

Call for participation: An OECD project on the value and sustainability of space-based infrastructure

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Background

The [OECD Space Forum](#) assists governments, space-related agencies and the private sector in better identifying the statistical contours of the growing space sector worldwide, while investigating the economic significance of space infrastructure and its role in innovation for the larger economy.

In this original project, the OECD Space Forum invites **students in universities and other research organisations** to examine the value and sustainability of space-based infrastructure. Individuals or teams of several students may participate. This is a ground-breaking initiative, bringing together academics and students from universities across the world to develop and present solutions to the same initial statements of work. Two topics are proposed (see the statements of work in the next pages), and students may focus on one or both:

1. The valuation of tangible and intangible space infrastructure (e.g. specific segments of the infrastructure such as earth observation, satellite telecommunications, human spaceflight infrastructure)
2. The valuation of the impacts of space debris incidents (i.e. the economics of space debris), including impacts on society (e.g. denial of service) and specific users (e.g. operators themselves, government users).

Who can participate?

The project aims to involve students and academic staff in engineering, ICT, and economics, at Master, PhD or post-doc levels. Participants can participate individually or they can establish multi-disciplinary teams in researching and responding to the statements of work.

Why participate in this international project?

The incentives for participating in this international exercise are many-fold for the academic community and the students:

- This is a first-ever international project on the economics of space infrastructure, gathering academics and students from diverse universities and research organisations to develop and present their solutions based on the same initial statements of work;
- Experts from up to 11 different space agencies around the world, other invited stakeholders and the OECD Space Forum Secretariat will peer review the proposed resulting papers;
- Participants will be able to present their preliminary findings at a dedicated OECD event in October 2021, assembling space agency representatives, peers from other academic institutions and other invited stakeholders;
- If accepted, the results of the papers will be featured in a OECD publication, and the best submissions may be published as joint OECD Science, Technology and Innovation Policy Papers, with the authors receiving a very large audience in the international science, technology and innovation community, far beyond the traditional space community.

What is the expected contribution?

This original project is based on the goodwill of participants and on the interest of the academic community and students to engage with the OECD and partnering space agencies.

Academic institutions and academics are kindly asked to select students who might be interested in participating in this exercise. This research activity can be part of and/or complement ongoing research (e.g. Master or PhD theses), conducted by students alone or as part of research projects with academics and post-doctoral researchers. Students in economics and/or engineering supported by experienced professors would be particularly welcome to participate individually, as well as small teams of students from multiple disciplines.

The main expected deliverables are:

- A draft paper presenting preliminary results (max. 10 000 words) authored by students with or without academic staff, to be delivered and sent to the OECD Space Forum Secretariat by 1 September 2021. The objective is to develop and present original perspectives. General findings are expected, but also new monetary valuation, supported in some cases by in-depth economic modelling (e.g. some students may wish to adapt some well-known environmental / economic models as part of their analysis).
- A presentation (one PowerPoint slide deck based on a template provided by the OECD Space Forum Secretariat) at a dedicated OECD Space Forum event that will take place in October 2021.
- A final version of the paper which will be edited according to comments from the OECD Space Forum Secretariat, space agencies and experts in the workshop.

What is the timeline?

- December 2020 – January 2021: Outreach and selection of interested universities and research organisations.
- Starting on 15 February 2021: Launch of activities. Zoom meetings will be organised with students to launch the project.
- 15 May 2021: Progress reviews - Participating students are invited to provide a brief progress report (up to 2 000 words) to the OECD Space Forum Secretariat. In case of potential issues and questions, participating teams will be able to contact the OECD Space Forum Secretariat at any time.
- 1 September 2021: Deadline for the delivery of draft papers and presentations of preliminary results (max. 10 000 words).
- October 2021: Presentation of preliminary results during an OECD Workshop on the Value and Sustainability of Space-Based Infrastructure, with key stakeholders from the space community and beyond.
- 30 November 2021: Final paper integrating comments from the OECD Secretariat, space agencies and participants in the workshop.

How to join?

If you have questions do not hesitate to contact the OECD Secretariat. To participate in this project, please get in touch by **3 February 2021**. Contact: spaceforum@oecd.org,

Statement of Work 1: The valuation of space-based infrastructure

Space-based infrastructure refers to the publicly and privately owned infrastructure developed for the exploration and utilisation of outer space, such as satellites, space stations, rovers and their associated ground equipment.

The space environment is increasingly international and diverse, mixing civil, military and commercial actors and interests, and is developing at a rapid pace. Some 3 000 operational satellites are now orbiting Earth, a third of which were launched in 2020 alone. In the last eight years, more countries registered their first satellite on orbit than in the first forty years of spaceflight.

A number of space applications are furthermore increasingly important for the functioning of society and the economy. Space infrastructures provide the best or only sources of data and signals for multiple areas of human activity, ranging from weather forecasting and sea navigation to the secure functioning of banking and electricity grids.

It is therefore important to take stock of the value represented by and derived from space-based infrastructure to better underpin future policy actions and decisions. However, this is a challenging task because of the many types of users and potentially contradictory interests involved, and because many of the benefits of space activities do not have an easily identifiable market value.

Project participants are asked to address the following research questions:

- Could you determine the capital stock (e.g. accumulation of equipment and structures available to produce goods and services) of space-based infrastructure, relative to other infrastructures (e.g. roads, energy)? Detail what you define as “space-based infrastructure” in your analysis (including public and/or private infrastructure, ground and space-based components, etc.), and describe the methodologies and data sources used to estimate their value. The analysis may concentrate on selected segments of infrastructure (such as earth observation, satellite telecommunications, human spaceflight infrastructure), or on all space-based infrastructure.
- Building on the assessed capital stock, how would you measure the socio-economic value derived from the selected space-based infrastructure?
- Based on the answers to the two previous research questions, could you provide an estimate of the total monetary value of the selected segment of space-based infrastructure?

Statement of Work 2: The valuation of impacts of space debris incidents

The stability of the space environment is a growing concern among policy makers, following an unprecedented accumulation of space debris and intensifying commercial use of low earth orbits. Several major new satellite constellations are under preparation, which, if fully deployed, could increase the number of operational satellites in low-earth orbits from around 3 000 in 2020 to many tens of thousands by the 2030s.

Space debris accumulation increases the costs of space activities through satellite protection measures, debris surveillance and tracking, and, in particular, the generation of further debris, which could ultimately lead to the so-called *Kessler syndrome* of cascading, self-generating collisions. The Kessler syndrome could render certain orbits of high socioeconomic value unusable and hinder much of humanity's further potential activity in space.

Learning more about the real costs of space debris incidents would be an important step forward, and will contribute to raising awareness about this important issue among space operators and decision-makers alike.

Project participants are asked to address the following research questions:

- What are the direct and indirect costs of existing and future space debris incidents?
- How would you model and evaluate the different costs using which methodologies (e.g. net present value calculations and discounting)?
- How should the modelled costs be distributed over time, and how would they affect different types of users?