



## The CRIAQ 2023 Space Challenge: Space debris and sustainable development of space



### The space challenge in brief

CRIAQ's Space Challenge is aimed at Quebec's university student communities and aims to address a growing issue in the space industry, namely space traffic management and space debris mitigation. How can we reconcile technology, economic growth, and the environment to promote sustainable development in space?

Teams of two (2) students or graduates are invited to submit their application including a preliminary analysis of the issue and a proposed work plan. CRIAQ and its partners will consider the issue from different angles: technological, economic, regulatory, etc. The proposals will be evaluated by a committee formed by CRIAQ and including experts in the field.

The winning team will be directly involved in the issue by carrying out an in-depth, paid mission on the subject at CRIAQ in the summer of 2023. Exchanges and workshops are planned with key players such as the **Canadian Space Agency**, the firm **Euroconsult**, and the Quebec companies **NorthStar Earth & Space** and **GHGSAT**. The students will be supervised to carry out this study which will be made public at the end of the mandate.

#### Key dates:

- Opening of the challenge: February 14<sup>th</sup>, 2023
- Closing: March 26<sup>th</sup>, 2023
- Selection of 5 candidates and invitation to present their team and approach for the study: March 27<sup>th</sup>, 2023.
- Flash presentations by selected teams: April 3<sup>rd</sup>, 2023
- Announcement of the winning team: 5 April 2023
- Duration of the Paid Mandate: 12 weeks, May to August 2023

This Application Guide outlines the guidelines and procedures for the Space Challenge.

Note: In this document, the masculine gender is used indiscriminately and solely for the sake of brevity.

## Introduction

Since its creation in 2002, the main mission of the Consortium of Research and Innovation in Aerospace in Quebec, CRIAQ, has been to increase the competitiveness of the aerospace industry by stimulating business innovation through collaborative R&D and by actively participating in the training of the next generation of aerospace professionals through concrete projects. The dozens of projects completed and underway have all allowed Quebec students to work directly on the aerospace industry's key issues.

In 2023, CRIAQ launches the first Space Challenge for the Quebec student community during its flagship event, the RDV Forum (February 14 and 15, 2023), <https://rdvforum2023.criq.aero/>.

The Space Challenge calls on the new generation to contribute to the reflection on the sustainable development of space, particularly the management of space traffic and the mitigation of space debris. Teams of two (2) students or graduates are invited to submit possible solutions and a work plan to analyze this issue from different angles (technological, economic, regulatory).

## Theme of the challenge

The exponential increase in space debris and traffic in space is currently posing significant challenges to space operations and governance. Space nations are calling for an end to tests to destroy obsolete satellites in orbit. An announcement came after Russia blew up a satellite at the end of its life in 2021, creating a massive debris field threatening ISS astronauts and other satellites <sup>1</sup>.

In the future, if the international community fails to take concrete action in the short term, the debris problem will worsen, and the booming economic development of space will be jeopardized. Every year, there are dozens of near collisions between active satellites and collisions involving debris of varying sizes. The more satellites in Earth's orbit, the more likely it is that a collision will occur. The more collisions there are, the more debris there is - all of which feeds into what some fear will become a destructive cycle (Kessler syndrome).

The number of active satellites has grown from about 1,400 in 2015 to nearly 5,500 in 2022, and many experts expect exponential growth to more than 58,000 satellites in space by the end of the decade.<sup>2</sup>

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<sup>1</sup> Washington Post (2022). U.S. calls for an end to destructive satellite tests in space <https://www.washingtonpost.com/technology/2022/04/19/satellite-debris-orbit-kamala-harris/>

<sup>2</sup> US Government Accountability Office (2022). Large Constellations of Satellites: Mitigating Environmental and Other Effects. <https://www.gao.gov/products/gao-22-105166>

Various ground and satellite systems, and private companies such as NORTHSTAR Sky & Earth<sup>3</sup> track tens of thousands of pieces of space debris, including operational and non-operational satellites and unknown objects, but there are many more pieces too small to see. NASA estimates that there are about 500,000 objects between 1 and 10 centimeters in diameter orbiting the Earth, and that there are more than 100 million particles larger than 1 millimeter. (The agency said that as of January of last year, the amount of material in orbit was more than 9,000 metric tons).<sup>4</sup>

Through the Space Challenge, CRIAQ wishes to raise the awareness of the ecosystem to this growing issue and to support a student team to work on the problem to allow the sustainable development of space.

Here are some examples of potential areas of work for the challenge (not exhaustive and for illustrative purposes):

- The urgency to act: what is the state of the space environment and how can it be stabilized to promote the sustainable development of space by 2030? What would be the consequences of inaction?
- New technologies, New Space companies and new business models as vectors of solutions.
- The role of Canada, governments and industry in international negotiations and commitments on the use of space.
- Multidisciplinary approach, addressing the issue of sustainable development of space at the technological, economic, environmental, and political levels.

## Why participate?

The CRIAQ Space Challenge is **paid mandate for 12 weeks**: a golden opportunity for students interested in the aerospace industry, in particular, for space development issues.

The participants of the winning team will have the chance to work on a paid mandate at CRIAQ during the summer of 2023. The objective of the mandate will be to carry out an in-depth study on the theme according to the work plan proposed in their application file.

The selected students will meet with various experts in the field to learn more about the realities of the industry, refine their understanding of the issue and test ideas for potential solutions. At the end of the mission, CRIAQ will publicly disseminate the study to promote the importance of this issue within the industry and to stimulate the emergence of new ideas and solutions. This is a great opportunity for students in the development of their careers.

The final terms and content of the study will be discussed with CRIAQ and its partners in April 2023, after the selection of the winning team.

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<sup>3</sup> Spacenews (2022). Defense, Commerce Departments select companies to prototype space traffic management solutions <https://spacenews.com/defense-commerce-departments-select-companies-to-prototype-space-traffic-management-solutions/>

<sup>4</sup> Washington Post (2023). Space Dodgers. <https://www.washingtonpost.com/technology/interactive/2023/space-debris-game/>

## To whom is the challenge for?

- Eligible candidates:
  - Students from Quebec universities at all levels (Bachelor's, Master's, Doctorate, Post-Doctorate) looking for a challenging work for Summer 2023.
  - Graduates of a Quebec university who have graduated less than a year ago.
- Tams must be composed of 2 people (preferably from multidisciplinary and complementary backgrounds)

## How to submit a proposal?

Students are invited to form teams of 2 students or graduates to prepare their application file which must take the form of a proposal to CRIAQ.

**If students have difficulty finding a teammate, we invite them to fill the following form : [CRIAQ - Student Challenge : Space Challenge \(office.com\)](#).** This form will help us pair you with another student interested in applying.

The main objective of the participants is to summarize their understanding of the problem and to think of a concrete work plan that can be executed over a 12-week period and that they will be able to execute themselves. The submitted proposal should contribute to the thinking on the issue of sustainable development of space and space debris.

Challenge participants are encouraged to be original in submitting a proposal, but their proposal should contain at least the following sections:

### **PART 1 – Team profile**

- Academic profile
- Interest in the theme and the space industry
- Relevant experiences

### **PART 2 – Summary of the problematic**

- Brief overview of the problematic
- Underlying issues: technical, legal, economic

### **PART 3 – Methodology and suggested approach**

- Methodology and tools
- Preliminary work plan
- Timeline

Since the best applications will be invited to make a short "flash" presentation to CRIAQ, it is recommended to prepare your application in the form of a presentation (PowerPoint, Google Slides, Canvas, etc.). You are asked to limit your proposal to 15 pages, in a reasonable font size (between 12 and 18 pts) and appropriate for this type of presentation.

**The application must then be sent to CRIAQ in PDF format at the following address:** [pierre.daligault@criaq.aero](mailto:pierre.daligault@criaq.aero)

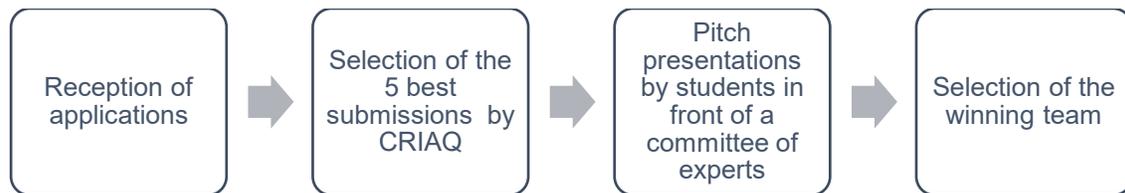
### List of documents to be attached.

- Teams' proposal (.PDF)
- Team CV's (.PDF)

### Timeline

Date	Item
February 14 <sup>th</sup> , 2023	Launch of the Space Challenge 2023 at the CRIAQ RDV Forum
Mach 26 <sup>th</sup> , 2023	Application deadline
March 27 <sup>th</sup> , 2023	Evaluation of files and invitation to submit to CRIAQ
April 3 <sup>rd</sup> , 2023	Presentation of the selected teams and final evaluation
May 2023	Beginning of the work mandate at CRIAQ for the winning team
August 2023	End of the course and final presentation of the study

### Evaluation process and criteria



The evaluation criteria considered for the evaluation of submissions are as follows:

Criteria	Dimensions
Understanding of the theme (35%)	Clarity and completeness in describing issues
	Relevance of the points raised as priorities
Quality of the team (35%)	Experience of students
	Complementary profiles (multi-university, multi-department)
	Maturity of existing connection, collaboration, and exchange links
Methodology and work plan (15%)	Quality of the proposed approach
	Feasibility in the given time frame
	Creativity or novelty in exploring the challenge
Presentation (15%)	Quality of the visual support
	Quality and ease of oral presentation

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