EU Space Research and Innovation 2.0

Preparing (for) the Future Space Ecosystem

Daniel Nölke • Innovation and New Space – Space Defence • DG DEFIS • European Commission

Introducing EU-funded space R&I

- Space is a **dynamically changing domain** marked by growing competition and major technology advances
- The EU space sector requires **continued, smart and coordinated investments**
- Horizon Europe (2021-27) has a budget of €95 billion, with close to **€1.6 billion dedicated to space research**
- Space entrepreneurship is supported by the CASSINI initiative with **€1 billion VC fund** and other activities
- Space R&I actions and projects are implemented
  - by the Health and Digital Executive Agency (**HaDEA**),
  - the EU Agency for the Space Programme (**EUSPA**),
  - the European Space Agency (**ESA**) and
  - the **European Commission**

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“This is not about closing the door to our partners. It is about developing and maintaining our infrastructures, technologies, skills, competences, and reducing critical dependencies on third countries, so we can rely on our own if necessary.”

Commissioner Thierry Breton,
22 January 2020

“Europe is already a major player in space. If we want to be stronger and more self-confident on the global landscape, we must also be stronger in space. [...] Developing our space reinforce our strategic autonomy sector will help us– goal number one of our generation, in my view.”

Charles Michel, President of the European Council
13th European Space Conference 2021

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EU-funded space R&I focuses on

Consolidating EU flagship programmes: Copernicus, Galileo/EGNOS, IRIS², SSA, GOVSATCOM,

Fostering competitiveness and **technological non-dependency** of the EU space sector

Developing **new downstream applications** leveraging the synergies of all EU Space Programme components

Supporting Space Entrepreneurship in business acceleration and technology development from low TRL up to market uptake.

Providing independent European **Access to Space**, including through the emergence of new launch systems

Enabling in-space operations & services such as on-orbit servicing, assembly, debris removal, or logistics services

Advancing future technologies such as quantum, robotics and propulsion technologies, AI/ML, space weather and space science

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Evolution of Galileo and EGNOS infrastructure

Ensuring independent and state-of-the-art services for European citizens and businesses

- Today, the use of a Global Navigation Satellite System (GNSS) **is deeply ingrained in our everyday lives**
- The European GNSS encompasses
  - **Galileo**, a state-of-the-art global satellite navigation system
  - **EGNOS**, a regional satellite-based augmentation system
- Both services create **extensive socio-economic benefits** through a range of applications spanning numerous markets
- The Galileo infrastructure evolves with the arrival of the second generation of Galileo (G2G) satellites
  - **Enabling diversification** of downstream applications
  - **Strengthening the robustness** with frequency diversity, increased power, signal encryption & authentication features
  - **Increasing the accuracy** in time and position

Preparing the new generations on a user-driven basis, considering the technological progress

Addressing the vulnerability of the European supply chain by supporting the R&I of critical space components and technologies

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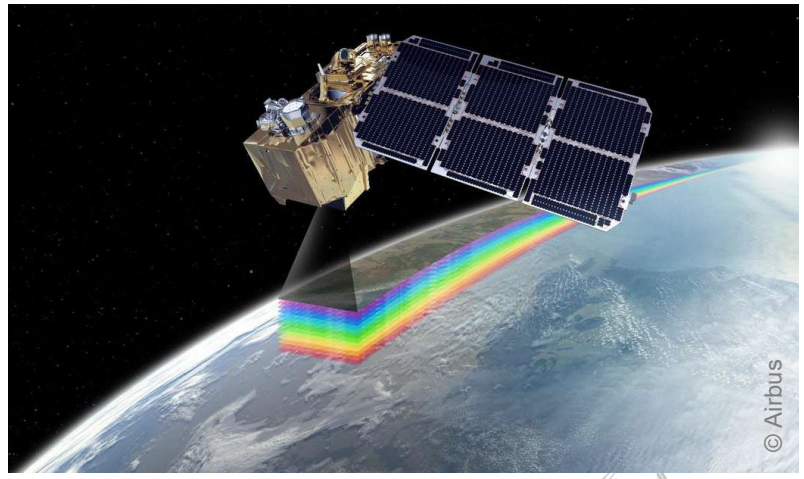
Copernicus: Earth Observation serving society

Extended capabilities for the benefit of Europe's citizens

- Through Earth Observation (EO) satellites the **status of and changes in Earth's systems** can be monitored and assessed
- Copernicus serves as an independent and powerful European EO solution with services to **benefit all European citizens**
- Its own fleet of Earth observation satellites (Sentinels) **provides global data free of charge**
- Additionally, the commercial market demand for EO products is expected to grow quickly in the next years with a focus on
  - Advanced, very high-resolution satellite imagery and
  - Affordable, high-resolution, high-revisit products

Preparing the evolution and expansion of Copernicus to address EU policy and user needs

Underpin competitiveness and contribute to the integration of space into society and the economy



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EGNSS and Copernicus applications

Why funding EGNSS and Copernicus applications is needed

- R&I is necessary to **strengthen and evolve** European space assets and value-added services using their synergies
- Activities target **innovative applications** in

Agriculture: Optimisation of fertiliser, fuel, pesticide and water use, assurance of food security and traceability

Security and emergency: Provision of crucial information and assistance in disaster mitigation, prepardness & recovery,

Digital innovation: Applications supporting smart cities, urban planning, smart waste management

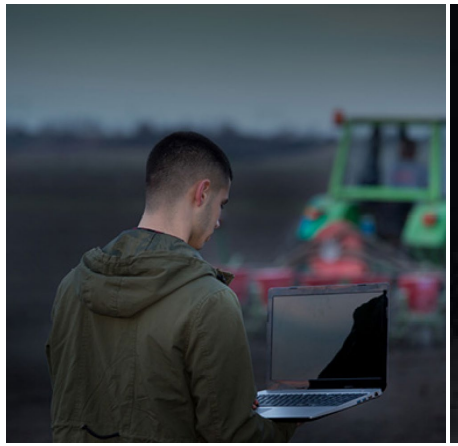
Climate change: Monitoring Earth's changes and support the supply of clean, affordable and secure renewable energy

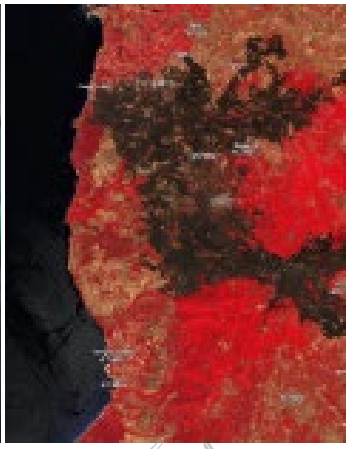
Health: Forecasting UV radiation or air pollution levels enable the use of autonomous robots in support of humans

Provide Europe with cutting-edge space-based services

Evolve and improve to continue responding to today's evolving challenges and market needs

Build a dynamic and innovative downstream ecosystem in Europe





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Access to Space

Why access to space is crucial for European competitiveness in space

- Access to space is **strategic for Europe**
- (Micro-) Launcher are a globally **ultra-competitive environment**
- Necessity to support a cost-efficient, responsive and **flexible access to space**
- Horizon Europe programme has **four R&I priorities**:
  - **Innovation for launcher competitiveness** – targeting initial operational capability by 2030
  - **Disruptive concepts for access to space** – starting at low technological readiness levels
  - Fostering and enabling **new commercial space transportation** solutions
  - Modern, flexible and efficient European **test, production and launch facilities**, means and tools

Rapidly improve launch competitiveness, in terms of cost and increased flexibility

Stimulate the development of new space transportation solutions, including through the emergence of new launch systems

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Future Space Ecosystem (FSE)

Act in space is crucial for EU competitiveness, sustainability, strategic autonomy, non-dependency and preserves EU's freedom of action in space

- Act in space is **strategic for Europe**
- Necessity to **support key enabling technologies and capabilities** for in-space operations & services increasing the operations flexibility, service life, system reliability, safety, economy, performance and function
- Under Horizon 2020, the Commission launched two Strategic Research Clusters:
  - **PERASPERA** in Space Robotics Technologies
  - **EPIC** in Electric Propulsion
- Horizon Europe programme has **three R&I priorities**:
  - **On-Orbit Servicing/Assembly/Manufacturing** (OSAM) technologies
  - **In-Space Services** incl. logistics, warehousing and disassembly/reuse/recycling
  - **New system concepts and functional building blocks**, tools required for design and new approaches for production and testing

Highly automated, flexible, sustainable and economically viable space infrastructure enabling growth of innovative applications and competitive services

Stimulate the development of in-space services and related technologies

Critical Space Technologies for European non-dependency

Supporting the development of critical space components, systems and technologies

- Space increasingly represents an **invaluable asset in many sensitive and high-stakes matters**
- COVID-19 pandemic has shown the necessity to **strengthen Europe's industrial base**
- Space-grade electronic devices and other space systems are **often subject to restrictive trade rules**
- To be non-dependent with a resilient and flexible supply chain, Europe has to develop its **own domestic production of critical technologies**

Achieving strategic autonomy while preserving an open economy is a key objective of the EU and calls for developing EU autonomy in the space sector.

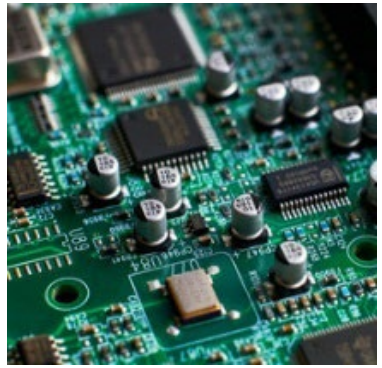
(EU Council conclusions, EUCO 13/20 Oct 2020)

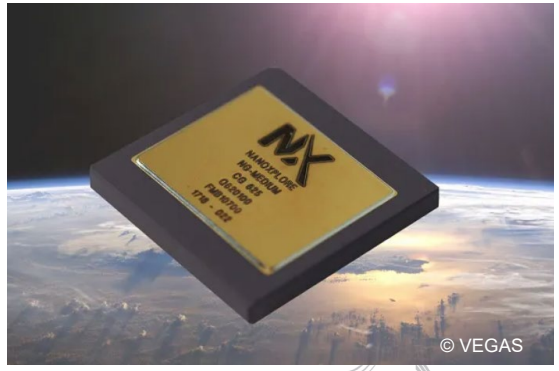
Reduce the dependence on critical technologies and capabilities

Develop or regain in the medium term the EU capacity to **operate independently** in space

Enhance the technical capabilities and overall competitiveness of European space industry

Open new competition opportunities for European manufacturers





In-Orbit Demonstration and Validation (IOD/IOV)

New technological developments and innovations tested in orbit

- Validating concepts and testing innovative technologies in real conditions **accelerates their entry into the market**
- In-orbit testing is a costly and complex endeavour resulting in the infamous "**valley of death**" for many innovators
- This is why the EU started the **IOD/IOV initiative** enabling new technologies to be tested in orbit
- **1st call 2018, 2nd call 2020**
  - 100+ proposals from various European entities
  - Technology innovation for EO, PNT, SatCom, STM and more
  - The first selected IOD/IOV experiment **UPMSat-2** was launched incl. six innovative payloads

Ensure the global competitiveness by allowing technologies to be effectively tested in orbit

Provide cost-effective services based on EU solutions

Prepare a generation of European engineers with hands-on experience

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NewSpace and European Entrepreneurship

CASSINI (HE Pillar 2) and EIC Actions (HE Pillar 3)

The **CASSINI Actions** covers the whole entrepreneurship cycle:

- **Cassini Facility** deploys a 1€ B investment for Venture Capital funds interested in investing in EU-based companies in the space sector (up- and downstream)
- **CASSINI Matchmaking** supports start-ups, scale-ups and SMEs by connecting them with potential investors and/or corporate partners
- The **IOD/IOV** service enables new technologies to be tested in orbit
- **CASSINI Business Accelerator** seeds grant and six months of business acceleration for space-based start ups
- **CASSINI Prizes** trigger entrepreneurs to develop close-to-market digital applications based on EU space data
- EU-wide **CASSINI Hackathons**: an opportunity to stimulate entrepreneurship and to develop ideas for digital applications building on space data

The **EIC Actions** identifies & develops breakthrough technologies:

- The EIC Pathfinder & Transition programmes support **research teams exploring bold ideas at low TRLs** for radically new & emerging breakthrough technologies, with grants of up to 4€ M
- Providing **grant funding and equity investments** for individual start-ups and small companies with TRLs above 5 to develop and scale up innovations

Total HE budget
10€ B

Action budget
0.5-15€ M

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Evoling towards Space R&I 2.0
The new Strategy for EU Space R&I
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What‘s the main purpose of the evolution?

EU’s investment in Space Research and Innovation is **key for preparing the future space ecosystem**

R&I investments must be made **strategically and with foresight** in order to have a meaningful impact and to preserve freedom of action in space

Provision of a vision and common orientation as well as to increase complementarity and efficiency in the use of public funding

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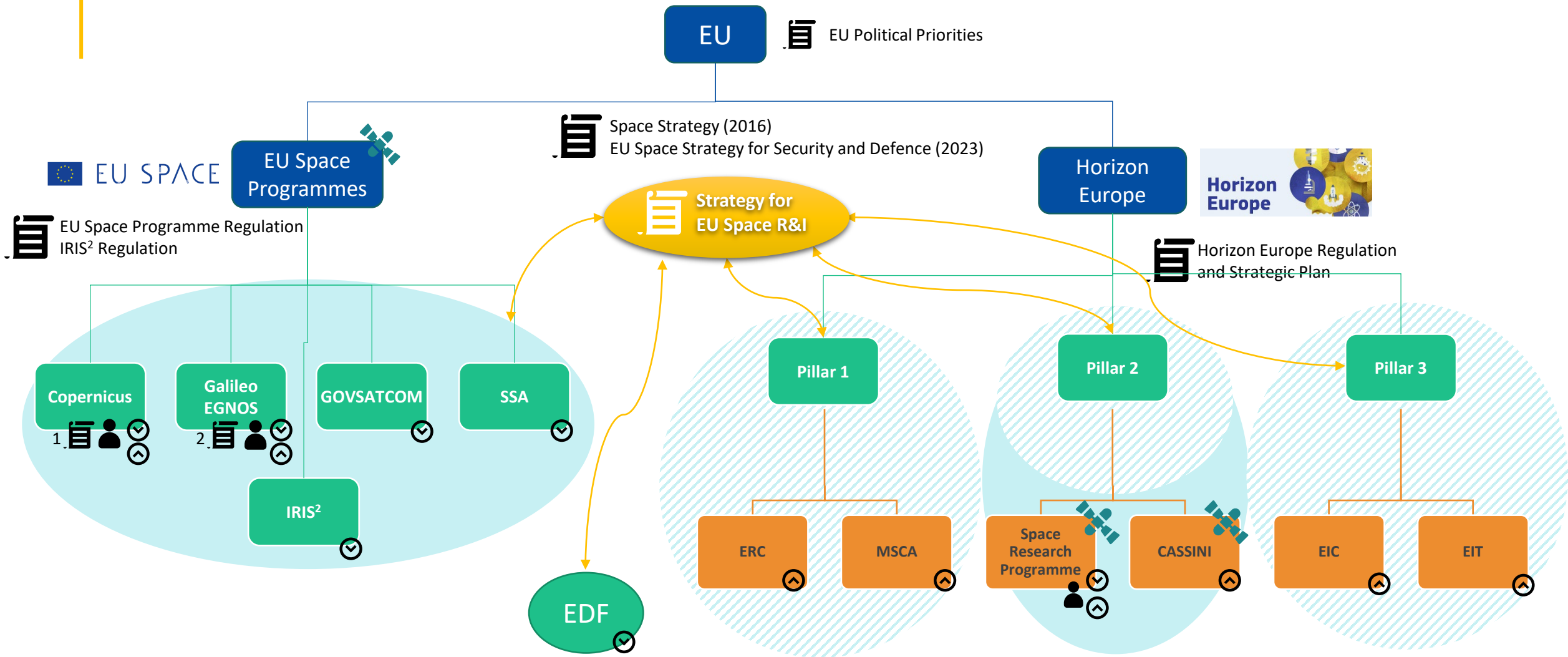
Space at the European Commission



Bottom-Up approach
Top-down approach
Consultation
Relevant documents
Space focus

ERC = European Research Council, MSCA = Marie Skłodowska-Curie Actions, EIC = European Innovation Council, EIT = European Institute for Innovation and Technology
1 Copernicus User Forum
2 EGNSS Upstream R&D Strategic framework

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Objectives of the Strategy for EU Space R&I

- Provide mid-long-term perspective for the EU
- Make space R&I a business case – provide reasonable recommendations for EU decision makers
- Identify future space R&I priorities for the EU to become a Space Power
- Reply to policy and stakeholder needs
- Provide an ambitious future-oriented space R&I agenda
- Address the different EU Space R&I areas in a comprehensive way
- Break silos - enhance use of synergies and coordination of actions

EU Space R&I Areas

Draft version

EU Space R&I

Horizon Europe • Pillar 1

Frontier Research, Science & Basic Technologies

ERC

- Systems and communications engineering (PE7)
- Products and processes engineering (PE8)
- Universe science (PE9)
- Earth system science (PE10)
- Materials Engineering (PE11)
- Computer Science and Informatics (PE6)
- Medical and bio-technologies (LS7, LS9)
- ERC Synergy Grants

MSCA

- Doctoral Networks
- Postdoctoral Fellowships

Horizon Europe • Pillar 2

EU Space Programmes R&I

- EGNSS Infrastructure evolution
- EGNSS Applications & data services
- GOVSATCOM Infrastructure evolution
- GOVSATCOM Applications & data services
- Copernicus Services evolution
- Copernicus Downstream applications
- SSA Infrastructure evolution
- SSA Applications & data services
- IRIS² Infrastructure evolution
- IRIS² Applications & data services

Space Technologies, Capabilities, Applications & Pathfinder Missions

- Launch Systems & Services
- In-Space Operations & Services
- Enabling Technologies
- Critical Space Technologies for EU non-dependence
- Science & Exploration
- Pathfinder Missions

R&I Booster

- Education and Skills
- CASSINI & Space Entrepreneurship
- IOD/V Service
- International Cooperation

Horizon Europe • Pillar 3

Game-changing Innovations & Market Uptake

Pathfinder · Transition · Accelerator

- Innovative In-Space Applications & Sustainability
- Innovative Space Technologies & Systems
- Exploration

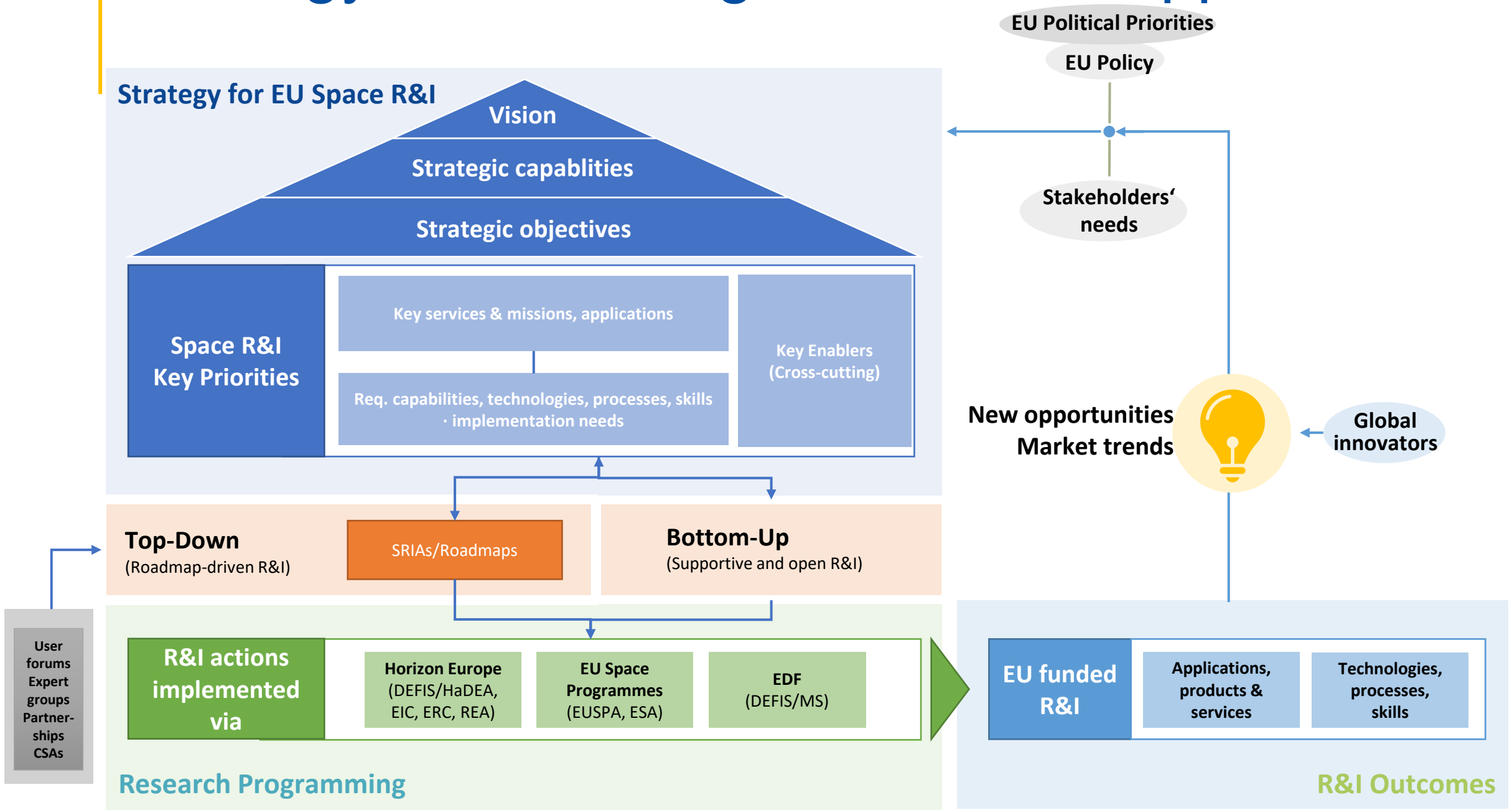
- Prizes
- EIC Business Accelerator

EDF

Space

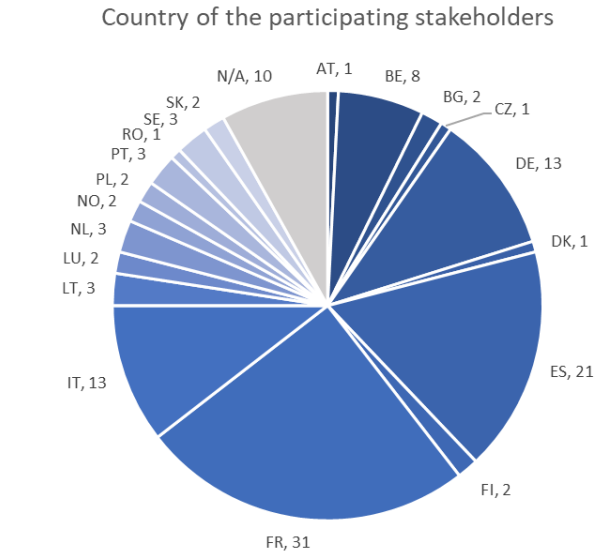
- Earth Observation for ISR applications
- Space Situational Awareness and early warning
- Space data processing
- Positioning, navigation, timing, navigation warfare
- Secure and robust communication
- Responsive space systems

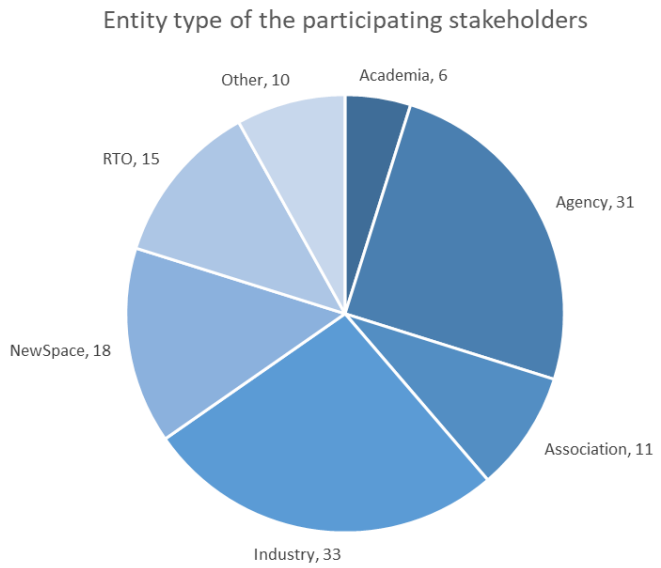
Strategy introduces goal-oriented approach



Consultation outcomes

- **250+ technology topics in the different R&I areas**
- **14 critical and enabling technology domains**
- **7 raw and advanced materials domains**
- **20 diverse skill sets of fresh graduate profiles**
- **20+ implementation needs**
- **20+ ideas and comments on current and future funding tools**
- **25 aspects related to synergies**





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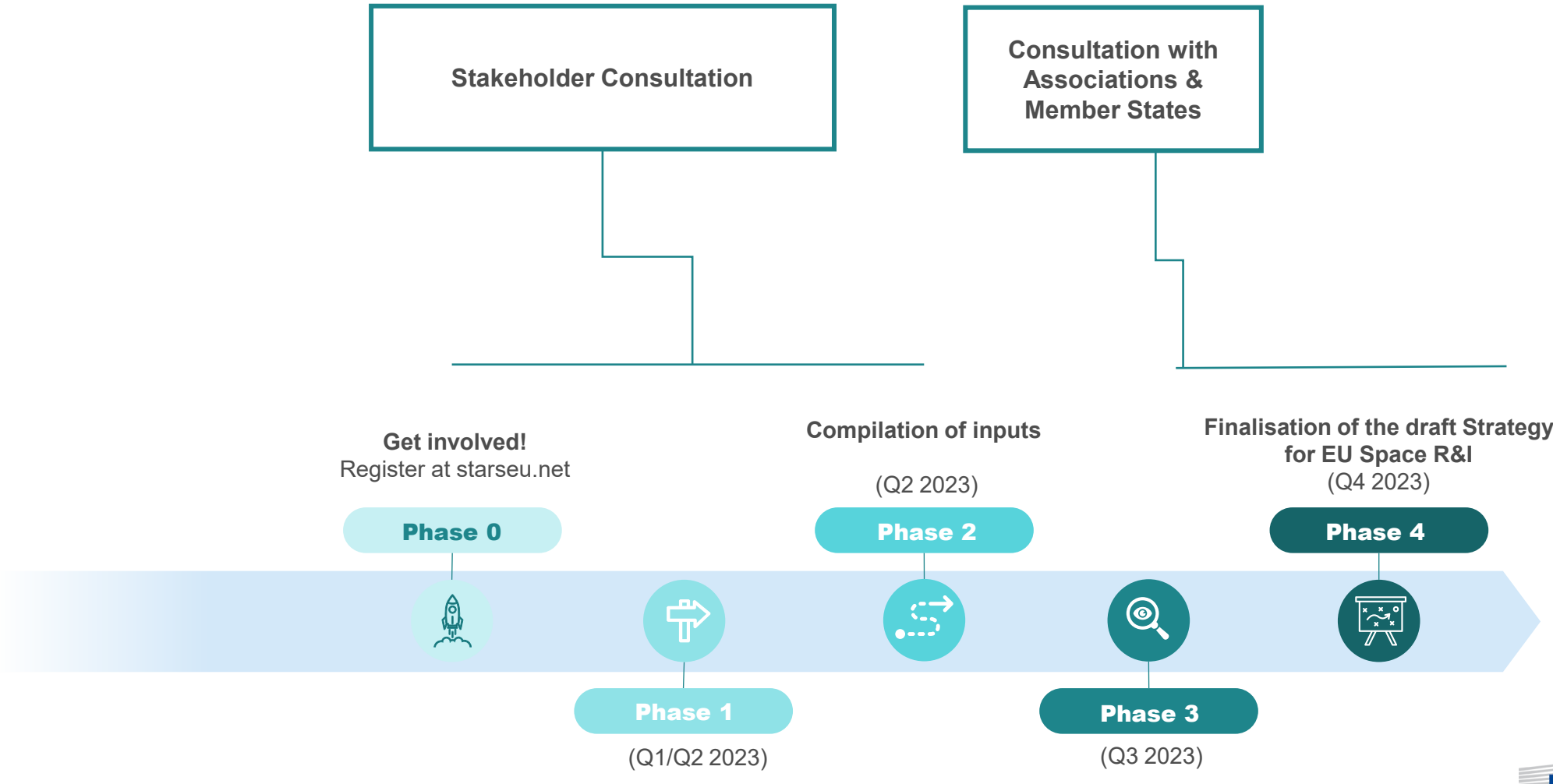
Main steps towards the strategy



Be part of EU-funded space R&I

Horizon Europe funding supports space R&I from fundamental science to close-to-market technologies

Pillar 1: Excellence Science

Marie Skłodowska-Curie Actions (MSCA) targeting doctoral education and postdoctoral training

European Research Council (ERC) supporting frontier scientific research in Europe.

Research infrastructures (RI) aiming at world-class sustainable research infrastructures

Pillar 2: Global challenges and EU Industrial Competitiveness

Digital, Industry and Space aiming to boost key technologies and solutions underpinning EU policies & Sustainable Development Goals (SDGs)

CASSINI entrepreneurship initiative supporting the European New Space ecosystem covering the whole entrepreneurship cycle

Pillar 3: Innovative Europe

European Innovation Council (EIC) supporting game-changing innovations throughout the lifecycle, from early-stage research to proof of concept, technology transfer, and the financing and scale-up of start-ups and SMEs

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For more information visit
https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-research_en
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