

Horizon Europe Space Programme for 2022 (2023)

Nigel Mason, 7 December 2021.

Last week, there was a briefing on the Horizon Europe Space programme. The Programme has been one of the later ones to be completed and the timelines for calls are now rather tight (mainly 16 February 2022). However, there are topics where the Europlanet community can and should engage and some consortia have already started to form. This document is to highlight those calls that I feel the Europlanet community should be engaged within.

The full Work Programme may be found here:

https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-7-digital-industry-and-space_horizon-2021-2022_en.pdf

I will draw down from the Work Programme the rest of this document. For detailed discussion of the programme and management at the briefing last week (30 November) please see the following sites for details:

https://ec.europa.eu/info/research-and-innovation/events/upcoming-events/horizon-europe-info-days/cluster-4_en with full presentations (recording of the day at <https://www.youtube.com/watch?v=yObnGaoZtoQ>)

The Space Programme

The Space Programme is organised in the following eight thematic topics:

1. Foster competitiveness of space systems
2. Reinforce EU capacity to access to space
3. Evolution of Space and ground infrastructures for Galileo/EGNOS
4. Evolution of services: Copernicus
5. Development of applications for Galileo, EGNOS and Copernicus
6. Innovative space capabilities: SSA, GOVSATCOM, Quantum
7. Space entrepreneurship ecosystems (incl. New Space and start-ups) and skills
8. Targeted and strategic actions supporting the EU space sector

To quote the call:

While headings 1, 2, 7 and 8 will support the EU space sector at large and are largely based on the recommendation of the Strategic Research and Innovation Agenda, headings 3, 4, 5, and 6 will be supporting the Space Programme components as well as the emerging quantum initiative.

The aims of each of these topics are summarised as follows:

1. Foster competitiveness of space systems. This requires the development of new competitive technologies for space and ground systems, such as very high throughput and flexible satellites, very high-resolution sensors, radiation-hardened electronics, on-board and ground Artificial Intelligence (AI), optical communication and quantum technologies, as well as advanced robotics. We also need to prepare the ground for future modular, flexible and intelligent satellites. In the mid to long term, the future space ecosystem should include hybrid, smart and reconfigurable satellites, which can be manufactured, assembled and serviced directly in-orbit, and with a de-orbiting capacity.

2. Reinforce EU capacity to access to space. Two specific challenges stand out. Firstly, the highly competitive global market for launch services, which is characterised by an increasing number of competitors. Secondly, the emerging opportunities in space transportation that have not been yet seized by European launch actors characterised by new uses of space (e.g. small satellites, larger constellations, payload recovery, payload quick deployment), new services (e.g. direct orbit injection, in-orbit servicing) and in-space transportation.

3. Evolution of Space and ground infrastructures for Galileo/EGNOS is what it says. Overall, this will maintain the EU's leadership position in the Global Navigation Satellite Systems.

4. Evolution of services: Copernicus. This will develop Copernicus core services (climate, marine environment, land monitoring, atmosphere monitoring, emergency management and security), which must evolve and improve to better-respond to new and emerging policy needs.

5. Development of applications for Galileo, EGNOS and Copernicus. This supports Research and Innovation (R&I) to foster the development of downstream applications and promote their adoption in the EU and worldwide, in particular in markets with a long lead-time.

6. Innovative space capabilities: SSA, GOVSATCOM, Quantum. Space Situational Awareness (SSA) will provide services to European users, including spacecraft owners/operators and governmental entities, that will reinforce the protection and resilience of European space and ground infrastructures against various hazards and risks (mainly collisions in/from space, Near Earth Objects or space weather events). New challenges are posed by the ever-increasing orbital population of smaller satellites and space debris and the associated increased risk of orbital collisions, fragmentations and re-entries. R&I activities shall address these challenges by developing novel architectures and technical solutions for ground/space sensors, data processing, networking and operation centres (including critical technological elements for the realisation of crucial future space weather applications and services). This will ensure safety and sustainability of space operations in Europe, as well as improve current EUSST

services and implement new ones (space debris mitigation and remediation services; space weather services).

The GOVSATCOM initiative aims to provide reliable, secured and cost-effective satellite communications services to EU and Member State authorities with an infrastructure supporting secure critical missions and the ability to exchange sensitive information in a environment of worldwide hybrid threats.

Space will pave the way for *quantum technologies* in EU space infrastructure and for space-based services (e.g. quantum inter-satellite communication, next generation atomic clocks or quantum sensors). It is of the highest strategic importance for the EU and its industry to be competitive and to become a global leader in this area.

7. Space entrepreneurship ecosystems (incl. New Space and start-ups) and skills. Business development, acceleration and upscaling of start-ups will be fostered across all space areas under the CASSINI Space Entrepreneurship Initiative. CASSINI will provide support to business and innovation-friendly ecosystems, including the strengthening business skills in the space market segments and digital services based on space data. The objective is to make start-ups and scale-ups investment-ready and able to secure venture capital funding. Synergies with the InvestEU Programme and the Space Programme will be established.

8. Targeted and strategic actions supporting the EU space sector. Development of associated technologies and actions of key importance to the sections described above will be pursued. These actions will at the same time contribute to foster the competitiveness of the EU space sector, to reinforce our capacity to use and access space, and to perform R&I for the Space Programme.

These targeted and strategic actions will include the development of critical technologies for EU non-dependence, the establishment of regular and cost-effective flight opportunities for In-Orbit Demonstration/In-Orbit Validation (IOD/IOV), *space science activities*, as well as *outreach, education and international cooperation activities*.

I will now discuss specific calls:

Call - STRATEGIC AUTONOMY IN DEVELOPING, DEPLOYING AND USING GLOBAL SPACE-BASED INFRASTRUCTURES, SERVICES, APPLICATIONS AND DATA 2021

HORIZON-CL4-2021-SPACE-01

I do not feel that there is a topic in this part of the call that is directly relevant to Europlanet. However, do note **HORIZON-CL4-2021-SPACE-01-81: Space technologies for European non-dependence and competitiveness** highlights some topics that underpin space exploration, e.g. *very high energy ion accelerators for component, shielding and radiobiology characterisation*.

Call - STRATEGIC AUTONOMY IN DEVELOPING, DEPLOYING AND USING GLOBAL SPACE-BASED INFRASTRUCTURES, SERVICES, APPLICATIONS AND DATA 2022

HORIZON-CL4-2022-SPACE-01

HORIZON-CL4-2022-SPACE-01-82: Space science and exploration technologies. This is the main opportunity for planetary science community and it is important that we respond in a positive way with a number of high quality proposals. The budget is 8 million Euros and projects are expected to be between 1 and 1.5 millions Euros each, hence there will be funding for 6 to 8 projects. This was discussed in the briefing session (starting at 1 hour and 35 minutes): <https://www.youtube.com/watch?v=yObnGaoZtoQ>.

Expected Outcome: Projects are expected to contribute to the following outcomes:

- Enable breakthroughs in technologies and scientific instrumentation for space science and exploration missions including those described in the Global Exploration Roadmap from the International Space Exploration Coordination Group (ISECG): <https://www.globalspaceexploration.org/> - the latest report being found here: <https://www.globalspaceexploration.org/wordpress/wp-content/uploads/2021/05/ISECG-Annual-Report-2020.pdf>
- Validate novel space/planetary robotic technologies and instrumentation through analogue tests.
- Increase collaboration of scientific, engineering and industrial teams both within and outside Europe across different domains.
- Strengthen European scientific excellence and support the development of leading edge scientific and technologic research in Europe

Scope: The development of innovative instrumentation (payload) and technologies enabling space science and exploration missions requires timely technology development associated with future space science and exploration missions, including robotic exploration technologies, early-stage scientific instrumentation and component technologies for space resources utilisation and space observatories. The development of new and innovative approaches, such as instruments for Cubesats and other small space platforms, including planetary entry probe, or the use of Commercial off-the-shelf (COTS) components, is encouraged as long as it contributes to the implementation of space science and exploration missions with significant scientific outputs.

Advances are expected in support to on-site activities such as innovative measurement techniques, increased sensitivity, increased robustness, faster and more accurate data processing or in-situ sample and data analysis.

The proposed activities should target primarily European and European-led space science and exploration missions or international missions where the participation of European partners provides demonstrated added value in technological development and scientific output.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

I also draw you attention to **HORIZON-CL4-2022-SPACE-01-72: Education and skills for the EU space sector**, a single project to be funded with a budget of up to 3 million euros. This was discussed in the briefing session (starting at 1 hour and 40 minutes): <https://www.youtube.com/watch?v=yObnGaoZtoQ>. It is expected to build upon

<http://www.eo4geo.eu/> Innovative solutions for Earth Observation/Geoinformation training and Perseus <https://cordis.europa.eu/project/id/101034240> (a COFUND project with a focus on the thematic areas of Big Data, Artificial Intelligence, Digital Twins, Internet of Things, Extended Reality and Information and Cyber Security), but we need to get the 'looking out' space exploration and exploitation into the mix.

Expected Outcome: Projects are expected to contribute to the following outcomes:

- A structured overview of the educational offer in the EU, including continuing education for the EU space sector.
- Socio-economic analysis of the space-oriented student population and identification of gaps/shortcomings and excellences across the EU-27 and Associated Countries.
- Identification of the needs for education and skills in the EU space sector and of potential new educational knowledge answering emerging and future needs
- Assessment of the adequacy between curricula and sector needs;
- Actions for the promotion of space jobs and career in Bachelor and Master courses
- Creation of educational material for jobs related to Earth observation and Positioning Navigation and Timing, in particular downstream.
- In relation to the expected impact, these outcomes will contribute to foster the EU space sector competitiveness by enhancing the adequacy between the needs of the sector and the qualification of the workforce and reinforce EU capacity to develop products and services with a higher level of autonomy.

Scope: Competitiveness and innovation of the EU space sector depends on the availability of high educational standards and skilled professionals across a range of qualifications and the possibility for these professionals to upgrade and update their skills. This is also in the interest of the research and innovation community where the quality of the results and the impact of EU-funded research is a precursor of the future space sector. The EU also plays a role in the aligning of educational degrees to provide more opportunities and promote mobility of professionals and researchers across countries and sectors.

The scope of this action encompasses:

- The analysis of the main curricula and courses available and existing educational standards across the EU-27 at bachelor, master and post-graduate levels as well as continuing education (training and staff qualification / certification). The study should provide an overview of the 'supply' of space-oriented education and of the 'demand', a quantitative analysis of the 'stocks & flows' of students at the different levels eventually employed in the space sector at large (academia, government agencies, upstream industry, downstream industry) including socio-economic aspects (e.g. gender, educational background, family income, parents' education, residence geography, etc.), and a comparative analysis of the cost/time to achieve a degree. This should be supported by extensive, in-depth quantitative and fact-based evidence and encompass EU-27 and Associated Countries.
- The analysis of the skills required and reskilling needs of the R&I and the industrial community (across the entire supply chain, ranging from upstream space to downstream space) will be performed and structured, presumably along existing educational modules (e.g. electrical, mechanical, telecommunication, system engineering, physics, psychology, medicine). The analysis should engage both industry and educational institutions. It

should not be limited to technical, scientific, engineering disciplines but also includes the essential soft skills needed, such as the ability to work in a diverse multidisciplinary team, to communicate efficiently, to create new activities and businesses, etc. An assessment of the number of professionals needed in the different sectors will be produced, based on fact-based and in-depth quantitative analysis of the demographics across EU-27, the current/projected enrolment rate into space-oriented disciplines, the success rate, etc. This will also include an exploratory look at future skills, which the space sector will need in the future. The analysis should take into consideration results stemming from existing activities funded under Horizon 2020, e.g. the EO4GEO project (<http://www.eo4geo.eu>) and the PERSEUS project <https://cordis.europa.eu/project/id/640211>

- The analysis of the match between needs and offer across the whole of EU-27 will be analysed and recommendations made to ensure a better match between the needs and the offer in the coming years. For this, a benchmarking of the career opportunities for space-oriented graduates coming from different universities across the EU-27 and Associated Countries (e.g. time to first employment, average salary after 3-5-7 years, etc.) will be performed. An assessment of the net inflows/outflows within EU-27 and Associated Countries and with non-EU countries will be carried out.
- In particular, the co-operation between academia and industry in the field of PhD studies will be assessed and measures to promote the research experience of the academic personnel proposed.
- The use of continuous learning “in-company” and “out-of-company” supported by the new digital technologies with guaranteed quality e.g. Massive Online Open Course (MOOC) will be assessed and promoted.
- Promotion of the space sector jobs and careers (in particular where there is a strong demand for qualified workforce) and information about the different curricula and disciplines of interest for such careers in Bachelor and Master studies.
- Creation of course modules in relation to the 2 EU flagship constellations Copernicus and Galileo for jobs related earth observation and PNT, in particular for the downstream sector.

There are several areas here that are relevant to the sustainability of the European planetary science community and therefore are of interest to the Europlanet community and Society with its education and early career sector.

Note some that some other topics in this call that may interact later with space missions, e.g. **HORIZON-CL4-2022-SPACE-01-12: Technologies and generic building blocks for Electrical Propulsion**, and the space weather call **HORIZON-CL4-2022-SPACE-01-62: Space Weather looking at effect of space weather on the Earth**.