Horizon EUROPE - Specific Programme

proposal for a Decision of the Council [ST_8550/19_INIT]

PILLAR II - Global Challenges and European Industrial Competitiveness

CLUSTER 4 - DIGITAL, INDUSTRY AND SPACE

The EU is confronted by many challenges, some of which are also global challenges. The scale and complexity of the problems are vast, need to be tackled jointly and matched by adequate, properly trained and skilled human resources, by the appropriate amount of financial resources and a proportionate effort in order to find solutions. These are precisely the areas where the EU must work together; smart, flexible and joined-up for the benefit and well-being of all our citizens.

Greater impact can be obtained through aligning actions with other nations and regions of the world within international cooperation along the lines indicated by the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals and the Paris climate agreement. Based on mutual benefit, partners from across the world will be invited to join EU efforts as an integral part of research and innovation for sustainable development.

Research and innovation are key drivers of sustainable and inclusive growth and technological and industrial competitiveness. They will contribute to finding solutions to today's problems, and the problems of tomorrow, in order to reverse as quickly as possible, the negative and dangerous trend that currently links economic development with the growing use of natural resources and growing social challenges. This will turn the challenges into new business opportunities and into rapid benefits for society.

The EU will benefit as user and producer of knowledge, technologies and industries showcasing how modern industrialised, sustainable, inclusive, creative, resilient, open and democratic society and economy can function and develop. The growing economic-environmental-social examples of the sustainable economy of the future will be fostered and boosted, be they for: health and well-being for all; or resilient, creative and inclusive societies; or societies strengthened by civil security; or available clean energy and mobility; or a digitised economy and society; or a transdisciplinary and creative industry; or space-related, marine or land-based solutions; or a well-functioning bioeconomy, including food and nutrition solutions; sustainable use of natural resources, protection of the environment, climate change mitigation and adaptation, all generating wealth in Europe and offering higher quality jobs. Industrial transformation will be crucial, as well as developing EU innovative industrial value chains.

New technologies affect virtually all policy areas. For each separate technology there is often a combination of social and economic opportunities, opportunities for efficiency and quality and improvement of the government, consequences for employment and education, but also possible risks for safety, privacy and ethics. Technology policy therefore necessarily requires an integral weighing of interests, and cross-sectoral cooperation and strategy formulation.

Research and innovation under this pillar of Horizon Europe is grouped into integrated, non-siloed broad clusters of activities. Rather than addressing sectors, the investments aim at systemic changes for our society and economy along a sustainability vector. These will only be achieved if all actors, both private and public, engage in co-designing and co-creating research and innovation; bringing together end-users, scientists, technologists, producers, innovators, businesses, educators, policy-makers, citizens and civil society organisations. Therefore, none of the clusters is intended for only one set of actors and all activities will be implemented primarily by collaborative research and innovation projects selected on the basis of competitive calls for proposals.

In addition to addressing global challenges, activities in the clusters will also develop and apply, key enabling and emerging technologies (either or not digital-based) as part of a common strategy to promote the EU's industrial and social leadership. Where appropriate this will use EU space-enabled data and services. All TRL levels up to 8 will be covered in this pillar of Horizon Europe without prejudice to Union competition law.

Actions will generate new knowledge and develop technological and non-technological solutions, bring technology from lab to market and to develop applications including pilot lines and demonstrators, and include measures to stimulate market uptake and to boost private sector commitment and incentives to standardisation activities within the Union. Technologies require critical mass of European researchers and industry to establish world leading eco-systems, that include state of the art technology infrastructures e.g. for testing. Synergies with other parts of Horizon Europe and the EIT, as well as other programmes will be maximised.

The clusters will boost the quick introduction of first-of-its-kind innovation in the EU through a broad range of embedded activities, including communication, dissemination and exploitation, standardisation as well as support to non-technological innovation and innovative delivery mechanisms, helping create innovation friendly societal, regulatory and market conditions such as the innovation deals. Pipelines of innovative solutions originating from research and innovation actions will be established and targeted to public and private investors as well as other relevant EU and national or regional programmes. Synergies will be developed with the third pillar of Horizon Europe in that perspective.

Gender equality is a crucial factor in order to obtain sustainable economic growth. It is therefore important to integrate a gender perspective in all global challenges.

Cluster 4: ' DIGITAL, INDUSTRY AND SPACE'

4.1. Rationale

To ensure industrial competitiveness and the capacity to address the global challenges ahead, the EU must increase its technological sovereignty and its scientific, technological and industrial capacities in the key areas that underpin the transformation of our economy, the work place and society.

EU industry provides one out of five jobs and two thirds of private sector R&D investments and generates 80% of EU exports. A new wave of innovation, involving a merging of physical and digital technologies, will trigger huge opportunities for EU industry and improve the quality of life for EU citizens.

Digitisation is a major driver. As it continues at a rapid pace across all sectors, investment in priority areas ranging from trustworthy artificial intelligence to next generation internet, high performance computing, photonics, quantum technologies, robotics and micro-/nano-electronics, becomes essential for the strength of our economy and the sustainability of our society. Investing, producing and using digital technologies provides a major boost to EU economic growth, amounting to an increase of 30% between 2001 and 2011 alone. In this context, the role of SMEs remains fundamental in the EU, both in terms of growth and jobs. Digital uptake among SMEs promotes competitiveness and sustainability.

Key enabling technologies[1] underpin the blending of the digital and the physical worlds, central to this new global wave of innovation. Investing in research, development, demonstration and deployment of key enabling technologies, and ensuring a secure, sustainable and affordable supply of raw and advanced materials, will secure EU strategic autonomy and help EU industry to significantly reduce its carbon and environmental footprints.

Specific future and emerging technologies will also be pursued as appropriate.

Space is of strategic importance; around 10% of the EU's GDP depends on the use of space services. The EU has a world-class space sector, with a strong satellite manufacturing industry and a dynamic downstream services sector. Space provides important tools for monitoring, communication, navigation, and surveillance and opens up many business opportunities especially in combination with digital technologies and other sources of data. The EU must make the most of these opportunities by fully exploiting the potential of its space programmes Copernicus, EGNOS and Galileo, and by protecting space and ground infrastructures against threats from space.

The EU has the unique chance of being a global leader and increase its share of world markets, by showcasing how digital transformation, leadership in key enabling and space technologies, the transition to a low-carbon, circular economy and competitiveness can reinforce each other through scientific and technological excellence.

To make the digitised, circular, low-carbon and low-emission economy a reality, action is needed at EU level because of the complexity of value chains, the systemic and multi-disciplinary nature of the technologies and their high development costs, and the cross-sectoral nature of the problems to be addressed. The EU must ensure that all industrial players, and society at large, can benefit from

[1] The Key Enabling Technologies of the future include advanced materials and nanotechnology, photonics and micro- and nano-electronics, life science technologies, advanced manufacturing and processing, artificial intelligence and digital security and connectivity

advanced and clean technologies and digitalisation. Developing technologies alone will not suffice. A societal understanding of these technologies and evolutions is crucial for engaging end users and behavioural change.

Industrially-oriented infrastructures, including pilot lines, will help EU businesses, and in particular SMEs, deploy these technologies and improve their innovation performance and may be facilitated also by other EU programmes.

A strong engagement of industry and civil society is essential for setting priorities and developing research and innovation agendas, increasing the leverage of public funding through private and public investments, and ensuring the better uptake of results. Societal understanding and acceptance, including consideration of the design of products, goods and services, are key ingredients for success, as well as a new agenda for industry-relevant skills and standardisation.

Bringing together activities on digital, key enabling and space technologies, as well as a sustainable supply of raw materials, will allow for a more systemic approach, and a faster and more profound digital and industrial transformation. It will ensure that research and innovation in these areas feed into, and contribute to the implementation of, the EU's policies for industry, digitisation, environment, energy and climate, circular economy, raw and advanced materials and space.

Complementarity will be ensured with activities in particular under the Digital Europe Programme and the Space Programme, while respecting the delineation between Programmes and avoiding overlaps.

Activities will contribute directly to the following Sustainable Development Goals (SDGs) in particular: SDG 8 - Decent Work and Economic Growth; SDG 9 - Industry, Innovation and Infrastructure; SDG 12 - Responsible Consumption and Production; SDG-13 Climate Action.

4.2. Areas of Intervention

4.2.1. Manufacturing Technologies

Manufacturing is a key driver of employment and prosperity in the EU, producing over three quarters of the EU's global exports and providing over a 100 million direct and indirect jobs. The key challenge for EU manufacturing is to remain competitive at a global level with smarter and more customised products of high added value, produced at much lower energy and material resource costs as well as with a reduced carbon and environmental footprint. Creative and cultural inputs as well as perspectives from social sciences and humanities on the relation between technology and people in production will be vital to help generate added value. The impact on work life and employment will be studied as well.

BROAD LINES:

- Breakthrough manufacturing technologies such as biotechnological production, additive manufacturing, industrial, collaborative, flexible and intelligent robotics, human integrated manufacturing systems, also promoted via an EU network of industrially-oriented infrastructures, which provide services to accelerate technological transformation and uptake by EU industry;
- Breakthrough innovations using different enabling technologies across the value chain. Examples are converging technologies, artificial intelligence, digital twin, data analytics, control technologies, sensor technologies, industrial, collaborative and intelligent robotics, human-

centered systems, biotechnological production , advanced batteries and hydrogen, including renewable based hydrogen, and fuel cell technologies, advanced plasma and laser technologies;

- Skills, workspaces and businesses fully adapted to the new technologies, in line with European social values;
- Flexible, high-precision, zero-defect, low-pollution and -waste, sustainable and climate-neutral cognitive plants, in line with the circular economy approach, smart, and energy efficient manufacturing systems meeting customer needs;
- Breakthrough innovations in techniques for exploring construction sites, for full automation for on-site assembly and prefabricated components.

4.2.2. Key Digital Technologies

Maintaining and autonomously developing strong design and production capacities in essential digital technologies such as micro- and nano-electronics, microsystems, photonics, software and cyber-physical systems, and their integration as well as advanced materials for these applications will be essential for a competitive citizen-centered and social EU.

BROAD LINES:

- Micro- and nano-electronics, including design and processing concepts, components and manufacturing equipment responding to the specific requirements of digital transformation and global challenges, in terms of performance functionality, energy and material consumption and integration;
- Efficient and secure sensing and actuating technologies and their co-integration with computational units as the enabler of industry and the Internet of Things, including innovative solutions on flexible and conformable materials for human-friendly interacting objects;
- Technologies as complements or alternatives to nano-electronics, such as integrated quantum computing, transmission and sensing as well as neuromorphic computing components and spintronics;
- Computing architectures and accelerators, low-power processors for a wide range of applications including neuromorphic computing powering artificial intelligence applications, edge computing, digitisation of industry, big data and cloud computing, smart energy and connected and automated mobility;
- Computing hardware designs delivering strong guarantees of trusted execution, with built-in privacy and security protection measures for input/output data, quantum computing as well as processing instructions and adequate human machine interfaces;
- Photonics technologies enabling applications with breakthrough advances in functionality, integration and performance;
- System and control engineering technologies to support flexible, evolvable and fully autonomous systems for trustworthy applications interacting with the physical world and humans, including in industrial and safety critical domains;
- Software technologies enhancing software quality, cybersecurity and reliability with improved service life, increasing development productivity, and introducing built-in artificial intelligence and resilience in software and their architecture;
- Emerging technologies expanding digital technologies.

4.2.3. Emerging enabling technologies

Key Enabling Technologies have demonstrated their potential to stimulate innovation in and across many sectors[2]. To facilitate the development of new enabling technologies and feed the innovation pipeline, transformative research themes must be identified and supported from an early exploratory stage to demonstrations in pilot applications. Furthermore, emerging, often interdisciplinary, communities need to be assisted to reach the critical mass enabling them to systematically develop and mature promising technologies. The goal is to bring emerging enabling technologies to levels of maturity that allow inclusion into industrial research and innovation roadmaps.

BROAD LINES:

- support for future and emerging trends in key enabling technologies;
- support for emerging communities involving a human centered-approach from the outset;
- assessing the disruptive potential of new emerging industrial technologies, and their impact on people, industry, society and the environment, building interfaces with industrial roadmaps;
- broaden the industrial basis for adopting technologies and innovation with breakthrough potential, including development of human resources and in the global context.

4.2.4. Advanced Materials

The EU is a global leader in advanced materials and associated processes, which make up 20% of its industry base and form the root of nearly all value chains through the transformation of raw materials. To remain competitive and meet citizens' needs for sustainable, safe and advanced materials, the EU must invest in research for novel materials, including bio-based ones and resource efficient innovative building materials, and must improve the durability and recyclability of materials, reduce the carbon and environmental footprint, and drive cross-sectoral industrial innovation by supporting new applications in all industry sectors. Furthermore, advanced materials have a tremendous impact regarding citizens' needs.

BROAD LINES:

- Materials (including polymers, bio-, nano-, two-dimensional, smart and multi-materials (including lignocelluloses), composites, metals and alloys) and advanced materials (e.g. quantum, responsive, photonic and superconducting materials) designed with new properties and functionalisation and meeting regulatory requirements (while not leading to increased environmental pressures during their whole life-cycle, from production to use or end-of-life);
- Integrated materials processes and production following a customer-oriented and ethical approach, including pre-normative activities and life-cycle assessment, sourcing and management of raw materials, durability, reusability and recyclability, safety, risk assessment for human health and environment and risk management;
- Advanced materials enablers like characterisation (e.g. for quality assurance), modelling and simulation, piloting and upscaling;

[2] "Re-finding industry - defining innovation" Report of the High-Level Strategy Group on Industrial Technologies, Brussels April 2018.

- An EU innovation ecosystem of technology infrastructures[3], networked and accessible to all relevant stakeholders, identified and prioritised in agreement with Member States, which provide services to accelerate technological transformation and uptake by EU industry, notably by SMEs; this will cover all key technologies necessary to enable innovations in the field of materials;
- Solutions based on advanced materials for cultural heritage, design, architecture and general creativity, with a strong user orientation, for adding value to industrial sectors and the creative industries.

4.2.5. Artificial Intelligence and Robotics

Making any object and device intelligent and connected is one of the megatrends. Researchers and innovators developing Artificial Intelligence (AI) and offering applications in Robotics and other areas will be key drivers of future economic and productivity growth. Many sectors including health, manufacturing, ship-building, construction, service industries and farming will use and further develop this key enabling technology, in other parts of the Framework Programme. AI developments must be conducted openly across the EU, ensure the safety, the societal and environmental soundness of AI-based applications, consider ethical aspects from the outset, assess the risks and mitigate its potential for malicious use and unintended discrimination such as gender, racial or disability bias. It must also be ensured that AI is developed within a well-coordinated framework which respects the EU's values, ethical principles and the Charter of Fundamental Rights of the European Union. This Programme will be complemented by activities set out under the Digital Europe Programme.

BROAD LINES:

- Enabling AI technologies such as explainable AI, ethical AI, human-controlled AI, unsupervised machine learning and data efficiency and advanced human-machine and machine-machine interactions;
- Safe, smart, collaborative and efficient robotics and complex embodied and autonomous systems;
- Human-centric AI technologies for AI-based solutions;
- Developing and networking the research competences in the area of AI across Europe under an open collaborative perspective while also developing the capacity for closed testing;
- The employment of AI and robotics to support people affected by disability, and inclusion of marginalised individuals;
- Technologies for open AI platforms including software algorithms, data repositories, agent-based systems, robotics and autonomous systems platforms.

4.2.6. Next Generation Internet

The Internet has become a key enabler of the digital transformation of all sectors of our economy and society. The EU needs to take the lead in driving the next generation Internet towards a human-centric ecosystem in line with our social and ethical values. Investing in technologies and software for the Next Generation Internet will improve EU industrial competitiveness in the global economy. Optimising EU

[3] These are public or private facilities that provide resources and services primarily for the European industry to test, validate and demonstrate key enabling technologies and products. Such infrastructures may be single sited, virtual or distributed, and must be registered in a Member State or a third country associated to the Programme.

wide take up will require large-scale cooperation across stakeholders. Ethical norms regulating next-generation internet should be also considered.

BROAD LINES:

- Technologies and systems for trusted and energy-efficient smart network and service infrastructures (connectivity beyond 5G, software defined infrastructures, Internet of things, systems of systems, cloud infrastructures, next generation optical networks, quantum, cognitive clouds and quantum internet, integration of Satellite Communications), enabling real-time capabilities, virtualisation and decentralised management (ultrafast and flexible radio, edge computing, shared contexts and knowledge) to ensure scalable, efficient, reliable and trustworthy network performance suited for massive service deployment;
- Next Generation Internet applications and services for consumers, industry and society building on trust, fairness, interoperability, better user control of data, transparent language access, new multi modal interaction concepts, inclusive and highly personalised access to objects, information and content, including immersive and trustworthy media, social media and social networking as well as business models for transactions and services over shared infrastructures;
- Software-based middleware, including distributed ledger technologies such as blockchains, working in highly distributed environments, facilitating data mapping and data transfer across hybrid infrastructures with inherent data protection, embedding artificial intelligence, data analytics, security and control in Internet applications and services predicated on the free flow of data and knowledge;

4.2.7. Advanced Computing and Big Data

High Performance Computing and Big Data have become indispensable in the new global data economy, where to out-compute is to out-compete. High Performance Computing and Big Data analytics shall be encouraged throughout the EU and are critical to support policy making, scientific leadership, innovation and industrial competitiveness, and to maintain national sovereignty while respecting ethical issues. These activities will be complemented by activities under the Digital Europe Programme.

BROAD LINES:

- High Performance Computing (HPC): next generation of key exascale and post-exascale technologies and systems (e.g. low-power microprocessors, software, system integration); algorithms, codes and applications, and analytic tools and test-beds; industrial pilot test-beds and services; supporting research and innovation for and preferably participation by all the Member States a world-class HPC infrastructure, including the first hybrid HPC/Quantum computing infrastructures and for shared services in the EU;
- Big Data: Extreme-performance data analytics; "Privacy by design" in the analysis of personal and confidential Big Data; technologies for full-scale data platforms for re-use of industrial, personal and open data; data management, interoperability and linking tools; data applications for global challenges; methods for data science;
- Reduced carbon footprint of ICT processes, covering hardware, architecture, communication protocols, software, sensors, networks, storage and data centres, and including standardised assessments.

4.2.7. Advanced Computing and Big Data

High Performance Computing and Big Data have become indispensable in the new global data economy, where to out-compute is to out-compete. High Performance Computing and Big Data analytics shall be encouraged throughout the EU and are critical to support policy making, scientific leadership, innovation and industrial competitiveness, and to maintain national sovereignty while respecting ethical issues. These activities will be complemented by activities under the Digital Europe Programme.

BROAD LINES:

- High Performance Computing (HPC): next generation of key exascale and post-exascale technologies and systems (e.g. low-power microprocessors, software, system integration); algorithms, codes and applications, and analytic tools and test-beds; industrial pilot test-beds and services; supporting research and innovation for and preferably participation by all the Member States a world-class HPC infrastructure, including the first hybrid HPC/Quantum computing infrastructures and for shared services in the EU;
- Big Data: Extreme-performance data analytics; "Privacy by design" in the analysis of personal and confidential Big Data; technologies for full-scale data platforms for re-use of industrial, personal and open data; data management, interoperability and linking tools; data applications for global challenges; methods for data science;
- Reduced carbon footprint of ICT processes, covering hardware, architecture, communication protocols, software, sensors, networks, storage and data centres, and including standardised assessments.

4.2.8. Circular Industries

Europe is at the forefront of the global transition towards a circular economy. Europe's industry should become a circular industry: the value of resources, materials and products should be maintained much longer compared to today, even opening up new value chains. Engagement of citizens is crucial.

Primary raw materials will continue to play an important role in the circular economy and attention must be paid to their sustainable sourcing, usage and production. Safe and sustainable materials cycles shall be ensured. In addition, entirely new materials, including bio-based materials, products and processes should be designed for circularity. Building a circular industry will have several advantages for Europe: It will lead to a secure, sustainable and affordable supply of raw materials, which will in turn protect the industry against scarcity of resources and price volatility. It will also create new business opportunities and innovative, more resource and energy efficient ways of production. Research and development focused on developing less hazardous substances will be encouraged and stimulated.

The objective is to develop affordable breakthrough innovations and deploy a combination of advanced technologies and processes so as to extract maximum value from all resources.

BROAD LINES:

- Industrial symbiosis with resource flows between plants across sectors and urban communities; processes and materials, to transport, transform, re-use and store resources, combining the valorisation of by-products, waste, waste-water and CO2;

- Valorisation and life-cycle assessment of materials and product streams with use of new alternative feedstocks, resource control, material tracking and sorting (including validated testing methods and tools for risk assessment for human health and environment);
- Eco-designed products, services and new business models for enhanced life-cycle performance, durability, upgradeability and ease of repair, dismantling, reuse and recycling;
- Effective recycling industry, maximising potential and safety of secondary materials and minimising pollution (non toxic material cycles), quality downgrading, and quantity dropouts after treatment;
- Elimination or, if no alternative, safe handling of substances of concern in the production and end-of-life phases; safe substitutes, and safe and cost-efficient production technologies;
- Sustainable supply and substitution of raw materials, including critical raw materials, covering the whole value chain.

4.2.9. Low-Carbon and Clean Industries

EU space systems and services reduce costs and improve efficiency, offer solutions to societal challenges, increase societal resilience, help monitoring and fighting climate change and foster a competitive and sustainable economy. EU support has been instrumental in helping to realise these benefits and impacts. Research and innovation activities should also support the evolution of the Union Space Programme which must remain at the forefront.

The EU will support synergies between space and key enabling technologies (advanced manufacturing, Internet of Things, big data, photonics, quantum technologies, robotics and artificial intelligence); foster a thriving and entrepreneurial and competitive upstream and downstream space sector, including industry and SMEs; boost application of space technologies, data and services in other sectors and help secure technological non-dependence in accessing and using space in a strategic, safe and secure manner; and will promote capacity building measures. Activities will be generally roadmap-based, taking account of the ESA harmonisation process and relevant Member States initiatives, and will be implemented with ESA and the EU Agency for the Space Programme, in accordance with the Regulation establishing the Space Programme for the European Union. However, the space part will also support bottom up calls to allow the emergence of future space technologies.

There is a need for a wider deployment, exploitation and update of new technologies and continued research and innovation to address gaps in Earth Observation (EO) on land and sea and in the atmosphere (e.g. healthy oceans and seas, ecosystem protection), benefiting from Copernicus and other relevant European programmes as essential sources and coordinating through the Global Earth Observation System of Systems (GEOSS) and its European component EuroGEOSS.

BROAD LINES:

- European Global Navigation Satellite Systems (Galileo and EGNOS): innovative applications, global uptake including international partners, solutions improving robustness, authentication, integrity of services, development of fundamental elements such as chipsets, receivers and antennas, sustainability of supply chains, at cost-effective and affordable conditions, new technologies (e.g. quantum technologies, optical links, reprogrammable payloads), towards sustained exploitation of services for impact on societal challenges. Next generation systems development for new challenges such as security or autonomous driving;
- European Earth Observation system (Copernicus): leveraging the full, free and open data policy, develop innovative applications, European and global uptake, including non-space actors and international partnerships, research needed to maintain, improve and expand core services and

research for space data assimilation and exploitation, robustness and evolution of services, sustainability of supply chains, sensors, systems and mission concepts (e.g. High Altitude Platforms, drones, light satellites); calibration and validation; sustained exploitation of services and impact on societal challenges; Earth observation data processing techniques, including big data, computing resources and algorithmic tools. Next generation systems development for challenges, such as climate change, polar and security; extension of the Copernicus product and service portfolio;

- Space Situational Awareness: developments to support robust EU capacity to monitor and forecast the state of the space environment e.g. space weather, including radiation hazards, space debris and near Earth objects. Developments of sensors technologies and new service concepts, such as space traffic management, applications and services to secure critical infrastructure in space and on Earth;
- Secure Satellite Communications for EU governmental actors: solutions supporting the EU's autonomy for governmental users including associated user equipment and architectural, technological and system solutions for space and ground infrastructure;
- Satellite Communications for citizens and businesses: integration of cost-effective, advanced satellite communications in the terrestrial networks to connect assets and people in underserved areas, as part of 5G-enabled ubiquitous connectivity, Internet of Things (IoT), and contributing to the Next Generation Internet (NGI) infrastructure. Enhancing the ground segment and user equipment, standardisation and interoperability, and preparation of quantum key communication by satellite to ensure EU industrial leadership;
- Non-dependence and sustainability of the supply chain: increased technology readiness levels in satellites and launchers; associated space and ground segments, and production and testing facilities in complementarity with ESA. To secure EU technological leadership and autonomy, improved supply chain sustainability at cost-effective and affordable conditions, reduced dependence on non-EU critical space technologies and improved knowledge of how space technologies can offer solutions to other industrial sectors and vice-versa;
- Space systems: in-orbit validation and demonstration services, including rideshare services for light satellites; space demonstrators in areas such as hybrid, smart or reconfigurable satellites, in-orbit servicing, manufacturing and assembly, energy supply using diversified sources; new industrial processes and production tools; ground systems; breakthrough innovations, and technology transfer, in areas such as recycling, green space, sustainable and peaceful use of space resources, artificial intelligence, robotics, digitisation, cost-efficiency, miniaturisation;
- Access to space: innovative technologies for increasing the technical compatibility and economic efficiency of European space launch systems, with regard to the launch of European Union satellites: low cost production processes, launcher reusability technologies and concepts for cost reduction; concepts for future launcher ground segments and adaptations of existing ground infrastructures (e.g. digitalisation, advanced data management); innovative space transportation services/concepts, including launch systems dedicated to light satellites (e.g. micro launchers), in complementarity with ESA.
- Space science: exploitation of scientific data delivered by scientific and exploration missions, combined with the development of innovative instruments in an international and interdisciplinary environment; contribution to precursor scientific missions for the evolution of the Space Programme.