and development.

The Competition

The competition starts with the submission of a proposal to design payload/experiment(s) that can solve real-life space exploration problems such as **collecting data on the global climate, environmental change and natural hazards.**

Winning teams will receive grant funding during **two years** that will be used to develop the proposed payload idea. Teams willing to participate must send a brief description of their mission concept (< 10 pages), indicating:

- Team: composition, background and expertise, motivation, and signed commitment letter during the duration of the project,
- Scientific rationale and feasibility of the proposed observations: innovative techniques (ways to conduct the measurement) and technologies are welcome,
- Development plan including characterization and testing,
- Budget proposal: budget can be higher, but GRSS request must be **less than US$15000/year for up to two years**). Budget must include the travel expenses for –at least- the environmental test campaign, the integration and test in UAE, and the presentation at a special session on Small Satellites at IGARSS 2022. A travel grant of USD 1000 will be provided to each of the winning teams to present the winning ideas at the Young Professionals in Space workshop during 4-6 November, 2019 in Dubai, UAE.
- If the proposing team is not yet part of an already established GRSS Student Chapter, it is important that commitment to form a new Chapter by the end of 2019 be included in the

proposal. Team including multiple Sections are welcome and encouraged. In this case the requirement to form a chapter in each Section applies, if there is none.

Proposals should be sent to Dr. Prashanth Marpu <prashanthmarpu@ieee.org> and Dr. Adriano Camps <camps@tsc.upc.edu> before September 30, 2019

The number of selected teams will depend on the scientific and technical quality of the proposals, and the accommodation requirements as well. It is expected to fund 2 teams, possibly 3, but the total GRSS contribution will not exceed US$30000/year.

Intellectual Property Terms

For purposes of this competition, the term Intellectual Property shall mean patented and unpatented inventions, mask works, copyrighted works, trade secrets, know-how and Proprietary Information.

1. The winning party shall retain full ownership in all Intellectual Properties that are generated or acquired by such Party prior to or independently of this grant (Background IP).
2. Should Intellectual Property be generated by the winning team in utilizing the grant (Foreground IP), then the ownership, use and exploitation of the Intellectual Property generated will also be owned by the winning team.

Technical Details and Specifications of the CubeSat

The payload is expected to be part of a 3U CubeSat, so the proposing teams should keep in mind the volume, mass and power restrictions in such a platform. Communications from the CubeSat to the Ground Station will be primarily UHF receive and transmit; S band receive capability can be explored for missions demanding higher data rates.

The payload is expected to be integrated with a standard 3U CubeSat configuration. This platform will be equipped with the following subsystems:

1. Attitude Determination and Control System (ADCS)
2. Communication System (COM)
3. Electrical Power System (EPS)
4. On-Board Computer (OBC)

A tentative schedule for the fully satellite development integrating the payload development and integration is as follows:

- **July, 2019**: Launch of the Competition
- **September 30, 2019**: Applications deadline
- **October 15, 2019**: Announcement of Winners
- **November 4-6, 2019**: Mission Concept Review and Presentation of winning ideas at IEEE Young Professionals in Space Workshop in Dubai, UAE.
- **July, 2020**: Preliminary Design Review and Payload Breadboard Model Demonstration
- **December, 2020:** Critical Design Review and Payload Qualification Review including verification of interfaces between the satellite bus and the payload.
- **July, 2021**: Flight Model Readiness Review
- **October, 2021**: Pre-shipment Review
- **December, 2021** – **March, 2022**: Launch

A detailed environmental testing requirements document for the payloads will be provided in due course once the satellite launch contract is finalized. However, the QB50 System requirements document provides a good baseline for the preliminary design of the payloads.

https://www.qb50.eu/index.php/tech-docs/category/QB50_system_requirements_issue_606e0.pdf

In general, COTS components will be utilized for the spacecraft bus, but GRSS is currently exploring to engage other IEEE Societies and their student chapters for the development of some of the subsystems in close collaboration with the payload teams and the integration team in the UAE.

Integration will be performed in the UAE at the National Space Science and Technology Center (NSSTC). Environmental tests (vibrations and thermal-vacuum cycling) of the payload can be performed anywhere, but the full spacecraft will be integrated and tested in the UAE. In addition, the testing facilities at the Universitat Politècnica de Catalunya (UPC) NanoSat Lab (https://nanosatlab.upc.edu/en/facilities) in Barcelona, Spain are also offered free-of-charge during one week to the winning teams.

The general information on CubeSat Design Specification and other details can be found at the following link http://www.cubesat.org/resources/

Evaluation

Proposals will be evaluated by a panel of academic, commercial, and government experts in space technology. Criteria for judging will include:

1. Innovation
2. Feasibility of development within two years
3. Relevance to the GRSS
4. Technical feasibility
5. Budget
6. Presentation
7. Team's Management plan for the payload development

Tentative Milestones and Payment Plan				
Title	**Description**	**Milestone**	**Date**	**Payment**
Payload Definition	Detailed description of the payload to be delivered	KO	15-Oct-2019	20%
Mission Concept Review	Definition of the in-orbit scientific campaign, system requirements, preliminary Payload interface control document, mechanical design	M1 - MCR	5-Nov-2019	20%
Preliminary Design Review	Payload Breadboard Model Demonstration and Concept of Operations (ConOps) of the Payload	M2 - PDR	15-July-2020 @ IGARSS 2020	20%
Critical Design Review	Complete Payload demonstration including functional and environmental testing of the payload	M3 - CDR	15-Dec-2020	20%
Payload Integration	Verification of the payload interface with the bus	M4	1-Mar-2021	20%
Flight Model Readiness Review	Full verification of the spacecraft	M5 - FMRR	15-July-2021 @IGARSS 2021	
Pre-shipment Review	Final verification before shipment. Acceptance Testing. Post-launch operations	M6 - PSR	1-Oct-2021	
Launch	Satellite Launch	M7	Dec, 2021 - Mar, 2022	
Satellite Operations Review	In-orbit demonstration data and analysis	M8	July, 2022 @IGARSS 2022	

Documents Definitions:

System and Mission Requirement Document	Document to verify that the system is well specified and able perform the work, including any performance	KO version 1, M1 final version
Environmental Design Specification (EDS)	Document to verify that the system is able to support the environment and perform the work	M1 version 1, M2 final version
Space Debris Mitigation Document	Document mandatory as part of the call	M2 final version
Product Assurance Plan (PAP)	Document to guarantee the PA and safety necessary to implement the work	M1 version 1, M2 version 2, M3 final version
COTS User Manuals	To verify that the use of COTS is compatible with the mission objectives	M1 version 1, M2 version 2, M3 final version
System Development Plan	Document to verify that all the activities to be performed are well planned in advanced.	M1 version 1, M2 final version
Platform-Payload Interface Control Documents (ICDs)	Document to verify interfaces between platform and payload	M1 version 1, M2 final version
Declared Lists for parts, materials and processes (DLs)	Document to guarantee that the list of the parts and materials to be used and compliant with quality and safety regulation	M1 version 1, M2 final version
Safety Data Package	Necessary for the authorization of any launch	M1 version 1, M2 final version
System Verification Control Matrix	Document for the acceptance of any hardware and software	M2 version 1, M3 final version
Test Procedures	Document defining any test procedure of any hardware and software	M2 version 1, M3 final version
Test Reports	Document to verify the results of the test for any hardware and software	M2 Unit functional testing, M3 Unit acceptance testing, M4 Interface Testing, M5 Flight acceptance testing
Integration Logbook	Document to verify the correct implementation of space and ground hardware	M3 version 1, M4 version 2, M5 final version
In-flight data		M8