

The ESA Director General's Proposal on

**Lifting Europe's Ambitions for a Green and Sustainable Future,
Access to Space and Space Exploration**

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1. Introduction and context: ESA - The Agency at the heart of Europe's space ambitions

The Space Summit in November 2023 shall be the occasion for the Ministers of ESA Member States to take a further step forward in shaping the future of Europe in space, on the basis of the Intermediate Ministerial Meeting 2021 in Matosinhos, the Toulouse 2022 Space Summit, including the address by the President of the French Republic Emmanuel Macron, and the Council at Ministerial level 2022 (CM22) in Paris.

Against this background, the Director General proposes two themes for this Council meeting: ESA driving space for our green future and ESA driving European space ambitions and modernising the implementation of its programmes. They cover, on the one hand, space for climate action, green transformation and crisis response, as well as a sustainable space sector and sustainability in space. On the other hand, guaranteeing Europe's access to space, as well as new ambitions and next steps for space exploration are dealt with. These elements of the Director General's Proposal can be based on the Agency's successful programmes, competences and achievements.

The new space age is a time of discovery and opportunity alike, as space becomes ever more available for a multitude of actors transforming it at rapid pace into the next global area of influence. Certainty exists that Europe must capitalise on these dynamics to generate and secure prosperity, competitive advantage and talent. ESA

will play, at the service of the Member States, on its strengths and ambitions to innovate, develop, enable and foster the potential of space on Earth, in orbit and beyond. It is thus time for ESA to unlock the full potential of space, lifting Europe's ambitions for a Green Future, Access to Space and Space Exploration. This is based on the conviction that the Agency is instrumental, central and indispensable to the collective effort of realising and strengthening Europe as a space power that shapes and embraces the transformation of the space sector. It is in this spirit, that the Director General intends to propose an "ESA 2040" Strategy to be prepared together with Member States Council in view of the Council Meeting at Ministerial level in 2025 (CM25).

The recent decisions of ESA Council, meeting at Ministerial level in 2022, have to be regarded as a strong sign of resolve on this unfolding path, pushing their implementation in an effective and efficient manner. This includes the importance for European actors to work together in a concerted and synergetic manner for collectively realising the ambition of Europe as a space power. ESA has a key role in identifying, developing and executing European programmes and partnerships through its recognised expertise, capabilities and role as the space system developer by offering effectiveness, certainty and flexibility for all Member States and by implementing EU programmes and furthermore reliably managing programmes of its Member States. This also implies the possibility for all ESA Member States to bring value to, and benefit from, all phases of such partnership and programmes while preserving the interests and respecting the roles and the institutional frameworks of the respective organizations.

In order to be successful today and in the future, ESA is continuing its transformation as it capitalises on more than five decades of success in space, able to motivate and realise new ambitions and to respond to the changing challenges of this domain, boosting European industry, contributing to European integration, and to further innovation and modernisation. As such, ESA intends to strengthen its role and relevance as a leading international organisation at the heart of the European space sector.

The ambition of Europe as a space power is expressly supported by ESA, realising autonomous capacities and possibilities in areas of strategic importance and in an international context of cooperation. We are firmly committed to continue engaging in value-based international space cooperation in a changing world, exploring and using outer space peacefully, with respect for the rule of law, and for the benefit of citizens, society and nature. The competence and capacities of ESA form the basis for it to continue contributing to the practice and development of rules and norms, assisting in space legislation, shaping space standardisation and carrying out its missions in a responsible and sustainable manner for the collective benefit of the international community.

ESA embraces the momentous occasion for the space sector brought by commercialisation and service-based approaches, which complement the traditional spaceflight and space applications portfolio and open previously unforeseen and unexpected possibilities. While strongly promoting these developments, we are facilitating a balanced blend of public and private sector participation, ensuring service demand and provision, unlocking new commercial potential, inter alia by revisiting and refining, together with the Member States, partnership models and procurement methods.

The purpose and roles of ESA under the Convention, as an intergovernmental cooperation and integration mechanism and a space actor, make it a unique tool for the Member States in this new space age.

2. ESA driving space for our green future

The space sector, both in Europe and globally, is undergoing a profound transformation with significant opportunities and challenges in relation to sustainability and especially a green and climate-resilient future. Agenda 2025 set out a vision for Europe to maintain and expand its excellence in space, for the benefit of everyone on Earth and in Europe. In particular, it argued that space must play an ever-stronger role in tackling the climate crisis - the most urgent challenge faced by humanity, affecting every region, continent, and ocean on Earth.

The relationship between space actors and current and potential users of space-based applications is evolving. Driven by disruptive innovation, synergies and dependencies between space and user sectors are deepening. These developments offer new opportunities to boost the value of space for society and the economy. As underlined by ESA's Member States in the Matosinhos Manifesto and the Council Resolution agreed in Paris in November 2022, the development of new space solutions and their adoption in sectors ranging from energy infrastructure to the digital economy, must be accelerated to ensure that space supports European efforts to tackle urgent challenges stemming in particular from climate change for the benefit of Europe and its citizens at large.

In pursuit of this vision, ESA must contribute future-defining initiatives, including development of ambitious missions, providing effective responses to urgent global challenges associated with the green transition towards carbon neutrality, as well as initiatives for greener space activities.

Serving the climate-related policies and goals of its Member States, ESA will continue to support climate action and the green transition on Earth and in Space and, in doing so, ensure that the European space sector is leading globally in these domains.

ESA also aims to foster the development of European capabilities in space-related technologies in synergy with EU policies and action plans to ensure a greener and safer future for Europe. For this purpose, ESA is building new strategic partnerships with the EU to strengthen synergies and avoid duplication of efforts, while leveraging established roles and responsibilities.

ESA strives towards the following ambitions:

- Continuing to develop cutting-edge, ambitious, and innovative missions delivering one-of-a-kind capabilities to address climate-related issues and to foster better usage of already existing data.
- Boosting the European space sector's role in the development of space-based contributions to the Green Transition, in line with national and European-level net-zero objectives by 2050 and embedding the space sector in Green Transition agendas.

- Significantly enhancing the European space sector's contribution to the implementation of the Paris Agreement, national green policies, and the European Green Deal.
- Fostering the development and the wide adoption of commercially sustainable integrated space-based solutions addressing the challenges and opportunities of the Green Transition in the main non-space greenhouse gas (GHG) generating sectors.
- Significantly enhancing the contribution of space solutions to support the Sendai Framework for Disaster Risk Reduction, for the substantial reduction of economic losses as well as losses in lives, livelihoods, and health due to climate induced crises.
- Fostering a socially and environmentally responsible management of European space sector activities, in line with the commitment in Agenda 2025 and the Statement for a Responsible Space Sector opened for signature at the occasion of CM22.
- Contributing to European leadership in the development of a sustainable and responsible space by implementing a Zero Debris approach by 2030.

ESA has played a key role in the development of world-class space application programmes, including those of the EU Space Programme, which directly contribute to climate resilience, while also delivering societal benefits and supporting sustainable economic development. ESA, through investments of Member States, will continue to develop ambitious missions delivering expanded capabilities to address climate issues, such as next-generation gravity missions, which will provide critical missing information on the water cycle, water resources – including underground, and in general redistribution of masses in the Earth system. ESA is also carrying out an ambitious space safety programme to support Member States' and, on their behalf, its own goals for a green and sustainable space sector.

ESA is furthermore implementing a growing portfolio of development and demonstration projects focused on climate, green transition, and resilience on Earth and in space. In the coming years, ESA will endeavour to enlarge its activity portfolio with ambitious missions related to urgent climate action, decarbonisation and overall greening of society as well as addressing resilience to crises induced by climate impact and ensuring the sustainable use of space.

In particular, ESA is developing the new Accelerator approach, in line with the mandate given by Member States through the Matosinhos Manifesto:

- ESA is creating new collaborative frameworks with key actors on climate and climate-induced crisis challenges, to foster the development of a more impactful, accessible and user-driven space sector.
- These frameworks and eventual partnerships will enhance synergies between partners goals, instruments, resources, areas of expertise and capabilities, and will help develop commercial opportunities against key use cases and build investors' confidence in space innovation.
- By bridging space and user ecosystems, these frameworks will foster the development and uptake of effective space-enabled solutions, aligned with

societal and environmental policies, and delivering concrete results via mobilization of technical, financial and other resources, as appropriate.

- They will also enable an active participation of relevant international, European and national actors to ensure an effective and inclusive strategy and action.

2.1 Space for climate action, green transformation and reducing the impacts of crises on Earth

2.1.1 Space for climate action and green transformation

Climate change and environmental degradation are an existential threat to Europe and the world and the challenges are global and urgent. The latest Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, AR6) warns that the present pace and scale of climate action are insufficient to tackle climate change and suggests that, without further action, current policies are projected to lead to a temperature rise of about 3.2 degrees by the end of the century.

Climate change already affects all regions of the world. Ice sheets and glaciers are melting, and the sea is rising. Extreme weather events, including heatwaves, floods and droughts are increasing in frequency and intensity, severely affecting people and ecosystems. These extreme events demonstrate the urgent need for reducing GHG emissions but also mean that Europe must already prepare for and adapt to both the current effects of climate change and the predicted impacts in the future.

Innovation has a central role to play in addressing the climate crisis by providing the technologies and solutions that will enable and accelerate the transition of the economy and society to reach climate neutrality and to become more climate resilient. Access to actionable information is also fundamental to addressing the climate crisis and supporting knowledge-based policies and initiatives and their implementation. More and better data are required for this purpose as well as a deeper integration between green and digital transitions to foster the development of new solutions such as Digital Twins that leverage the latest digital technologies to boost our understanding of present and future climate impacts at planetary and local scale.

The space sector already plays a unique role in tackling climate change, from enabling climate monitoring and understanding Earth-systems science to providing concrete solutions for the green transition and climate action at national, European and global level. The programmes subscribed at CM22 play a major role in addressing the climate crisis and many of them continue existing programmes such as the development of the FutureEO Earth Explorers and support to the continued development of Copernicus, including on applications driven by the data delivered by these systems. In fact, ESA is already actively developing and delivering relevant space technologies and solutions:

- Prior to CM22, ESA had identified nearly 100 ongoing or planned activities relevant to the Green Transition and Sustainability across its programmes and technology portfolio.
- Currently available assets and services include the Copernicus Sentinels, ESA Earth Science missions (Earth Explorers and Scout missions supported by the FutureEO Programme), satellite-derived information including Essential

Climate Variables for assessment and tracking which result from the Climate Change Initiative and Climate Space, services stemming from EO Science for Society as well as information which will come from Destination Earth (DestinE) and Digital Twin Earth (DTE).

The proposals by ESA at CM25 in the area of Earth Observation will aim at sustaining these vital programmes in order to ensure continuity of the critical long-term data sets required to address climate and sustainability issues. Consideration will furthermore be given to centring some proposals around important thematic areas or initiatives which may emerge from the ongoing discussions with the science community as part of the update of the EO Science Strategy.

ESA is committed to maximising the value of Earth Observation in support of climate action, from mitigation to adaptation. With this goal, ESA will continue the development of high-value EO programmes and prepare ambitious future EO missions to address climate-related challenges, paving the way for pioneering green solutions. ESA will foster a targeted, user-centric and concerted effort to propose grand initiatives for a green future, including crucial elements such as next-generation gravity missions to observe change and transport of mass and heat, which will vastly expand EO capabilities in support of top climate priorities in the domain of water cycle and water resources management.

Encouraged by Member States to further improve the ambition and impact of space for green initiatives, ESA is developing the Space for a Green Future (S4GF) Accelerator with major public and private actors involved in Climate Action and the Green Transition and eager to leverage one another's complementary capabilities and competencies in policymaking, financing, innovation and user engagement to foster a fruitful cooperation between green and space ecosystems.

The S4GF Accelerator is establishing actionable partnerships with these actors to reinforce the role that space plays in support of their green goals and initiatives. Partners will jointly define green priorities and targets, identify new use cases, develop and demonstrate new space solutions and scale the impact of proven solutions for a green future. Under the S4GF Accelerator ESA will work with partners to:

- Develop an impactful and efficient cooperation framework.
- Prepare a joint strategy and cooperation plan.
- Define the priority issues to be addressed and the relevant instruments to be utilized.
- Explore and initiate immediate cooperation opportunities.

The outcome of this collaborative work will also help shape ESA's contribution to climate action and the green transition with a view to maximising the impact of space programmes in reaching net-zero objectives by 2050.

To ensure alignment with and delivery against national climate policies strategies and plans, ESA proposes that its Member States engage with the S4GF Accelerator through the direct involvement of a nominated lead national partner. Nominations will be sought through delegations. The Accelerator will also establish relations with relevant national and multilateral initiatives such as the Space Climate Observatory.

Sectorial Task Forces have been created in the context of the Business Applications and Space solutions programme with the purpose of defining priorities of specific vertical market sectors and user communities and inform possible ESA initiatives. At the same time, they offer solution providers the opportunity to foster adoption of space-based services and strengthen business sustainability. In the context of the S4GF Accelerator, they can be instrumental to foster a user centric and bottom-up approach by federating key representatives of industry and institutions from high greenhouse gas emitting sectors, at national, European and global level, with the aim of defining needs and priorities for achieving net-zero objectives. The Space for Smart and Green Cities Task Force, for instance, is federating the priorities of major cities and defining space solutions to address them while another task force on Innovation in Energy Through Space is focusing on priorities related to renewable energy, electric mobility planning, green hydrogen and alternative energy carriers, decarbonisation, etc. ESA aims to continue developing these Task Forces and to expand this approach to other relevant high-priority sectors. Each is open to new members and ESA Member States are invited to encourage national entities to participate.

The S4GF Accelerator is developing a portfolio of collaborative, user-driven and scalable seed activities for the development and demonstration of new space solutions for the Green Transition, including relevant activities in existing ESA programmes and exploitation of data from satellite missions developed by ESA and others; the topics addressed include decarbonisation, green transition information factories, and quantum missions for climate.

Funded by ESA's programme budgets, these ESA seed activities are reviewed in the relevant Programme Boards, as appropriate.

The Green Transition Information Factories (GTIF) provide an excellent example of the Accelerator Seed approach. GTIF-Austria is a precursor demonstrating how space-based information can be integrated to support transparent and quantitative analysis and decision making in line with national green transition priorities. Implemented by industry, the GTIF-Austria was co-designed with the Austrian Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Austrian Research Promotion Agency (FFG) who facilitated the dialogue with over 40 national green transition stakeholders and implementers. After a successful beta phase, the first version of the GTIF demonstrator was released in May 2023. ESA is now working on new GTIFs (national or regional) and developing an approach to scale up the GTIF concept at European level through the S4GF Accelerator. The support of Member States will be critical to this process.

Another example of a successful seed is IRIS, a satellite communication-based service for the aviation sector allowing to reduce the aviation environmental footprint. IRIS-related average CO₂ savings in Europe over the 2024–2040 timespan is estimated to be around 1.5-3 M tons/year. IRIS adoption in the market is increasing: easyJet has already signed an agreement, ITA Airways and others are planned to follow. Although the initiation of IRIS pre-dates the S4GF Accelerator it embodies the concept perfectly and the Accelerator will be used to help support its future scale up.

The progress, early results and potential of these Seeds will be presented at the Space Summit and the engagement of both transnational and national partners will be sought within the S4GF partnership to scale Seeds up more generally in order to deliver against key Green Transition objectives.

As the previous two examples, many more seeds related to commercial solutions for decarbonisation and Green Transition leveraging on space technologies have been so far developed through ESA programmes. The “Green Dossier” collects about 150 green applications supported by the Business Applications and Space Solutions (BASS) Programme since 2010, which have delivered commercial space-based solutions supporting decarbonization in different sectors such as agriculture, mobility, energy. An update of the Green Dossier will be issued at the time of the Space Summit with new figures related to the space contribution to the green transition and green economy.

More widely, green space-based technologies that are being developed in ESA in support the Green Transition will need the establishment of policy, legal and regulatory environments which recognise their potential and are fully open to space-based technical solutions. At the Space Summit ESA will also seek the support of its Member States to fully leverage the Accelerators to embed space in national, European, and international climate agendas and institutional landscapes.

To be achieved at the occasion of the Space Summit

- Acknowledge the increasing importance of space technologies, in particular Earth Observation, in addressing Climate issues and the need to ensure adequate resources to continue and expand provision of data and actionable information such as through ambitious new missions to address climate and natural resources issues.
- Encourage national Green Transition stakeholders to participate in the S4GF Accelerator and to facilitate the various cooperation mechanisms.
- Support ESA in its efforts to reach out to and cooperate with Green Transition partners as part of S4GF, in particular EU and international institutions.
- Support ESA in its efforts to foster the development of commercially sustainable integrated solutions addressing user and stakeholders needs in the main GHG generating sectors for addressing the Green Transition challenges.
- Support the up scaling of GTIF and other S4GF seeds to maximise their impact on Green Transition goals.

2.1.2 Reducing the impacts of crises on Earth

In addition to supporting the Green Transition, Space can play a much stronger role in supporting resilience in a world where climate induced crises such as floods and fires are threatening human life and prosperity ever more significantly.

Space already provides unique capabilities to address climate-related resilience challenges in particular through the Galileo and Copernicus services and collaborations such as the International Disaster Charter, enabling responders to make real-time decisions during crises and supporting planning and mitigation beforehand and recovery afterwards.

These capabilities have the potential to be enhanced, in full synergy with and complementing the existing national, EU and commercial European solutions and services, to a next generation level, supporting significantly more effective crisis response actions. In doing so they will take full advantage of the substantial augmentation of space-based communication and earth sensing satellites. Particular opportunities include:

- Orchestrating the combined capabilities of space, aerial and ground sensors to ensure comprehensive and permanent coverage over land, air and sea.
- Providing enhanced sensory data collection, advanced connectivity solutions and smart processing of data into actionable information.
- Turning data into information to take mitigating action prior to events, respond during an unfolding disaster and finally support the efficient recovery post crises; thereby
- Enabling a holistic solution and improving the coordination of efforts for better and more timely crisis management services, providing relevant information to the end user anywhere at any time.

The Civil Security from Space (CSS) programme that was adopted and subscribed at CM22 in particular addressing these opportunities and in particular the orchestrator function needed to make independent systems interoperable. Three initial projects that will be the first seeds for Rapid and Resilient Crisis Response (R3). Testing new innovations in 11 demonstrations to be completed by 2025 of 6 crisis response use cases (wildfires, flash floods, earthquakes, maritime safety, critical infrastructure monitoring and humanitarian aid).

In support of this work a User Consultation group and an Industry Association have been put in place in order to gather user needs, address the challenges and identify potential (existing, planned or future) solutions to address the wide range of climate induced hazards. The groups are composed of international organisations, national entities, industry and end users, all active in crisis management, and will support buildup of the Accelerator.

ESA has already undertaken many projects that address crises (e.g. for floods, fires, infrastructure protection or rescue & emergency) and a number of demonstrators have been developed. An analysis will be performed of those activities that can contribute to early demonstration of solutions and user engagement. Many ESA programmes in Earth observation, telecommunications, secure connectivity or navigation will be important contributors to the solutions addressing climate-induced crises.

The R3 Accelerator will aim to scale up successfully demonstrated solutions by forming partnerships with and between key transnational and national stakeholders, contributing to ubiquitous space-enabled crisis response infrastructure.

To be achieved at the occasion of the Space Summit

- Have the first partners (funders, user representatives or industry) engaged with the R3 initiative.
- Run stakeholder consultations with users, industry and at national level with selected partners.
- Within R3, identify scalable national contributions to future crisis response capabilities in both space and ground segments.

2.2 A sustainable space sector and sustainability in space

2.2.1 A sustainable space sector

Considering the crucial role that space-based data, applications, and services are playing in contributing to sustainable development and in boosting climate action, ESA is uniquely positioned to act as role model and support the European space sector and Member States in achieving climate neutrality as set out by the Paris Agreement and the European Green Deal.

For decades, ESA has contributed to a better understanding of the Earth and the impact of human activity on global warming. Building upon this rich legacy, ESA stands at a crucial juncture and must take the next steps to decarbonise its activities and support its partners and suppliers in doing the same. The Agency engaged in the Agenda 2025 to increase the contribution of its space programmes and activities to the sustainable development of society, and to reduce the environmental footprint of its operations.

To implement the Agenda 2025 objectives the ESA Green Agenda (EGA) has been approved at CM22 and is being executed. EGA activities, besides aiming at increasing the contribution of the Agency to tackle key sustainability challenges by maximising the environmental benefits of applications and services provided by new activities and programmes, intent to reduce ESA GHG emissions by 2030 by 46% for its operational activities and by 28% for the activities executed by its suppliers, compared with the 2019 baseline. According to the 2019 GHG evaluation, 86% of the Agency carbon footprint has been generated by industrial activities associated to the conception, definition, development, and in orbit delivery of space systems.

Under EGA, concrete actions aiming at reducing the GHG emissions generated by ESA operational activities have been initiated, e.g., purchase of renewable energy plants at the European Spaceport and at the largest ground stations, optimisation of the Data Centres, deployment of Green Projects aiming at increasing the energetic performance of buildings and infrastructures.

On the other hand, to reduce the largest quota of its carbon footprint that is generated by industrial contracts, ESA must build upon the Clean Space initiative and play a leading role and support the European space ecosystem towards the progressive decarbonisation of its operational activities.

It is the Agency's intention to foster the European space sector's contribution to the climate neutrality of Europe, while increasing its competitiveness. In this context, ESA, in collaboration with the European Commission and other key stakeholders, plans to reinforce the life cycle thinking in designing and developing new space missions so to minimise their environmental footprint along their entire life cycle and qualify the European space industry as a responsible and sustainable one. The dialogue with European stakeholders initiated in the frame of the Statement for a Responsible Space Sector signed by near to 40 organisations so far (space agencies, large system integrators, SMEs, new space companies, satellite operators, public institutes) will be continued in the coming months on key topics like Life Cycle Assessment and eco-design applied to space projects, building on ESA experience matured during the last years on these topics.

The adoption of the Corporate Social Responsibility (CSR) Code of Conduct by Council at the last meeting in June (ESA/C(2023)106), combined by specific sustainability criteria to be added to its procurement actions and with the support to be given to SMEs and LSIs, will reinforce ESA as role model of sustainability and responsibility and provide the European space industry with the competitive advantage to be compliant with the upcoming European regulations on the matter.

To be achieved at the occasion of the Space Summit

- Acknowledgement of the importance of ESA becoming a role model and leading the European space sector to contribute to the climate neutrality of Europe by reducing the carbon footprint of space activities on Earth.
- Encouragement of the Director General to deploy the activities needed to guide and support the European space industry's decarbonisation, with particular attention to Small and Medium Enterprises (SMEs).
- Invite to the Director General to intensify the dialogue with the European Commission and other key stakeholders and regularly report about the progress made.

2.2.2 Sustainability in space: European leadership towards a Zero Debris space environment

Aware of the growing risk posed by the degradation of the space environment and committed to the development of solutions to safeguard vital infrastructures from space hazards, ESA has initiated the Space Situational Awareness Programme with a modest EUR 50M budget in 2009. Since its evolution into the Space Safety Programme in 2019, it has grown into the world's largest programme dedicated to space safety and sustainability, with a total investment of EUR 1186M by ESA

Member States. It now covers all aspects of space safety and sustainability: space weather, space debris, clean space, frequency management and planetary defence. Encouraged by Member States to implement “a Zero Debris approach for its missions; and to encourage partners and other actors to pursue similar paths, thereby collectively putting Europe at the forefront of sustainability on Earth and in space, while preserving the competitiveness of its industry” (ESA/C-M/CCCXIII/Res.1.36), ESA is embarking on two parallel tracks: (a) co-developing a Zero Debris Charter with all relevant European and international stakeholders, and (b) supporting the implementation and integration of clean space technologies and practices by the European space industry.

The Zero Debris Charter, based on ESA’s internal Zero Debris approach encouraged by Member States at CM22, will contain the most ambitious commitments on space debris mitigation and remediation from industrial and institutional stakeholders to-date.

Co-developed by ESA and interested European parties (e.g., operators, large and small satellite integrators, regulators, insurers, investors), it aims to be a reference in measures taken by relevant stakeholders to ensure the long-term sustainability of space. ESA will lead by example by implementing, by 2030, the world’s strictest debris mitigation standards for its missions, and by demonstrating in-orbit clean space technologies and risk estimation and mitigation tools to realise that ambition.

Each signatory to the Charter will contribute to the extent of its abilities and constraints. The Charter aims to display European leadership in ensuring the long-term sustainability of space activities, while supporting the long-term international competitiveness of the European space sector. To support the realisation of these commitments and go beyond merely preserving the European space industry’s competitiveness, ESA will set up an ambitious capacity building initiative to ensure European leadership in Zero Debris space activities, thereby guaranteeing international competitiveness of the European space industry and preparing it in an optimal way for ever-more stringent debris mitigation and remediation requirements in Europe and beyond.

ESA will also continue its work towards the development and spread of effective and efficient in-orbit servicing and debris removal technologies.

Finally, ESA will continue to engage with Member States and the EC on issues of standardisation, expert support to the licensing authorities, and remediation and mitigation technologies.

To be achieved at the occasion of the Space Summit

- Acknowledgement of the progress in the implementation of the Zero Debris approach, in particular with the completion of ESA’s new internal Zero Debris standards applicable to all newly designed ESA missions by 2030.
- Political willingness, and encouragement of the European space sector, to abide by stricter space debris mitigation and remediation standards and practices.
- Opening of the period of registration of intent to sign the Zero Debris Charter.

2.2.3 Towards operational space weather services in Europe

To test in deep engagement with the end users of the space weather service infrastructure developed by the S2P programme, ESA is initiating a demonstrator in the Arctic, most active area during small and moderate space weather events, where the probability of detecting concrete impacts is the highest. This limited pilot project is foreseen to be funded on an ad-hoc basis by the participating countries to collect concrete evidence of space weather impacts on the operation of sensitive elements of the infrastructure and gather end-user feedback on ESA's existing pre-operational space weather service infrastructure. Participating countries are Finland and Norway, represented respectively by the Finnish Meteorological Institute and the Norwegian Mapping Authority.

This pilot project can be seen as enhancement and elaboration of the engagement with the end users that is already carried out in the framework of the S2P programme. For this, the existing pre-operational service network will be used without any changes. The aim is to test space weather services on a restricted geographical area at the time when the solar activity is increasing. Collected feedback from the users will support identification of services that provide the most valuable information and help the users to mitigate space weather impacts. User feedback also helps identification of shortcomings in the current services or in the way that the information is provided. The pilot project also aims to emulate how a fully operational European space weather service would appear and contribute to accelerating the identification and setting up of a space weather governing concept for Europe.

To be achieved at the occasion of the Space Summit

- Acknowledgement of the successful contribution of the Arctic space weather demonstrator in collecting evidence of space weather impacts and in gathering end-user feedback.
- Support for ESA to continue development of the European space weather capabilities and space weather system with all relevant stakeholders and in engagement with the end users.
- Encouragement to ESA to accelerate efforts towards supporting the identification and setting up of an operational space weather governing concept for Europe.

Through its activities on enabling European leadership towards a Zero Debris space environment and on supporting the identification and setting up of an operational space weather governing concept for Europe, facilitated by the Protection of Space Assets (PROTECT) Accelerator, ESA is contributing to the building blocks of space traffic management. Accordingly, ESA will continue to engage with Member States and the European Commission on the definition and execution of a common European approach on space traffic management in a synergetic, complementary and cooperative way.

3. ESA driving European space ambitions and modernising the implementation of its programmes

3.1 Guaranteeing Europe's access to space

This chapter addresses how to guarantee Europe's autonomous and independent access to space, including the short and medium term with Ariane 6 and Vega and the preparation of future space transportation solutions through organisation of a challenge.

3.1.1 Global and European context

The space transportation sector worldwide is changing at an accelerated pace. While US, China and Russia already have established capabilities of launching humans to space, India will soon follow.

SpaceX, with the US government as anchor customer for human and cargo transport to and from the ISS, has established itself as a market leader in commercial space transportation, while at the same time being a vertically integrated telecom operator benefitting from in house satellite manufacturing, launch services and satellite constellation operation. In this context European commercial telecom operators have voiced their concerns with respect to the currently reduced access to reliable launchers and launching capabilities being in the hands of a single non-European provider. They have further reiterated the strategic importance of Ariane 6 availability as soon as possible for the survival of the European space industry.

Europe's independent access to space is in a temporary crisis, with the halt of Soyuz from Europe's Spaceport, the delay of the development of Ariane 6, the grounding of Vega C after the VV22 failure in December 2022 and the stop of Ariane 5 exploitation. Both Ariane 6 and Vega have a solid manifest with 28 and 17 launches respectively, necessitating a fast ramp-up of Ariane 6 and an increase of the launch rate of Vega to meet customers' expectations.

In face of the fierce competition from SpaceX, Ariane 6 has failed to meet the overarching requirement to halt public support to commercial exploitation.

At the same time, a wealth of privately funded start-ups is working on developing launchers in Europe in parallel with development of launch facilities for such launch vehicles in a number of European countries. It is unlikely that they will be able to take the step towards development of larger launchers, which is a condition for their viability, without a public anchor customer.

3.1.2 Actions to take now

A number of lessons learned has been drawn from the present situation, among which:

- A solid overlap between established access to space and new developments must be ensured.
- Competition in the context of Europe's access to space is desirable.
- Europe's independent access to space will strongly rely on Vega and Ariane 6 in the coming decade.
- Privately developed launchers will have their role, but they will not replace Vega and Ariane 6 in the near future.

Therefore, top priorities shall be the Ariane 6 inaugural flight and manufacturing and launch ramp-up, the Vega C return to flight and increase of launch rate, and the stabilised exploitation of Vega C and Ariane 6.

It is essential that the preparation of the future takes due account of the lessons learned from the present crisis.

3.1.3 Preparation of the future of space transportation

With the success of Falcon 9 and the prospects of Starship, SpaceX is putting the world in front of an unparalleled reality in launchers with lower cost of access to space enabling commercialization and development of a space economy. Europe must now face this reality and act boldly, developing today a radically different European model for access to space beyond Ariane 6 and Vega C fostering competition and commercialization of European independent access to space.

The transformation of the worldwide space sector has accelerated over the last decade, leading to unprecedented changes. This is also the case of space transportation. Prospects of generating revenues from space applications is increasingly drawing both newcomers and established space companies into new commercial services. In Europe, the evolving space transportation sector is also a reality with new space transportation solutions presently under development yet attracting private investment. Many of these new services involve the deployment of light satellites.

ESA is keen to see European economic operators establish new commercial space transportation solutions. This wish to foster more commercial undertaking, more competition for more diversified services and more providers to further space transportation capabilities in Europe is at the core of the ESA Boost! programme.

The advancement of space transportation capabilities now needs to fast-forward in Europe, along revisited development and procurement modalities and public and private roles and responsibilities. These revisited schemes need to consider the specifics of the demand accessible to Europe, which can also increase as a result of a diversified offer, industrial capabilities and potential for further advancements.

ESA role shall evolve from that of a launch system procuring entity towards a new role as "Anchor Customer", procuring commercial services with long term commitments, building up trust for private investment. ESA will act also as "Enabler", procuring demonstrators and supporting de-risking technological activities with calculated risk sharing with industry.

To that end, in parallel to the exploitation of Ariane 6 and Vega C to guarantee access to space in the mid-term, it is proposed that ESA prepares the future, in close cooperation with the Member States, together with the European Union and other European institutional users as potential customers of future launch services.

3.1.4 European “Challenge” to prepare the future of space transportation in Europe

It is proposed that ESA organises a “Challenge” between service providers of European space transportation solutions to demonstrate in-flight space transportation service capabilities along a series of milestones.

The main elements of such proposed “Challenge” and its preparation process are described below.

Proposed European “Challenge”

The European Challenge will consist of a competition between European space transportation service providers called upon to demonstrate their ability to develop and fly a new capacity to serve mission needs to access space.

The determination of associated high-level requirements, missions to be served, amounts and performances and milestones timeline as well as selection process is proposed to be made in the course of 2024 so that a proposal can be submitted and subscriptions made at CM25 within the frame of an ESA optional programme and contracts awarded immediately thereafter.

The service use cases will stem from the actual European institutional demand. That demand and the offers received will determine if one or more suppliers can be retained.

Proposed “Challenge” main elements

The “Challenge” is to be set up in the form of two-stage competitive tenders organised by ESA.

Scope and funding:

- Within the frame of the European “Challenge” ESA would procure demonstration services and follow-on space transportation services.
- The scope of the tender would include all-encompassing space transportation scenarios.
- Overall technical and commercial authority and responsibility for the services would be retained by the private economic operator.
- Private co-funding of development would be required.
- Public funding will be associated with:
 - attainment of technical and financial milestones by European economic operators providing European space transportation solutions, ultimately leading to flying a demonstrator responding to pre-defined public service requirements;

- procurement of follow-on space transportation services for European institutional missions. Several European institutional missions would be identified in the course of 2024 and committed for launch service contracts with the solutions selected as a result of the “Challenge”.
- Evaluation will be based on actual demonstration of technical maturity and commercial financial viability, including level of private investment.

To be achieved at the occasion of the Space Summit

Adoption of a chapter on "The ambition for European Space Transportation" within the Resolution on “Lifting Europe’s Ambitions for a Green Future, Access to Space and Space Exploration”.

3.2 New ambitions and next steps for space exploration

Sending humans into space and preparing for long duration deep space exploration is a challenge that the United States and China are planning to master end-to-end. Others, like India, are also entering into this perspective. Indeed, the United States has firm plans to be back on the Moon in this decade, China has officially announced a human mission before 2030, and India is now the first nation to land robotically on the Moon’s South Pole.

At the same time, smaller new actors, both institutional and private, have demonstrated or are actively pursuing human spaceflight capabilities. In this context, the High-Level Advisory Group on Human and Robotic Space Exploration for Europe, in its report “Revolution Space – Europe’s Mission for Space Exploration” of March 2023, has called Europe to “Act Visionary, Act Differently, Act Now”, increasing its ambition in space exploration. Responding to this strong call for action, this Director General’s Proposal argues for a bold vision and an ambitious exploration programme. The following sections briefly outline the rationale (Why), the strategic goals and initial activities to pursue (What) and the high-level principles for implementation (How).

3.2.1 The case for a bold and ambitious European human and robotic exploration programme

The arguments in favour of a bold and ambitious human and robotic exploration programme can be divided in three broad categories:

- Economic benefits.
- Inspiration and science.
- Geopolitics and security.

While no single argument is sufficient if taken in isolation, a compelling rationale emerges when all benefits are considered together.

Economic benefits

The economic benefits can be divided into two broad categories:

Direct economic benefits, which are associated with participation in the nascent LEO and Moon economies include:

- Procurement within Europe of flights for European astronauts and payloads, avoiding direct transfer of funds to non-European commercial entities.
- Participation in the LEO economy, with sizeable impacts in terms of GDP and job creations expected from provision of space flights, in-orbit R&D, manufacturing and servicing as well as construction and servicing of large LEO infrastructures.
- Participation in the lunar economy, with significant potential markets especially in the fields of transportation and commercialization of data.
- Technology spill-over effects.

Wider economic benefits, which are associated with enhanced technological autonomy and industrial competitiveness, both in the overall space sectors, as well as in the entire economy. They include benefits in:

- The overall space sector (“More than an exploration programme”);
- The entire economy (“More than a space programme”).

Cross-fertilization between exploration and other space activities will occur via different, mutually reinforcing effects:

- Synergistic effects in critical technological domains, such as launchers; rendezvous and proximity operations; refuelling and automation; entry, descent and landing.
- Provision of critical mass of investment and procurement volumes, through a bold publicly funded initiative combined with procurement models that encourage co-financing and risk-sharing with private industry.
- Introduction of transformative practices that promote competition, innovation, reduction of costs and of development cycles.

In other words, investment in exploration, accompanied by private funding, will help European companies to become competitive in many strategic segments of the space industry. This will allow Europe to maintain and grow industrial champions that capture a significant portion of the space economy, expected to grow to 1 trillion Euros by 2040, and to create a strong ecosystem in which European start-ups can grow organically or be acquired by European companies.

Finally, and possibly most importantly, a competitive space industry is strategic for the prosperity of Europe well beyond space activities, with cross-benefits in the fields of sustainability, digitalization, security, and overall economic competitiveness, thanks to increased adoption of space-enabled solutions in many industries.

STEM, skills and inspiration

Economic benefits are closely linked to inspirational ones and in particular to the retention of talent. An ambitious space exploration programme has the potential to spark interest and pride in younger generations, encouraging them to pursue STEM (Science, Technology, Engineering, Mathematics) careers and fostering a pioneering mindset. Communicating the endeavours and benefits of space exploration would therefore help in overcoming the current shortage of new talent in the STEM areas and avoiding further brain drain, contributing to Europe's future competitiveness and innovation potential.

Scientific advancement is an obvious benefit, as space exploration offers unique opportunities to answer humankind's profound, enduring questions, such as:

- Fundamental questions in physics, biology and chemistry.
- The search for extra-terrestrial life.
- Understanding the origins of life on Earth.
- Unravelling the history of our solar system.
- Peering back into the earliest epochs of the cosmos.

Moreover, microgravity research can improve our understanding of the psychological and physiological changes that humans undergo in space and can help humanity confront acute challenges on Earth.

Geopolitics, security and cooperation

In terms of geopolitics, security and cooperation, a bold and ambitious exploration programme will provide unique benefits crucial for Europe, including:

- Enhancement of international standing and soft power, ensuring that Europe will have a strong voice in shaping the future space governance and the economic and international relations in space.
- Increase of non-dependence, ensuring that Europe's Member States have the necessary technical and industrial means to pursue their sovereign interests, national and collective, as free as possible from constraints of external dependencies.
- Enhancement of cooperation, improving the quantity and quality of cooperation opportunities and greater freedom for Europe to choose its partners and own contributions.
- Enhancement of space-based and space-enabled capabilities, through mastering of critical technologies, including dual-use ones, in the interest of its Member States.

3.2.2 A way forward based on a solid strategy and a focused first step to secure LEO utilisation

Strategy considerations

ESA has articulated its exploration strategy around three destinations: Low Earth Orbit (LEO), Moon, and Mars. International exploration is changing at an increasing pace, with new institutional and commercial actors starting endeavours to explore all of these destinations. The LEO destination is moving towards commercial exploitation post-ISS institutional needs centred around science, technology and astronaut flights, as well as a LEO economy, are expected to develop further by the end of this decade.

A balanced political, programmatic and technical solution for European participation in post-ISS LEO infrastructure(s) must be assessed and prepared by CM25. Transport of cargo and crew to various platform options will be critical to the LEO economy's success, the development of reusable vehicles is thus desirable for a sustainable LEO ecosystem. In the overall costs of a LEO presence, cargo and crew transportation represent around 70%, and infrastructure development, operations and utilisation only 30%. The primary challenge in LEO is therefore to reduce costs associated with transportation, including launch costs. An obvious chance for Europe is therefore to provide cargo transportation services to commercial LEO station operators and thereby to offset the European utilization of such station, including astronaut flights, without direct exchange of funds.

The Moon represents more difficult challenges, but also offers many opportunities for unique contributions and achievements. It is considered the next milestone for sustainable exploration, acting as a first proving ground for exploration of Mars as the horizon goal. Similarly to LEO, Moon missions are shifting from purely institutional concepts to commercial endeavours with the aim to create new business cases and markets.

On 2 December 2014, the Council at Ministerial level in Luxemburg adopted the Resolution on Europe's space exploration strategy (ESA/C-M/CCXLVII/Res.2(Final)), which was thereafter supplemented by the Terrae Novae 2030+ Strategy Roadmap. This comprehensive strategy framework, which covers the three destinations LEO, Moon and Mars, needs to be revised taking into account the elements below with particular relevance for exploration:

- The accelerated pace of activities at international level.
- The role of new institutional and private actors.
- The new programme elements, e.g. in the framework of Artemis.
- The refinement of the narrative on benefits in relation with the evolution of the societal dimension of exploration.
- The need for a stepwise approach with political decision checkpoints.
- The reinforcement of existing partnerships and initiation of new opportunities.

Due to the drastically changing environment in space exploration, it is timely to revisit the European exploration strategy and to create a coherent framework that interrelate the endeavours that Europe pursues for exploring LEO, Moon and Mars. This strategy update needs to be guided by a vision that embodies a European identity and will result in more non-dependence.

The Director General will implement this review process together with Member States mainly via the PB-HME, aiming at completion in time for the Council meeting in March 2024, so that the updated European Exploration Strategy can be available to support (i) the actions covered by this DG's Proposal, (ii) the formulation of an envisaged overall ESA Strategy 2040, and (iii) the preparation of the decisions to be taken at CM25.

Advancing in an incremental implementation approach that preserves flexibility and affordability

Reemphasising the strategic importance of transportation for exploration and noting that the major transportation elements of the LEO and Moon exploration architecture are cargo and crew vehicles, an incremental implementation approach offers an optimised and flexible path to achieving a technically sound and financially sustainable programme implementation which allows Member States to set priorities and pace.

Proceeding incrementally allows to find a balanced mix of immediate action and preparing potential future evolutions among the different Inspirator objectives as follows:

First increment (initiated now, while preserving CM25 freedom of decision):

- Objective 1:
developing a LEO cargo return service to enable ESA's participation in the post-ISS LEO ecosystem and economy, requiring a first mission by 2028.

Subsequent increments (decided and initiated later):

- Objective 2:
enabling an affordable and swift development of a potential future LEO crew vehicle, should it be decided by Member States at a later stage.
- Objective 3:
enabling an affordable and fast development of potential future cislunar cargo and crew vehicles, should they be decided by Member States at a later stage, by maximising commonalities and synergies with the LEO vehicles.

3.2.3 Proposed pre-CM25 activities: Phased and competitive first LEO cargo return service procurement

For Europe to achieve major results in pursuit of its aspirations and objectives before the end of this decade, in particular to secure continued utilisation of LEO under a new commercial post-ISS approach and making maximum use of the availability of ISS in the meantime with extended barter opportunities, the activities detailed below are proposed to be initiated before CM25.

Content, scope and funding

Following the Summit and a consultation of and decision of PB-HME, ESA would issue a competitive call for proposals for an end-to-end first LEO cargo return service to be accomplished by 2028. As part of this call, ESA would provide only high-level requirements such as the up/down mass (e.g. 4 tons up, 2 tons down) while also including a small set of carefully selected requirements aimed at enabling potential future evolution towards a LEO crew service and cislunar cargo return, as one of the possible solutions towards that goal.

While bidders would be requested to make a binding proposal for the full demo mission and the price right at the beginning, ESA's commitment would be phased to keep within presently approved programme funding and preserve Member States' full freedom of decision for CM25. Phase 1 of the contract would therefore cover the period until CM25, while Phase 2 would only be committed, in ESA's free determination, if supported by Member States' decisions at CM25.

Phase 1 of the LEO Cargo Return Service procurement can be covered by the European Exploration Envelope Programme (E3P) Period 3 for an amount of up to 75 M€ (2024 economic conditions), under the precondition that this must not affect the agreed priorities in E3P or leave programme risks uncovered. Selected activities in support of potential evolutions towards crew and cis-lunar cargo return could also be supported by E3P Period 3 (ExPeRT) or STS programmes, notably the Future Launcher Preparatory Programme (FLPP).

Based on proposals received, ESA would then select up to 3 contractors for Phase 1. The Phase 1 contract value awarded per contractor would be determined as part of the proposal evaluation and negotiation in view of work and funding requirements before CM25. Phase 2 will be executed by two companies, conditionally on the outcome of CM25. Pending the outcome of Phase 1, the Agency reserves the right to re-open the competition for Phase 2.

Specific implementation features

A bold and ambitious exploration programme for Europe needs to establish cost-effective procurement models and enhance risk-sharing among private and public players to support the growth of the space economy. A tailored industrial and procurement approach, fully compliant with applicable ESA rules and regulations and based on the discussion on modalities with the Member States, is at the core of the success of this initiative and crucial to the competitiveness of the European space industry.

Among the important drivers for the contractual implementation are the following:

- **Competition:**
To mitigate schedule and cost risk, up to 3 contractors would be selected for Phase 1.
- **Service contracts:**
To enable industry to find optimal solutions in terms of cost and schedule, ESA would only provide the high-level requirements for a cargo delivery and return service, with a demo mission to ISS in 2028, while leaving it to the bidders to

propose technical solutions, development plans, technical and financial milestones.

- **Swift procurement process:**
To account for the ambitious goal of flying the demo mission by 2028 and to provide an early contractual opportunity to the nascent, but fragile startup ecosystem, the procurement for the service contracts should be completed by Q2 2024.
- **Evaluation-based allocation of funds:**
Allocation of funds to the contracts would be based on proposed activities and milestones as well as bidders' demonstrated funding needs.
- **Co-funding:**
To ensure affordability, to incentivise private investment, and to increase the financial and schedule robustness of the service offer, the service provider would be requested to demonstrate commensurate co-funding through capital investments and private business opportunities (in particular with Commercial LEO Destination providers).
- **Tailored milestone definition and follow-up:**
To mitigate the risk and ensure effective progress control for ESA, payments would be made only upon the achievement of specific and meaningful milestones linked to technical and financial achievements, to be proposed by the bidders and approved by or further negotiated with ESA. When contractors fail to meet a milestone, ESA would have the right to terminate the contract for cause.

It is also planned to make this activity from Phase 1 a testbed for the transformation of the current ESA project management approach, both ESA internal and in relation with industry, which builds on a competent, lean, accountable and efficient project and procurement team that will follow an implementation approach that is tailored to a service procurement and to working with legacy as well as start-up companies.

Benefits

The proposed approach offers several important benefits:

- Allowing Ministers to send a powerful signal at the Space Summit by initiating the first European service contracts for LEO exploration.
- Securing continuity in LEO utilisation in the ISS to post-ISS transition phase as well as during the era of the post-ISS LEO economy, while maintaining added value in Europe.
- Obtaining early end-to-end demo mission commitment and price from service providers while maintaining freedom of decision for Member States at CM25.
- Enabling European providers to raise private capital (indispensable for the start-up ecosystem) and to secure timely deals with Commercial LEO Destination providers under advantageous conditions.
- Implementing risk- and cost-sharing between ESA and service providers through to co-funding.

- Contributing as one of the possible solutions to the parallel preparations towards potential LEO crew service and/or cislunar cargo return, should Member States wish to opt for it in the future.
- Offering a suitable test case for the transformation of ESA project management and tailored procurement approaches.

To be achieved at the occasion of the Space Summit

- Acknowledgment of the need for an ambitious European exploration strategy and the importance and benefits of an ambitious European space exploration programme using an innovative industrial and institutional governance approach.
- Political endorsement of the proposed phased LEO Cargo Return Service procurement, securing continued European utilization of LEO and reinforcing international cooperation, while contributing as one of the possible solutions to the parallel preparation work towards a potential future crew vehicle and further destinations.

4. Conclusion

This Council at Ministerial level at the Space Summit 2023 presents the next milestone for developing our strategies for the new space age for Europe. The key elements of this Director General's Proposal will be progressively implemented. This will happen in close coordination with the Member States. The European Union and other actors will be included in this process, conscient of the purpose, role and contribution of ESA as an international partner and eminent space actor. In this way, we will collectively advance space as a strategic agenda by recognising prospects and opportunities.

The Space Summit 2023 emphasises ESA's determination to follow an ambitious path towards unlocking the full potential of space for the benefit of Europe and its citizens. It can be identified as a further important step along the way towards the ESA Council at Ministerial level to be held in 2025 in Germany, using the announced high-level meeting to be organized during the Belgian Presidency of the EU Council in the first half of 2024 to further maximize the potential of space for Europe.