Introduction

The **Van Allen Foundation,** a partnership foundation of the University of Montpellier, supports the Montpellier University Space Center, where students are trained in space jobs through the development of nanosatellites as part of projects and internships.

Through this Call for ideas, the Foundation intends to feed a reservoir of innovative projects, offering engineers and students of the Space Center a source of inspiration, and at the same time, allowing the establishment of partnerships with research laboratories and organizations, to which it will bring its ability to gather funding that has already enabled the construction and launch of several nanosatellites since 2012.

The **IEEE (Institute of Electrical and Electronics Engineers) Geoscience and Remote Sensing Society** is an international professional society that seeks to engage students and young professionals in contributing to the solution of complex engineering problems within the scope of this call. The IEEE GRSS has in the past sponsored two previous "Student Grand Challenges" related to remote sensing based on drones or Remotely Piloted Aircraft Systems, and nanosatellites.

The two organizations have agreed to join forces in publishing the present Call for ideas. While the Van Allen Foundation is addressing the wide community of scientists, engineers and students, the GRSS is focusing its cosponsoring participation in this Call on students and young professionals, as described below.

Scope of the Call

The van Allen Foundation and GRSS invites public and private organizations to propose ideas and suggestions aimed at addressing the issue of **detection and tracking marine pollution and litter** in the western part of the Mediterranean Sea, including the Gulf of Lion, the Ligurian Sea and the Balearic Sea, by the combination of various techniques, such as spectral signatures, artificial intelligence, in situ data, merged datasets from existing satellite platforms, etc.
While direct detection remains problematic, space techniques are likely to provide a significant contribution, making it possible to increase current capacities, mainly to improve spatial-temporal monitoring of the Western Mediterranean and amplify reactivity (in the event of more intense pollution, following a flood or extreme events). Although the Western Mediterranean is the focus of this activity, application of techniques developed herein for worldwide monitoring of marine pollution will also be considered as a valuable contribution.
An effective solution could exploit the combination of *in situ* monitoring by boats and by marine or aerial drones, modeling, and observations complementary to operational systems (primarily Copernicus satellites), integrating or augmenting the current AIS (Ship Tracking) system. *In situ* surveillance could potentially be piloted from space. The models would either be based on past experiments or purely digital. Such a system would bring into play a dedicated fleet of nanosatellites and could involve local actors to deploy *in situ* solutions.

Although the emphasis is on the contribution of space techniques, the call for ideas is thus open to studies of numerical simulation, physics of measurement, measurements in the laboratory or at sea, and the application of artificial intelligence for the recognition of polluted pixels, or the carrying of sensors of opportunity, etc.
In all cases, ideas will need to use the capabilities offered by nanosatellites, whether for data collection or direct observation.

Potential respondents

The present Call for ideas is aimed at two categories of respondents:

- The Call for ideas of the Van Allen Foundation is addressed to scientists and engineers, as well as to students, working in public or private laboratories or entities in France and worldwide.

- GRSS Student Chapters worldwide are also encouraged to respond, new student chapters may be formed after submission. This proposal is for a one-and-a-half-year project intended to engage students and young professionals in solving a complex engineering problem within the scope of GRSS and other sister societies (e.g., Aerospace and Electronic Systems, Antenna Propagation, Ocean Engineering, Computer, Microwave Theory and Techniques). Student chapters DO NOT have to be formed at the time of submitting the proposal, but if selected, they commit to form it before the end of the current year. For more detail, visit https://www.grss-ieee.org/community/groups-initiatives/community-groups-initiatives-van-allen-foundation-ieee-grss/.

Applying to the Call and selection process

The selection will be made in two stages:

- As a first step, applicants are invited to complete a preliminary two-page form, accessible at https://fondationvanallen.edu.umontpellier.fr/files/2021/03/Applicationform.pdf.
  If necessary, at this stage, an interaction with the proposers may take place for clarification purposes. The preliminary applications will then be evaluated by the Scientific Committee of the Van Allen Foundation, drawing on the technical expertise of the University Space Center of Montpellier and GRSS. This assessment will permit the pre-selection of a limited number of projects.

- Secondly, the candidates of the preselected projects will be invited to provide a more complete proposal, based on a template that will be sent to them. The full proposals shall include a scientific and technical description of the envisaged solution, the type of data produced or used and the means available or to be acquired, as well as the biographical and administrative elements allowing the experience of the proposers to be assessed. They should specify the duration of the study or experiment to be carried out, the additional budget required and any resulting constraints to abide to.

Perspectives

The selected projects may be the subject of studies and developments, the funding of which will be submitted to the members of the Van Allen Foundation and GRSS. A budget is already set aside to finance phase 0 studies, for example by hosting or sponsoring interns or post-docs. Results could be presented at scientific conferences and congresses and a dedicated session at a future GRSS-sponsored International Geoscience and Remote Sensing Symposium (IGARSS) will be planned. In the longer term, depending on the results obtained in phase 0, the Foundation plans to do everything possible to achieve and launch selected projects.

Deadline for proposals

Applications must reach the Van Allen Foundation Secretariat **before April 30, 2021**.
Postal address: Bât. 5-IES, 860 rue St Priest, CC 06 002, 34095 Montpellier cedex 5, France.
Email: fondationvanallen@umontpellier.fr

Confidentiality

The van Allen Foundation is committed to put in place all the necessary measures to strictly respect the confidentiality of all information communicated to them in the framework of this call for ideas.

Useful references

The issue of detection and monitoring of marine waste and pollution is a highly active area of research and development. Thus, in 2019, the European Space Agency (ESA) launched a "*call for innovative ideas on ways to accomplish the currently impossible task of detecting and tracking marine plastic litter from space*".
Twenty-six ideas dealing with this subject were retained by ESA within the framework of the OSIP program (Open Space Innovation Platform, https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/A_step_forward_in_detecting_plastic_marine_litter_from_space).
Several articles have been published in the scientific literature where such ideas are tested.

The following articles or websites can also be consulted:

UNEP, Marine Litter: A Global Challenge, April 2009 (https://wedocs.unep.org/bitstream/handle/20.500.11822/7787/-Marine%20Litter_%20A%20Global%20Challenge%20(2009)-2009845.pdf?sequence=3&amp%3BisAllowed=)

UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter (http://wedocs.unep.org/xmlui/handle/20.500.11822/13604)

Plastic waste inputs from land into the ocean, by Jenna R. Jambeck, Roland Geyer, Chris Wilcox, Theodore R. Siegler, Miriam Perryman, Anthony Andrady, Ramani Narayan, Kara Lavender Law, *Science* 13 Feb 2015: 768-771 DOI: 10.1126/science.1260352 (https://jambeck.engr.uga.edu/landplasticinput)

Optical Methods for Marine Litter Detection (OPTIMAL) – Final Report (https://zenodo.org/record/3748797#.X8Fv_y2ZPUL)

International Coastal Cleanup (https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/)