

Scoping paper for the Horizon 2020 work programme 2018-2020
Siii Leadership in Enabling and Industrial Technologies - Space

1. Context

Space is important for Europe. It is both a strategic asset and enormous opportunity for our society and economy. Space technologies, infrastructure, services and data provide the EU with the tools needed to address societal challenges and big global concerns, such as climate change, migration, mobility, energy security and many others. The security and well-being of our citizens increasingly depend on information and services provided from space.

Space has a growing importance for the European economy. Space provides data and connectivity for the digital economy. It boosts innovation and creates new sources of jobs and growth, particularly through the development of value-added (downstream) products and services, which opens new market opportunities for European companies, including SMEs and start-ups, and contributes to the competitiveness of our economy. Space can help increase the resilience of key sectors of the economy, such as transport networks, energy grids, or financial and banking services. The importance of space for the functioning of European society is expected to grow in the future as we move towards a more interconnected society and digital data-driven economy which will increase the demand for space-based services.

To bring the benefits of space to the European citizens and unleash the potential of space as a vector for growth, competitiveness and jobs creation in the wider European economy it is necessary to stimulate the integration of space into European society and economy, foster a globally competitive European space sector and ensure European autonomy in accessing and using space in a safe and secure environment.

Horizon 2020 is a key instrument to progressing towards these goals. This must be done in coordination with the activities of the operational space programmes Copernicus and EGNSS (Galileo and EGNOS), with activities in other parts of Horizon 2020 and with the activities of Member States and ESA.

The scoping paper is based on the priorities set out in the Space Strategy for Europe and takes into account the work of the Space Advisory Group and the dedicated consultation in view of the space work programme 2018-2020. The latter included 26 position papers submitted to the Commission by Member States and stakeholder associations, technical meetings, workshops and a stakeholder consultation workshop held on 26-28 September 2016 in Brussels where issues of continuity and emerging priorities were discussed in the format of dedicated panel sessions.

The analysis of what has been addressed in the work programmes 2014-2017 with respect to the objectives for space of the Horizon 2020 Specific Programme did not reveal any specific gaps in coverage. The programme for the remaining three years will need to reflect an adequate balance between priorities in line with the needs of the EU space programmes, recommendations of stakeholders and be aligned with the Space Strategy for Europe.

The Space Advisory Group (SAG) recommendations¹ were rather broad involving all areas addressed in the 2014-2017 period. SAG points out the need to further strengthen European competitiveness, in particular to formulate an EU response to challenges brought about by a new industrial logic and new actors in space in particular in the United States (so called "New Space"). This includes injection of private capital, new trends towards large constellations of small inexpensive satellites replacing or complementing the traditional ways of developing space systems. There is also a need to continue strengthening European non-dependence in critical space technologies and to safeguard Europe's independent access to space both for larger and smaller payloads. Support for in-orbit-demonstration and validation remains important and an

¹ Report of the Space Advisory Group June 2016.

effort should be made to create a mechanism for offering flight-opportunities for this purpose. The SAG also points to the importance of sustaining EU activities in support of space science and exploration as a breeding ground for new innovative ideas in order for Europe to remain competitive in the sector. The group also recognises that EU space programmes (Copernicus and EGNSS) need to be supported by an adequate R&D effort for its evolution and user uptake. Outreach and communication of European space activities needs to be further strengthened to show the benefits for the citizen and to emphasise the role played by space technologies and applications in everyday life.

The input from stakeholders and Member States so far indicates broad support for sustaining the activities that have been included in the first four years of Horizon 2020 Space:

- Widening the use of Earth observation and satellite navigation data, information and signals;
- Supporting the development of downstream applications and boost the market uptake of EGNSS and Copernicus relying on a mixture of tools in support of innovation (innovation procurement, access to finance, SME instrument);
- Supporting the evolution of EGNSS and Copernicus;
- Setting up a recurrent service for In-Orbit-Demonstration and Validation (IOD/IOV) of space technologies and systems enabling space qualification and smoothing the path towards commercialisation;
- Cost reduction of access to space both for large and small satellites (for example: flexibility, reusability, in-orbit servicing, small launchers);
- Coordination between EU-ESA-EDA for critical space technologies by facilitating continuity of research activities supported in European technology development programmes;
- Exploiting opportunities in using commercial Off-The-Shelf (COTS) components;
- Promoting synergies between space and non-space activities of Horizon 2020 notably in the areas of technologies and societal challenges;
- Dedicated support to exploitation of space science and exploration data and development of scientific instrumentation in a context of international cooperation;
- Support to Space Surveillance and Tracking and improved modelling and forecasting of space weather events.

2. Strategic orientations for 2018-2020 and translation into calls

The Space Strategy for Europe outlines priorities in areas such as: reaping the benefits of space for Europe; fostering competitiveness and innovation in the European space sector; strengthening Europe's autonomy in critical areas of technology and access-to-space; promoting a secure and safe space environment; promoting Europe as a global actor in space. In line with this, the main priorities for the final three years of Horizon 2020 fall into four broad areas of activity:

- Supporting EU flagship space programmes Copernicus and EGNSS (Galileo/EGNOS);
- Strengthening the competitiveness of the European space sector;
- Supporting Europe's autonomy in accessing and using space in a secure and safe environment;
- Strengthening Europe's role as a global actor.

Horizon 2020 Space will support open access to research data, results and publications unless prevented for imperative reasons of security or EU industrial competitiveness. The Copernicus Earth observation programme already provides free, full and open access to environmental data including data from the Sentinel satellites.

a. Supporting EU flagship space programmes Copernicus and EGNSS

Research activities at EU level should address the full value chain in a balanced way. Potential synergies between Copernicus, EGNSS and satellite communications should be exploited.

Copernicus: Focus on widening the use of Copernicus data and market uptake of Copernicus services by relying on development of applications, innovation procurement, the SME instrument and access to finance for SMEs, notably venture capital and business angels. Support to the evolution of Copernicus focusing on research to improve services and mission concepts.

EGNSS: Activities will continue to address the evolution of the EGNSS with focus on new missions, new services, infrastructure as well as science and technology², and market uptake activities of EGNSS applications via calls for proposals³. As regards EGNSS applications, the focus will be on building on the initial service declaration of Galileo which is planned for later in 2016. All main application areas are due to be covered. Close links will be established with the Societal Challenge Smart, Green and Integrated Transport, LEIT-ICT and Energy challenge.

b. Strengthening the competitiveness of the European space sector

Support to generic and mission-oriented R&D technology at low and mid TRL levels is important for addressing non-dependence and competitiveness of the European Space industry. Generic technology development allows longer-term, innovative and breakthrough technologies to emerge. IOD/IOV (in-orbit-demonstration/validation) addresses mission specific or application-oriented needs and permit industries to mature marketable products.

On the low TRL side, future emerging space technologies actions are expected to initiate and push forward through the TRL scale new lines of disruptive technology through collaborations between advanced multidisciplinary science and cutting-edge engineering often involving innovative SMEs. This will turn the excellent science base of Europe into a competitive advantage by establishing a European leadership early on in promising future space technology areas able to renew the basis for future European competitiveness and growth.

The COM-ESA-EDA Joint Task Force process on critical space technologies ensuring European non-dependence is well-established and valued by stakeholders. The updated list of actions should be the basis for the work programme in this area.

Mission or application oriented technologies RD&T actions should anticipate, in the medium and long-term, the necessary evolutions in order to maintain the capacity of established European programmes (Galileo, Copernicus) and prepare for new ones (GOVSATCOM, SST). In addition, actions related to technologies and standardisation enabling competitiveness of the EU space industry, and allowing adaptations to new challenges in Earth observation and satellite communication missions (e.g. small satellites, mega-constellations, new manufacturing processes) need to be supported.

The work programme should, where applicable, rely on a roadmap-based approach providing European industry and research community with a long-term vision. Such an approach should be implemented in conjunction with activities of Member States and ESA, for instance building on the ESA Technology Harmonisation process, to ensure greater complementarity. Examples of multi-annual research agendas implementing common roadmaps are the two established **Strategic Research Clusters** on Space Robotics and Electric propulsion which should be support in the programming period.

² The R&D on EGNSS infrastructure, Science and Technology is implemented under an existing delegation agreement with ESA.

³ The implementation of EGNSS calls for proposals for applications is delegated to the GSA agency.

Synergies with other parts of the Work Programme have to be sought. There may be scope in the areas of Key Enabling Technologies or Future Emerging Technologies to consider potential application to Space, therefore improving cross-Horizon 2020 coherency. Likewise, instruments which allow industry, research institutions, and academia to directly participate in the definition and implementation of research and innovation priorities, such as Joint Technology Initiatives (JTI) or the contractual Public-Private Partnerships (cPPP) should be considered.

Opportunities, on a regular basis, for **In Orbit Demonstration / Validation (IOD/IOV)** of technologies or products would enable the ultimate required qualification before using them on a real mission. The work programme should aim at setting up a regular cost-effective IOD/IOV service offering flight tickets. Such service should rely on a European approach including access to space aspects and building on complementarity with other European initiatives.

c. Supporting Europe's autonomy in accessing and using space in a secure and safe environment

Access to space is an indispensable element of the entire value chain of space and has been recognised as an area of strategic importance towards the direction of Europe's non-dependence. There is a need to foster the competitiveness of European industry by increased support to research and innovation in order to address low-cost access to space for small satellites; advanced manufacturing; breakthrough concepts; mitigating environmental impact and providing regular opportunities for European in-orbit validation services. R&D activities will support disruptive technologies in order to reduce the production and exploitation costs of launch systems and to anticipate future innovations.

Support for the EU Space Surveillance and Tracking (SST) framework aims at encouraging the development and upgrade of SST sensors owned and operated by the Member States participating in this Framework. For Horizon 2020, this is planned to be implemented through grants to an identified beneficiary (the SST consortium).

Other activities will be launched in view of protecting users against threats including impact of **space weather, space debris and cyber threats**. Future services could include space weather forecasting and cyber protection of satellites. These activities may also address the legal and technical issues posed by space debris proliferation.

d. Strengthening Europe's role as a global actor

Horizon 2020 space should be a tool for **economic diplomacy** in support of the European space sector in the global context. The development of cutting edge space technology is increasingly taking place within space science and exploration international partnerships. Ensuring access to these constitutes an important success factor for European researchers and industry. The use of space will have to take into account cooperation with international partners. Accordingly, international cooperation aspects will be mainstreamed in the work programme as far as possible.

Space science and exploration expand the frontiers of knowledge and boost the development of technologies that later find their way into operational space programmes. The definition and implementation of long-term roadmaps and the coordination with international partners are essential for instance through ISECG⁴ where major European space agencies participate. The work programme should promote activities that create the appropriate framework for Europe to maintain and further enhance its role as a key partner in international space science and exploration endeavours. These activities should build upon technological and scientific expertise across the European Union and encourage co-development, spin-in or spin-out between space and non-space actors.

⁴ International Space Exploration Coordination Group.

The work programme will support **exploitation of scientific space data** from space and exploration mission and the early stage development of scientific instrumentation for future human and robotic missions. The exploitation of space science data should stimulate multidisciplinary, international co-operation and the use of data from multiple sources, including past, current and upcoming space missions, and data collected on Earth. The activities should result in higher-level data products in openly available data archives including software tools for using these, and include training for the next generation of space and data scientists. In this context, it is also important to benefit from and integrate with activities in other areas, as for instance Big Data techniques.

Communication and outreach activities should highlight, for European citizens, the benefits of space-based applications in all aspects of life in our modern society. They should support education in science and technology and inspire the young generation to explore the Universe and to better understand our planet Earth.

Table of calls for proposals for the period 2018-2020

<i>Call working title (indicate 'FA' if proposed as a focus area)</i>	<i>Brief description of the scope of the call including information if it is cPPP. If a focus area please show how the criteria have been met.</i>	<i>Possible contribution from and to other work programme parts (mandatory for focus areas)</i>
Space-2018-2019-2020 (managed by REA)	The three annual calls will address R&I in the Space sector in support of European S&T competitiveness. They will include targeted technology development including demonstration and validation in space, support to space science and to mitigating threats from space. User uptake of Copernicus (including downstream applications and services) and the evolution of operational Copernicus services will be an important part of the call.	<p>Topics of this call will contribute to focus areas:</p> <ul style="list-style-type: none"> • Winning the race for a low-carbon, climate resilient Europe • Digitisation • Supporting the Security Union. <p>Close links will be reinforced with "Research infrastructures", LEIT-ICT, LEIT-NMBP, FET and the following Societal Challenges:</p> <ul style="list-style-type: none"> • Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy; • Climate action, environment, resource efficiency and raw materials. • Secure Societies
EGNSS-2019 (managed by GSA)	The call will address applications of satellite navigation through Galileo and EGNOS.	<p>Topics of this call will contribute to the "Digitisation" focus area.</p> <p>Close links will be reinforced with the Societal Challenge "Smart, Green and Integrated Transport", the ICT-LEIT and the Energy Challenge.</p>

R&I on mission and services, infrastructures, as well as science and technology, of Galileo and EGNOS will mainly be implemented through public procurement in 2018, 2019 and 2020.

Continuity of support to the European SST framework will be implemented with calls to identified beneficiary (the SST consortium of participating states).

Links to other parts of the work programme

Space applications play a critical role in enabling solutions to challenges in important sectors including climate, (smart) transport, energy, information technologies, security, agriculture and marine. Moreover space technologies are underpinned by advances in key enabling technologies. Therefore, close links will be reinforced with "Research infrastructures", FET, LEIT-ICT, LEIT-NMBP and the following Societal Challenges:

- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
- Secure, clean and efficient energy;
- Climate action, environment, resource efficiency and raw materials;
- Smart, Green and Integrated Transport;
- Secure societies.

The coordination between these Horizon 2020 parts will be strengthened with appropriate cross-references, guidance and explanation in the corresponding work programme parts and visibility in the participant portal. This will help optimise the coherence of Union action and use of resources and will facilitate access to opportunities for applicants.

Possible participation of LEIT-Space to Focus Areas:

LEIT-Space will contribute to the following focus areas:

- Winning the race for a low-carbon, climate resilient Europe
- Digitisation
- Supporting the Security Union.

Detailed information regarding the focus areas is included in the "Draft Strategic Programme Overarching Document".