

# ESA AGENDA 2025

*Make space for Europe*

*#SpaceCare*

The year is 2035. ESA has just celebrated the 60th anniversary of its creation in 1975. Europe has grown as a global leader in space, alongside the US, Russia, China and other prominent space partners. Thanks to clever investments and new rules of engagement made by ESA, the EU, and national agencies, space has been opened up to private companies whose activities contribute to increased employment, profit and inclusive growth in Europe. Europe's presence in space has increased its global influence, prestige and economic standing worldwide. Europe has had to revolutionise its launcher sector of the 2020s and has created a completely new, more competitive and reusable launcher system. European astronaut Aurora is about to start her adventure as the third European to land on the Moon. It will be her final training mission before the next big exploration leap: setting foot on Phobos, in orbit around Mars. The Phobos landing will cement Europe's exploration heritage and confirm Europe as part of humankind's next historic venture: a Mars landing.

**Ground control:** T-minus 3 ... 2 ... 1 ...

**Aurora:** ... and lift-off! Wow! You would think I would get used to this after five times ... !

Eight minutes later and 30 000 km/h faster, Aurora and her international astronaut colleagues are in space. Even now, the feeling of looking down on her home planet does not leave Aurora untouched. So much has changed compared with when she was a child dreaming about space.

Alongside her in orbit are the vast constellations of satellites that carefully observe, connect and protect so many aspects of human life and civilisation. Space applications and innovation are helping humanity to make immense progress on sustainable development worldwide. The climate targets needed to reach the ambitions of the Paris Agreement and the European Green Deal are well on track.

Europe has expanded its leadership in some of the most inspiring fields of space and planetary exploration; having recently mapped several exoplanets with Earth-like atmospheres, it is preparing a flagship space mission to study them in detail. Its gravitational wave interferometer is just being readied for launch and will soon allow us to see the Universe in ways imagined by Einstein and being made real more than 100 years later. Thanks to these and many other first-of-its-kind and pioneering space science missions, Europe is more than ever at the forefront of STEM and breakthroughs in humanity's understanding of nature and the cosmos.

European and international companies use advanced robots to remove debris and to provide in-orbit services, refuelling and recycling, making sure space can be used by the generations of the future.

By pursuing an audacious innovation agenda, Europe has gained a strong position in the internet of things. Space-enabled secure connectivity, Earth observation and navigation systems link up over a trillion devices and mobile vehicles simultaneously, contributing to a global multi-trillion euro market.

Eager to share the thrill of her arrival in space, Aurora asks her virtual assistant to call Leo, her best friend from her class at university. Within a fraction of a second a secure online connection is set up from space to the 'quantum valley' of Europe.

**Aurora:** Hi Leo! How are you doing?

**Leo:** You're on your way to the Moon and still have time to talk to me? I'm honoured! I heard the news of your seat on the mission to Phobos. Congrats!

**Aurora:** Thanks! It will be the thrill of a lifetime, there's still a lot to learn but I just can't wait to finish my training. How is your company doing?

**Leo:** Start-up life is good. I just hired some great additions to the team. We've got a bunch of ESA data on exoplanet atmospheres to crunch and see how they fit with Earth climate models. We got to make sure our kids grow up in a good place right?

**Aurora:** Exactly! I'm counting on you to make it happen. Space nerds for the win!

**Leo:** I'll do my best while you get on with your travels; stay safe out there...

**Aurora:** Thanks. Send me some pictures, will you? I look forward to staying in touch.

**Leo:** Sure. You'll see it all soon enough. Ad astra!

The story, all names, characters, and incidents portrayed in this production are fictitious.

Until we decide to make it happen together.



# 1 THE TIME FOR EUROPE TO ACT IS NOW

We are back in the year 2021. Space is at a crossroads of global changes. We want Europe to fully benefit from space. Europe has the expertise, knowhow and competitive industrial capacity. What we need now is a common European space ambition unlocking the full potential.

First, such a common vision will guarantee Europe's leading position in certain space markets. This decade, the global number of satellites launched each year will be four times higher than in the 2010s.<sup>1</sup> The US, China and others have identified clear political and technological space targets, and have put the corresponding resources and plans on the table. The commercialisation of space took off strongly in Silicon Valley only a few years ago and is creating a true New Space revolution, now mirrored in Japan, China and India, but only to some extent in Europe. Today, the two richest people in the world provide some of the biggest space investments. These changes and their impact threaten the entire European space economy.

## Europe needs a space ambition for 2035+

We want Europe to benefit from space as much as the US and China. We already have the required expertise, knowhow and industrial capacity. What we need now is a common European space vision and ambition.

And this is only the beginning of the exponential New Space growth curve. **The global space industry could generate revenue of US \$1 trillion or more in 2040, up from US \$350 billion currently.**<sup>2</sup> If Europe wants a slice of this growing pie, it will need to contribute to the baking. Doing so will support the current market champions and create new ones. Europe unfortunately missed the boat in the dotcom, Big Tech and artificial intelligence (AI) domains. Europe can still avoid the same fate in space.

Second, **Europe is confronted with a concurrence of massive challenges that need a united front with bold responses.** The continent needs a new mission statement that focuses its space excellence to propel society out of the current health, economic and climate crisis into a more sustainable, fairer and more resilient society. Space will contribute much more than just data, navigation signals, or connectivity. It will connect the dots to provide information and intelligence. It will create an uplift of spirit, engage young generations into new visionary projects and unite Europe as a continent through common goals, dreams and ambitions that space can deliver. The COVID-19 pandemic has exposed the dangers of relying on others for the provision of our societal needs. Strategic autonomy and technological non-dependence, central to space activities, are back centre stage. Equally, the pandemic has shown the importance of science and the need for fairer and more sustainable economic development, with healthcare access and digital connectivity for all citizens recognised as basic needs. Climate change, the main environmental concern, will define global political agendas, national elections and international relations. Europe has pioneered the environment agenda since the 1970s. Today, a new generation is stepping up, and it will completely rethink society and politics on its path to climate neutrality and a circular economy in which growth is decoupled from resource use. Europe has the best space infrastructure to monitor climate change and the health of our planet. The challenge is to translate the targets of the Paris Agreement into an unprecedented societal, economic and industrial transformation.

In the 21st century, investing in space is investing in the future of Europe through smart answers to complex cross-disciplinary questions and challenges. Investing in space is investing in people and in the science and technology required to be a global actor.

**To address these challenges, Europe needs targeted and determined actions today, complemented by a clear plan to benefit from space tomorrow. ESA Agenda 2025 provides both.**

<sup>1</sup> Euroconsult, The Space Economy Report 2019. December 2019

<sup>2</sup> [www.morganstanley.com/ideas/investing-in-space](http://www.morganstanley.com/ideas/investing-in-space).

To overcome the immediate challenges, ESA will tackle five specific priorities (in no particular order) with clear targets for 2025. This will increase ESA's value for citizens and society and pave the way for a long-term ambition for Europe in space.

If Europe wants to grow its role as a global space leader competing with the US, China and others, Europe needs to get its act together. ESA Agenda 2025 presents a clear way forward to kick-start this process today through the creation of a common European ambition for 2035: one coherent space programme for Europe and its citizens, today and tomorrow, based on its own culture, values, societal needs and political priorities.

The respective Member States of ESA and the EU, together with the European Commission, are best-placed to identify and formulate these needs, and provide a solid political dimension to a European space ambition. ESA, as Europe's space agency, will use its proven experience and critical mass of technical and programme management expertise to translate these societal needs into space solutions. Jointly defined new flagship programmes and a modernised European Space Agency will ensure that this ambition is realised.

## 5 ESA Priorities for 2025

- Strengthen ESA–EU relations
- Boost green and digital commercialisation
- Develop space for safety and security
- Address critical programme challenges
- Complete the ESA transformation



## 2 FIVE ESA PRIORITIES FOR 2025

### 2.1 STRENGTHEN ESA-EU RELATIONS

To intensify the development of a space sector at the service of European policies, citizens and industry, relations between the EU and ESA must be improved and reinforced. Today's space infrastructures and applications are already crucial tools for the implementation of most European, EU and national policies such as the digital, environment, agriculture, transport, emergency management, and research agendas. Space is an instrument for safety and security, diplomacy and soft power, development and international cooperation – a political necessity for a strong Europe as well as an important enabler of sustainable economic growth and stimulus.

Space is higher on the agenda now than at any time since the 2004 ESA–EU Framework Agreement and the 2009 Lisbon Treaty which recognised space as a specific competence of the EU and emphasised the need to establish appropriate relations between the EU and ESA.<sup>3</sup> The European space sector has been significantly reinforced by the decisions taken by ESA Member States in November 2019 on the most ambitious set of mandatory and optional programmes since the creation of the Agency, and by the EU political decisions on the Space Regulation<sup>4</sup> providing the largest EU budget ever for space, as part of the

“The European Space Policy will continue to rely on ESA and its unique technical, engineering and science expertise”

European Commissioner Breton,  
January 2021

2021-2027 Multiannual Financial Framework (MFF). Those decisions give Europe the capacity to develop and act on the common European Space Policy in all its dimensions. As highlighted in the EC-ESA joint letter signed together with European Commissioner Breton, it is “only by collectively joining our forces - EU, ESA and Member States – that we will be able to develop an ambitious space agenda for Europe”. EU and ESA must and will work hand in hand to make sure we are responding to the challenges ahead of us. This priority shall be dealt with urgently in order for Europe to proceed all together in space.

On a more immediate issue, the Financial Framework Partnership Agreement (FFPA) between the European Union and ESA require clarity of roles to be resolved rapidly. It is essential to resolve the remaining FFPA issues in a manner that maximises the strengths of each partner, and by minimising overlaps among these key entities in Europe, the EU and ESA. We need stronger coordination, more trust and coherence of actions between the different actors at different levels; we cannot afford duplications of project teams at European level using Member States' funding inefficiently.

Complementary to the definition of the processes of the (near-term) implementation of the EU Space Programme through the FFPA, **the time is right for a fresh start reinforcing the cooperation between the EU and ESA.** Europe must take the next step in the establishment of appropriate relations between the EU and ESA. The variety of actors is Europe's hallmark and strength and all future cooperation shall provide, while respecting individual institutional settings, complementarity between the political weight of the EU and the space-related expertise of ESA, national agencies and industry as well as of EUSPA for Galileo operations and new potential domains defined by the EU Space Regulation.

“EU and ESA must and will work hand in hand to make sure we are responding to the challenges ahead of us”

European Commissioner Breton  
ESA DG Aschbacher

<sup>3</sup> Treaty of Lisbon amending the Treaty of the European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007. (2007/C 306/01)

<sup>4</sup> Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013, (EU) No 377/2014 and Decision 541/2014/EU

It is equally crucial that the good relations of ESA with EUMETSAT, the EU SatCen, EDA, EMSA, ECMWF, EEA and other public entities relying on space assets are well coordinated and reinforced. This is a great opportunity, which ESA must and will now seize.

To this end, ESA will pursue two avenues: trigger and support a political dialogue, and develop a proposal for possible evolution of the current cooperation based on a comprehensive analysis.

First, the ESA Director General will immediately engage with ESA Member States, the European Commission (EC) and its Commissioner Breton, space industry and other stakeholders in a constructive dialogue to define Europe's ambition in space, their respective and evolving roles and related implementation steps.

Second, the ESA Executive will prepare an in-depth assessment of the experience of ESA in working with or for the EU on very diverse types of cooperation for almost 30 years. This assessment will support the continuation of Galileo and Copernicus and guide the stakeholders in the identification of future new flagships and of new potential partnerships like the proposed secure connectivity capability and the Competitive Space Start-ups for Innovation (Cassini) initiative to support SMEs and industrial competitiveness.

Both processes, namely the political dialogue and the analysis of current cooperation leading to the identification of future opportunities, will be done in close coordination with the ESA Member States through Council and with the European Commission. Industry will be consulted as a key stakeholder throughout this process.

**While ESA serves as the space agency of its Member States implementing mandatory and optional programmes, it must also be able to serve as the implementing agency of the EU space programmes.** This diversity of roles is a distinctive strength of ESA and serves the European space ecosystem at large.

The European Union has planned the Conference on the Future of Europe, which will take place during 2022. As outlined in Chapter 3, ESA proposes to organise, together with the EC, and in the run-up to this conference, a European Space Summit in 2022 to jointly define Europe's ambition in space for the next decade. The results of this Summit shall be an essential input for the ESA Council Meeting at Ministerial Level at the end of 2022.

## 2.2 BOOSTING COMMERCIALISATION FOR A GREEN AND DIGITAL EUROPE

New Space<sup>5</sup> has led to smaller, narrowly focused satellites and reduced launch costs, which has lowered the entrance barrier to space and increased the pace of innovation. Supported by new, commercial-supply oriented policies<sup>6</sup>, this has multiplied the number of actors ready to take commercial risks to profitably serve the growing public and private markets. In 2019, private funding in the US reached €5 billion compared with €188 million in Europe (for start-ups only).<sup>7</sup> The US boom in commercial space – strongly supported by the US government – has triggered similar policies in Japan and China and has compelled some European companies to establish business in the US.

Europe too needs to benefit from a vibrant commercial space sector to serve its own societal and economic needs and priorities. In particular, the European Green Deal and Digital Agenda as well as similar national policies of ESA Member States can be ideally served by competitive and innovative commercial space companies, transforming big data and connectivity into smart information products, knowledge and commercial services. This is a perfect environment for advances in AI-based data analytics and in prototyping quantum computing and quantum communication –

We need to stimulate a more vibrant and dynamic commercial space ecosystem to realise green and digital transformations.

<sup>5</sup> For the purpose of the Agenda, New Space is understood as a revolution in approaches regarding space activities, which is pursued both by new and established actors in the value chain including start-ups, SMEs, mid-caps as well as large system integrators.

<sup>6</sup> National Space Policy of the United States of America. Published 9 December 2020

<sup>7</sup> Source: ESPI Space Venture Report 2019

technologies that are key to unlocking new markets. Europe's private sector will be needed to safeguard Europe's digital sovereignty in the upcoming era of universal space-based connectivity.

Progress is needed to transform vast sets of climate data from space into digital twins that will allow, through 'what if' simulations, the testing of policy effectiveness, and support decision-making. Energy is central to environmental sustainability. Space missions have to be energy-efficient and require advanced recycling and robotic technologies – especially for exploration – as well as innovative materials sciences. Breakthroughs in all these areas will be pursued and commercialised to support a circular economy and climate neutrality in Europe. Space-based services to support the energy transition, and potential space-based solar power generation deserve to be further investigated. ESA will strongly support market creation efforts for new applications in these areas, similar to what NASA has done for space transportation in the US.<sup>8</sup> ESA can build on its experience gained in areas like satcom, debris removal and exploration capabilities. Pursuing this approach will allow Europe to succeed scientifically, technically and commercially, based on its own industrial set-up, market and methods.

**To boost commercialisation in the European space sector, ESA and its partners need to evolve focusing on three key ingredients: talent, access to capital and, fast innovation.**

In terms of talent, Europe already has one of the best-educated and most productive workforces in the world. With only 16% of global space spending and 5% of the global space workforce, Europe captured about 30% of commercial satellite manufacturing revenues in 2019, making Europe the 2nd global satellite exporter; Europe also captured 25% of global downstream commercial revenues in 2019.<sup>9</sup> The challenge is to offer European talent attractive opportunities within Europe and to adapt higher education curricula to the skills required for the future. In this respect, ESA is strongly committed to working with its partner organisations to increase the number of European students in STEM fields by 20%, by means of much stronger inspirational outreach.

The second element, access to capital, requires efforts in two domains: creating sufficient public demand, and ensuring easy access to capital from investors. In the US, NASA and the Department of Defense create an attractive internal market for space assets, services and data by acting as anchor customer in certain areas. The situation in Europe is different. However, Europe too needs its public demand for space to reach the critical size needed to kick-start strong private involvement, and reward risk-taking and bolder innovation responses. ESA is ready to strengthen its role as a user and first buyer or anchor customer on behalf of its Member States and the EU. In anticipation, ESA will provide industry with a procurement forecast for space products and services so that public demand is predictable in the medium term.

ESA will also offer its expertise as technical partner/adviser in new cooperative schemes with funding entities like venture capital funds and business angels to facilitate access to private capital. This will allow those funding entities to make sound decisions when supporting start-ups, SMEs and other businesses, that will be able to focus on market risks rather than on technical ones when scaling up beyond the incubation phase. This is a radical shift in how ESA deals with its technical expertise, which has traditionally been devoted to ESA-defined development projects. ESA is strongly committed to offering its technical expertise and knowledge to Member States and their industry, including in particular new space actors, in the frame of ESA's Business Incubation Centres and among others under the space entrepreneurship initiative Cassini, launched by the EC in cooperation with the European Investment Bank / European Investment Fund.

To speed up innovation cycles – the third element – ESA will create an integrated and agile framework for innovation. The time it takes for an idea to translate into a new product or service will be drastically reduced. This entails different actions.

ESA will ambitiously update its overall procurement approach and technology strategy to serve commercialisation and innovation targets. By the end of

ESA has to supplement its role of a risk mitigator with that of a risk taker in areas with commercial growth potential.

<sup>8</sup> Starting with ISS re-supply as service contracts, now the Commercial Crew Programme, Human Landing System.

<sup>9</sup> Euroconsult and Eurospace

2022, the average time-to-contract will be reduced significantly for contracts below €1 million. ESA will shift the implementation focus of its Technology Strategy<sup>10</sup> to achieve 30% faster development and adoption of innovative technologies.

Adopting an open innovation approach, ESA will double its spending on game-changing technologies and enhance in-orbit demonstration and validation opportunities, together with the EC. To provide commercial actors with more pre-developed technologies, which they can readily use to create commercial applications, ESA will increase the industry-driven technology development share of its technology portfolio<sup>11</sup>, and the use of prizes and grants. In addition, ESA will support fast prototyping and enhanced opportunities for in-orbit demonstrations of these new technologies, services and products.

ESA will simplify the access to its programmes and activities, in particular for start-ups, SMEs, mid-caps, and New Space companies, allowing them to integrate supply chains by, for example, setting open standards and interfaces. In particular, ESA will better adapt the management and reporting requirements applied in ESA programmes and contracts to the size and nature of the activities involved.

One of the keys to European industrial competitiveness has been the pooling of major laboratories and testing facilities, and unique scientific and technological competence in ESA centres, where it is available to all industries and maintained for all programmes. ESA will open up access to its unique technical facilities, leveraging its infrastructure, laboratories, testing, data elaboration and operation centres for the benefit of New Space approaches and commercial actors<sup>12</sup>. Cooperation and coordination with national facilities and centres will be paramount. Taking stock of the maturity gained by the European space industry, ESA will delegate more responsibilities along with an appropriate sharing of risks with industry, and increase its partnership schemes with industrial actors large and small.

All of the above actions will be further supported by the creation of a dynamic network of  $\phi$ -labs across ESA and across Europe focused on delivering disruptive innovations ready for market adoption. This network of  $\phi$ -labs will take benefit from existing initiatives, such as ESA's Advanced Concepts Team, Business Incubation Centres, Spaceship initiatives, ESA\_Lab@s, Technology Ambassadors, etc. By doing so, ESA fully adopts an 'innovate and apply under-one-roof' approach, teaming up with academia, research centres, national space centres, industry and private investors, including venture capital, to boost disruptive innovation in emerging commercial space domains. Priority will be given to projects that help achieve Europe's inclusive green and digital transitions.

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<sup>10</sup> ESA Technology Strategy,

[http://esamultimedia.esa.int/docs/technology/ESA\\_Technology\\_Strategy\\_Version\\_1\\_0.pdf](http://esamultimedia.esa.int/docs/technology/ESA_Technology_Strategy_Version_1_0.pdf)

<sup>11</sup> ESA's strong mission-focus in its technology portfolio makes its missions cost effective compared with equivalent NASA ones, but it provides for less diverse matured technologies.

<sup>12</sup> This refers to ESA facilities not available on the commercial market, with which ESA does not compete.



## 2.3 DEVELOP SPACE FOR SAFETY AND SECURITY

The COVID-19 crisis is a painful reminder of the fact that we live in an ever-changing world, with existing and emerging risks. With the rise of global challenges, the understanding and definition of safety and security have become much broader, extending beyond the military dimensions. Today, many programmes such as weather satellites, the Galileo Public Regulated Service, satellite-based communications or European launchers already serve national dual use needs on an operational basis. Most risks to our society and economy require space to be properly involved. The same space industry is working on ESA programmes as well as national defence programmes, with technological overlaps and complementarity. Several Member States have integrated civil and military space policies or teams.

**ESA has the recognised R&D experience, covering the entire spectrum of space activities, to address many of the safety and security challenges faced by its Member States and those of the EU.<sup>13</sup>**

ESA should become the natural technical partner for developing space infrastructure with safety and security purposes at European level

ESA proposes to increase its activities in the safety and security pillar. In doing so ESA will complement – not duplicate – efforts at national and EU level, and focus on synergies to optimise the resources needed to meet common safety and security priorities of its Member States and Europe. This will happen in close cooperation with the ESA Member States, the EU (EC, the EU Council and European Parliament), EU member states, civil protection and security agencies, and the European Defence Agency (along the lines of existing cooperation agreements) and within associated funding schemes such as the European Defence Fund. Specifically, this concerns protection from hazards and threats both in space and on Earth, as defined already in the ESA Safety and Security pillar.

In space, ESA will develop European technological and commercial leadership in the areas of space traffic management, debris mitigation and removal, space weather, planetary defence, space logistics and cyber resilience. Thanks to successful contributions to collision risk estimation and mitigation programmes and to a global space traffic management system, ESA will safeguard European investments in a space environment characterised by a sharp increase in objects and debris. ESA is the first space agency to adopt the ambitious target to invert Europe's contribution to space debris by 2030<sup>14</sup>, tackling the issue of space debris directly by advancing the technology needed to maintain a clean space environment. The first ESA active debris removal services will be launched in 2025 to remove debris from an orbit at 800 km. This capability will enable the establishment of a commercially viable market for active debris removal and in-orbit servicing. In the mid-2020s, Europe's first operational space weather observatory will be nearing launch. Together with NASA and NOAA assets, this mission will feed data into space weather services protecting European infrastructure and astronauts. At the same time, the first-of-its-kind asteroid deflection demonstration mission will be approaching a mountain-sized asteroid to test a deflection technique for planetary defence.

To increase Europe's ability to act sustainably and commercially in space, ESA will launch Europe and the world into the era of space logistics by developing in-space servicing, manufacturing, construction and recycling capabilities, including the exploitation of material space resources and the concept of maintainable satellites and flexible in-space transportation services. To secure European space assets, ESA will further develop and upgrade active cyber technologies, ensuring availability, integrity and confidentiality of space-based systems and data in addition to continuing to address European non-dependence.

<sup>13</sup> EU Global Strategy (HR/VP June 2016) and its implementation plan (November 2016), Member States White Papers on Security & Defence, respective national security strategy or equivalent, respective cyber security strategy clearly highlight these security orientations.

<sup>14</sup> ESA Technology Strategy, [http://esamultimedia.esa.int/docs/technology/ESA\\_Technology\\_Strategy\\_Version\\_1\\_0.pdf](http://esamultimedia.esa.int/docs/technology/ESA_Technology_Strategy_Version_1_0.pdf)

On Earth, safety and security cover state and collective security, safety and security of people, access to resources, and critical economic activities. Contributing to national policies and the EU Common Foreign and Security Policy (CFSP), ESA will deploy its R&D support to activities, for example, in maritime safety and security, surveillance and reconnaissance, by investing in or using new instruments and complementary systems such as

Europe will work to face the safety and security challenges ahead and to guarantee its strategic autonomy. ESA can strongly support this challenge.

High Altitude Pseudo-Satellites (HAPS) and small satellites, secure satellite communications, and frequent and rapid response Earth observation. This will boost the availability of critical and strategic space technologies resourced in Europe and start pre-development of ground segment equipment for commercialisation of services. Building on ongoing dialogues and efforts, ESA will propose programmatic elements to ensure holistic end-to-end approaches using its space assets in the areas of autonomous vehicles and supply chains, natural disaster prediction, and border situational awareness and migration flows. Africa, as well as isolated territories such as the Arctic and the oceans, will receive special attention, together with regional needs and priorities.

Together with relevant actors, ESA will perform an in-depth analysis of Member States' and EU priorities in terms of safety and security. This will allow the mapping of priorities and needs to existing and planned programmes to identify gaps which may be covered by ESA. In parallel, ESA will organise consultations with interested ESA Member States to better understand their specific needs, followed by a conference on space for safety and security involving national security stakeholders at the end of 2021. ESA will then investigate the definition of optional programmes with interested Member States addressing their needs for safety and security applications, always in accordance with the ESA Convention.<sup>15</sup>

Finally, ESA will support the development of the market and commercialisation dimensions of its safety and security activities. These are considered an attractive new economic domain for many start-ups and established industries in ESA Member States. All this will take place within the ESA mandate and according to Member State decisions, while ensuring a policy of openness including all economic operators across the Member States.

## 2.4 ADDRESS CRITICAL PROGRAMME CHALLENGES

ESA's success relies on the success of its space projects and programmes. All of them are important for Member States, the EC, industry, the scientific communities and in short: the citizens. Some programmes are particularly crucial for the future of space activities in Europe.

**In Europe, ESA has the unique ability to implement, together with industry, complex and ambitious space missions and programmes on equal footing with other leading space agencies worldwide.** The actions described below do not represent a full overview of ESA's programmes and missions, but focus on the most pressing issues requiring immediate and high-level responses.

First and foremost, access to space, the enabler of Europe's space activities and freedom of action in space, is facing destabilising external challenges. In response to an erosion of the classical accessible commercial market, the successful maiden flights of Vega-C and Ariane 6 and their transition into exploitation are an absolute priority, while keeping institutional funding needs under control. In parallel, ESA will propose rapid advancements in technological innovation and encourage new industrial actors and customers as well as creating and capturing new demand. ESA will work with Member States, the EC and industry to establish a way forward for space transportation, with concrete programme elements proposed for the 2022 Council at Ministerial Level. In this respect, ESA will follow a fast-learning/higher-risk approach for future technology maturation such as reusability, new engines, building notably on 3D printing and AI. Europe's Spaceport in Kourou, French Guiana, will be streamlined to allow for adaptation to increasing launch needs to better serve

<sup>15</sup> In all its undertakings ESA will ensure that each individual ESA Member States remains free to pursue programmes within ESA inside the full perimeter of space activities and that ESA staff works against a single set of rights and obligations in all domains and programmes of ESA, individual ESA Member States or Third Parties.

constellations. ESA will also assess new launch site initiatives and reinforce its current stimulation of innovation, growth and competitiveness through boosting privately led space transport services and infrastructure led by new European actors.

Second, ESA will do what it takes to preserve the excellence of its space application domains. In telecommunication, contributing to one of the largest service markets of the space economy. ESA will take action on the creation of secure digital connectivity for Europe in close relation with its Member States and the EC. ESA will work on a partnership framework and business case, from design, implementation, launch, and validation to operations and commercial service provision. As a result, a new generation space system will provide high-speed encrypted connectivity services to everyone and will propel Europe into the quantum era, and enable global 5G/6G mobility and Internet of Things services, thus realising its strategic autonomy in these critical fields. In satellite navigation, ESA is committed to delivering on the EC ambition to launch the first satellite of the Galileo second generation before the end of 2024, with its accompanying downstream applications and services – a goal to be achieved with the EC and industry. This shall keep Europe at the forefront in the navigation domain, providing billions of users with positioning, navigation, and timing capabilities for their professional or private use, contributing to a huge and growing downstream market of space-based services. In Earth observation, ESA will strongly support New Space involvement and commercialisation. New technologies like AI and quantum computing will be integrated upfront to translate big data into smart information and services. ESA will also foster the development of commercial European constellations of small- to medium-sized missions to complement larger public high-precision reference missions such as the Copernicus Sentinels. This system of systems approach will reinforce existing programmes and will create a strong rapid-response Earth observation capability in Europe. The creation of digital twins of Earth will advance the understanding of complex systems and problems like climate change, loss of biodiversity and questions in Earth science. Through stronger integrated approaches, ESA will safeguard and reinforce Europe's global leadership by fostering synergies between the three space application programmes, to contribute to the green and digital agendas.

Third, ESA will implement Europe's next leap in space exploration: *Terrae Novae*. Human and robotic exploration is on the move with India entering into human spaceflight, the next Chinese space station to become operational by 2025 and the US returning to the Moon and beyond through the Artemis programme. Currently, ESA has secured European astronaut presence and the provision of habitation/refuelling modules on the NASA-led Lunar Gateway. ESA will engage in a large robotic mission to the Moon's surface to reinforce European exploration identity and strategic autonomy. If supported, ESA will find the right arrangement with NASA to secure the historic landmark of a European walking on the Moon by the end of this decade. ESA will implement ExoMars2022 and Mars Sample Return as well as preparing for the post-International Space Station era and post-Mars Sample Return mission timeframe, to develop key building blocks by 2035 for the horizon goal of a human mission to Mars.

Top-notch science and knowledge acquisition will remain at the core of the Agency's DNA and focus. ESA's ambition and execution of space missions should be the envy of the world, especially in Earth sciences, exploration and space science. This will provide European scientists with new tools, missions and data to achieve and maintain international leadership. The payloads of future scientific missions, within the Voyage2050 strategic plan, will continue to grow more complex. ESA will address this challenge with its Member States and find a new balance for the Member States' direct contributions. By 2025, ESA will have presented the Voyage2050 plan and started technology developments towards the future flagship missions. It will have launched JWST, JUICE, Euclid and the ESA/China mission SMILE. The Cosmic Vision flagship missions Athena and LISA should be adopted by the Science Programme Committee. Through its science missions ESA consistently helps to answer the biggest scientific questions of our time, such as the mysteries of our Universe, the understanding of our Solar System and the search for habitable planets or life outside our home planet.

ESA will continue to master the most complex space operations with efficiency gains by systematically introducing ever more automation and AI, and be at the forefront of multi-mission operation systems. By 2025, ESA will have introduced the European Common Core Mission Operations Software as a new standard for use by the private and public sector in Europe. Our world-

class space operations will become more automated and cost efficient and will deliver progress in areas of space traffic management and debris mitigation, space weather, planetary defence, and space logistics. Further, ESA will drive cyber security in operations.

Technology is the key enabler of all major technological and commercial disruptions. Reusability and on-board intelligence have disrupted the launcher sector, miniaturisation and standardisation have disrupted telecommunications and Earth observation. It is now time to shape and grow the disruptive technologies of tomorrow. In line with its Technology Strategy<sup>16</sup>, ESA will immediately launch three new technology R&D initiatives on innovative propulsion, in-orbit servicing and construction, and quantum technologies. Innovative propulsion spans from air-breathing rocket engines, to electric propulsion for extremely low orbits, to green propellants. In-orbit servicing and construction will help enable cheaper, expendable, serviceable and upgradeable space assets. Breakthroughs in quantum technology will enable a whole new generation of sensors and clocks of unprecedented accuracy, and open up new avenues to commercial success and leadership.

## 2.5 COMPLETE THE ESA TRANSFORMATION

**To prepare for the challenges ahead, ESA will boost its effectiveness and attractiveness.** This will be pursued through two channels. The Agency's internal processes will be streamlined, including its interaction with Member States and industry. In parallel, the ESA workplace culture will be modernised as an investment in its most important asset: its diverse European workforce.

ESA's internal processes have a direct impact on the Agency's value for European space. When procurement and decision-making processes become less bureaucratic, and adjusted to the nature of the desired product, they become faster. This makes it possible for ESA to focus on its core tasks and to stimulate commercialisation and disruptive innovation in Europe. The momentum for digitalisation created by COVID-19 shall be maintained.

A comprehensive data strategy will be implemented. Through this strategy, ESA will organise and use both its space and non-space information to the benefit of society. This strategy will make use of the latest data analytics technology and will treat data as a central and critical corporate asset within the Agency.

As part of the data strategy, dashboards will be devised and implemented to radically transform the communication culture in ESA. Platform-based information access will optimise communication and knowledge exchange, and will ensure that Member States, ESA personnel and industry have fingertip access to the latest information on ESA programmes, budgets and activities, within the limits of applicable confidentiality or industry IPR restrictions. ESA dashboards will internally lead to the rapid implementation of procurement process streamlining, and to the seamless functioning of the network of ESA  $\phi$ -labs across Europe. Externally, they will be used to increase transparency of ESA decision-making for citizens and to facilitate the creation of a seamless value chain for businesses and entrepreneurs. The financial management and control processes of ESA will also be improved to avoid duplication, reinforce visibility and coherence, and allow progress to be better measured by fully adopting a modern financial planning tool.

ESA projects are characterised by heavy engineering efforts from geographically dispersed teams in ESA and industry. Digital continuity throughout the life cycle of projects allows the substantial reduction of cost and errors, and will shorten schedules. ESA will therefore digitalise its full project management, enabling the development of digital twins, both for engineering by using Model Based System Engineering, and for procurement and finance, achieving full digital continuity with industry.

To ensure that the programmes and the internal processes of the Agency can benefit from the latest IT tools, ESA will give special emphasis to a business-led strategy, to coordination of initiatives, and to shared development roadmaps and implementation plans for all of its information technology.

A key avenue to increasing productivity is the creation of a modern workplace culture. To keep on attracting and retaining the best talents, ESA's actions must reflect the values of the future. This will

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<sup>16</sup> ESA Technology Strategy,  
[http://esamultimedia.esa.int/docs/technology/ESA\\_Technology\\_Strategy\\_Version\\_1\\_0.pdf](http://esamultimedia.esa.int/docs/technology/ESA_Technology_Strategy_Version_1_0.pdf)

be aided by the establishment of new ways of working that take advantage of advanced collaboration and communication tools that will reduce barriers to exchanging information and collaborating efficiently and securely, from anywhere and at any time.

The Agency will appoint a Senior Climate and Sustainability Adviser to the Director General to ensure that ESA and European space programmes can support the implementation of the Paris Agreement and the European Green Deal to the fullest extent. The Agency will improve its own environmental responsibility, to contribute to the climate neutrality of Europe. By 2030, ESA's greenhouse gas emissions will be decreased by 46.2% compared to 2019.<sup>17</sup> In addition to environmental ambitions, the Agency will develop a set of objectives addressing all of its Corporate Social Responsibility Principles<sup>18</sup>. An internal ESA sustainability fund will be established and used to guide investments into a sustainable ESA and European space infrastructure over the coming years. ESA is ready to sign a Charter for a Responsible Space Sector, focused on shared sustainability practices with industry.

ESA in 2025 will be a greener, younger and more diverse organisation. Women will be better represented in our staff, including at management level. ESA shall become a model for the space community and beyond.

**At ESA we believe that an Agency can only be as strong as its people. An essential element in this respect is diversity.** Building upon its geographic and cultural diversity, ESA will undertake even more steps in becoming a diverse, attractive employer that serves as a model to the space community and beyond. By 2025 around one fifth of the current ESA staff will retire. This provides a unique opportunity to create a better gender balance and bring more diversity into the workforce. ESA will also take steps to improve inclusiveness for LGBTQ people. As regards gender, at present 28.6% of ESA staff are women and at management level only 1 out of 6 managers is female. The Agency will aim for at least 40% of recruitments by 2025 to be women, including for STEM positions. Efforts shall also be pursued, in particular through internal reassignments, to progressively reach a similar ratio at managerial level. Moreover, ESA will expand its efforts to reach out to more diverse communities to address the root cause of female underrepresentation: the low percentage of female applicants. Through strengthened acquisition measures and equal opportunities, ESA will attract the diverse pool of talents needed to reinforce its engineering and science expertise – the core of the Agency. This will allow ESA to stay on top of space programmes while preparing a diverse pool of potential leaders for the future. Furthermore, the Agency will create a Young Professional Programme to ensure the recruitment of a younger generation, contributing to a decrease in the average age at ESA (currently 49). ESA will also launch internal measures to prepare people for leadership roles, in particular to strengthen women in such roles, and to ensure our future leaders comprise a diverse range of people.

Further work will be done to build a fully inclusive workplace where we welcome everybody, irrespective of their identity. To achieve this, ESA will take measures to improve inclusiveness of people with disabilities, and will in particular check that staff rules ensure inclusivity, removing potential discriminatory bias. Wherever possible, external assessment will be sought on those topics aiming at relevant certifications for benchmarking, best practice and corporate responsibility.

Last, ESA will also develop a proper workforce and succession planning and distribution process to improve the matching of skills. This will boost mobility across the Agency's programmes and sites.

These actions will increase the motivation of personnel, who will be fully engaged in this transformation, and will help in establishing ESA as one of the most attractive employers in the European science, research and technology domain. ESA will organise regular 'ESA days' in each country to further strengthen its connection to its Member States and to create the spirit of 'one ESA' comprising the Executive and Member States.

<sup>17</sup> This ambitious target is according to the needs expressed within the COP26 framework.

<sup>18</sup> ESA/INFO(2020)6

### 3 TAKING EUROPEAN SPACE TO THE NEXT LEVEL

Gandhi once famously said that the future depends on what you do today. This is definitely true in space, since the technologies and programmes that are being developed now will define our missions and in-orbit capabilities 10–15 years from now. If Europe wants its space sector to thrive by the mid-2030s, it needs to take the right steps and decisions today.

The five priorities of the ESA Agenda 2025 will ensure that Europe can stay at the forefront of space in the coming years. However, to ensure long-term growth, Europe needs to up its game in space. To put the European position into perspective: the total public spending on space in the US amounts to roughly €40 billion in 2019 (or 60% of the global market), compared to a total European public investment of a mere €10.5 billion (or 16% of the global market share)<sup>19</sup>. From today's perspective, it is hard to imagine having the same budget for space in Europe as in the US, in spite of having a comparable economy. Europe shall, however, make sure it has the right critical mass in its own priority areas and Europe shall make sure that the gap to other global players gets smaller, not larger, over time.

1. Initiate political dialogue at highest level
2. Create a joint European vision for space
3. Space Summit 2022

Europe, through ESA, is currently successfully active in all space domains and a recognised and reliable partner in all major international endeavours in science and exploration. ESA will pursue and will strengthen its cooperation with key international partners like the US, Japan, and Russia and will also promote the value of space and its applications in regions like Africa, Southeast Asia and Latin America. ESA has realised many premieres such as the Huygens landing on Titan, Rosetta/Philae orbiting and landing on a comet, unravelling the history of our Galaxy, or mapping the gravity field of Earth. Europe is the leader in public space infrastructures and operational services such as meteorology, environmental monitoring and navigation, where we are one generation ahead of our competitors. However, one cannot be complacent – as illustrated by the eroding European leadership in launchers and satcom.

Considering the rapid transformation of the global space sector, all European space actors shall work together to maintain or further develop leadership in key space domains. This chapter proposes a concrete way to make this happen.

#### 3.1 INITIATE POLITICAL DIALOGUE AT HIGHEST LEVEL

Defining steps and taking them requires a shared vision and an agreed direction as a starting point. Therefore, it is of utmost importance to reach a common understanding of where the European space sector boldly wants to go.

Such a common understanding will be achieved by a stepwise approach that is flexible enough to be adapted when needed. First, consultation will be sought from science, industry, society and our Member States. A 'group of wise people' mandated by the ESA Director General and the European Commissioner responsible for space, consisting of high-profile figures not affiliated to ESA nor to the Commission, will be asked to supply an independent perspective. The group will also include members from the younger generation to facilitate an 'outside the box' view and ensure that topics of the future like climate change and digital challenges are adequately addressed. The group would be challenged to provide a vision of Europe's ambition in space for the coming decades, identify domains for flagship programmes, suggest governance evolution options and to make the case for political support at Member State level. This output will serve as input for the Space Summit in 2022 (see section 3.3).

<sup>19</sup> Euroconsult

The EU–ESA Space Council, with the ESA Council and the EU Competitiveness Council (or similar), will have a central role in guiding the process, taking into account the outcome and formalising the result to create a common understanding as a foundation for all subsequent steps.

### 3.2 CREATE A JOINT EUROPEAN VISION FOR SPACE

In contrast with the strong diversity of European actors at local, regional, national and European levels, the challenges faced are fairly homogeneous and common: building a peaceful, sustainable, inclusive and better future for all citizens. All big societal goals share common ground and could benefit from common responses and capabilities.

Space is one of those tools that offers common responses to shared challenges. It needs to enter into the natural toolkit that any decision-maker considers, and no longer be considered as an exotic niche activity.

To serve the European citizen and Europe's global interests, European actors – in particular ESA, the EU, their Member States and industry – shall create a joint vision for space, based on their priorities, needs and schemes to benefit from space in the best possible fashion.

To translate this European space vision into reality requires an industrial policy. ESA's industrial policy over the last 50 years has allowed Europe to shape and mature a competitive space ecosystem. However, the context of space activities has evolved. To empower stronger European ambitions and a resilient space value chain and ecosystem, Europe needs an inclusive and truly common European industrial policy for space. This innovation and industrial policy shall define and develop critical technologies and capabilities for supporting industrial competitiveness, achieving societal needs and non-dependence. It shall be based on common objectives at EU, ESA and Member State levels, whilst maintaining a flexible implementation framework to combine public-directed actions with free-market undertakings. This will allow a balancing of European and national interests, whilst providing strong institutional leadership and a European approach to the commercialisation of space activities. This policy shall also address the issues of access to venture capital, internal markets, and faster time-to-market, three areas where Europe lags behind the US.

### 3.3 SPACE SUMMIT 2022

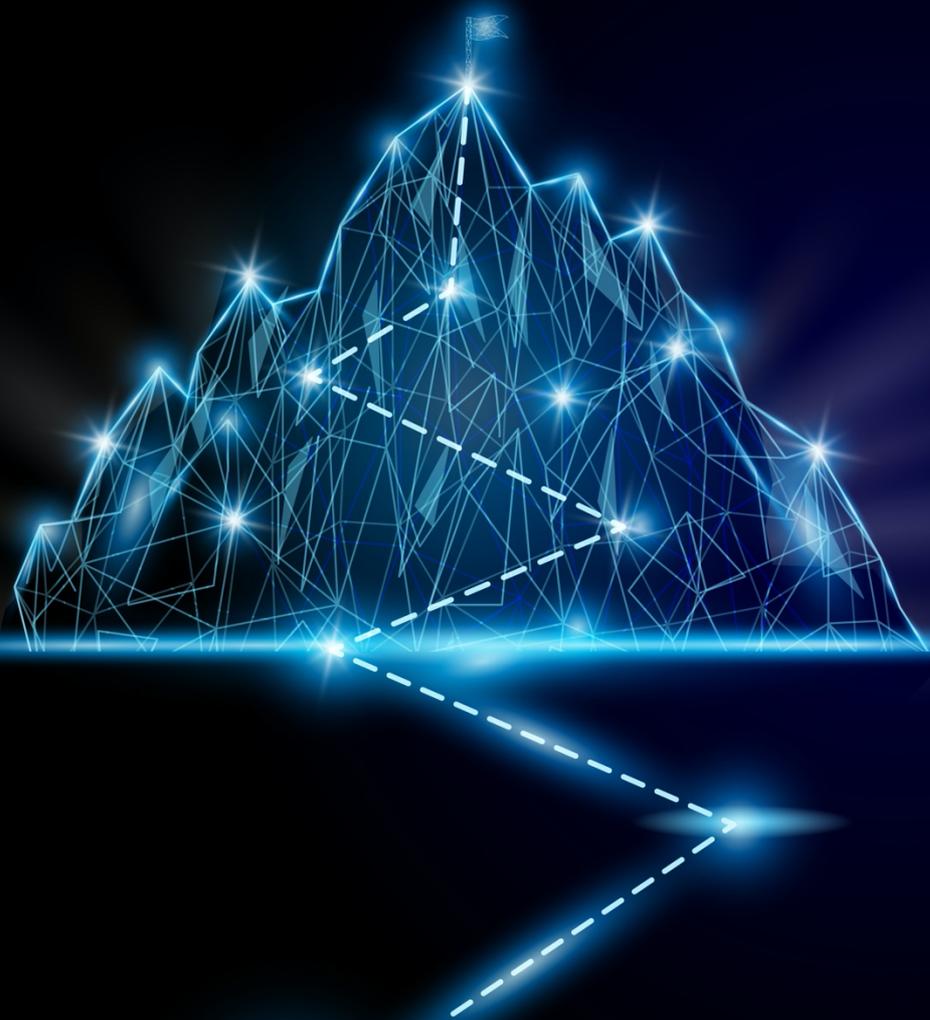
In 2025 we will celebrate half a century of common space commitments, European space cooperation and successes, kick-started by the establishment of the European Space Agency in 1975. At that time, ESA was established in less than two years. The multilateral governance arrangements contained in the Convention, and ratified in the meantime by 22 Member States and the related modalities may deserve a fresh political impetus.

It is proposed to organise in spring 2022, under the auspices of ESA and of the EU, in a Space Council configuration, a dedicated Space Summit. This Space Summit shall gather the top European decision makers, ideally at Head of State / government level, to propose a new ambition for space in Europe. **The Space Summit should thus officially announce new flagship space programmes in addition to Copernicus and Galileo**, launched as strong partnership projects between the EU and ESA. New flagships will establish new areas of European leadership, and create more critical mass for the entire value chain of spacecraft development, launches and operations, allowing European industry to better compete on the global market.

Various candidates have been envisioned over recent years, some of which were mentioned by European Commissioner Thierry Breton at the Brussels Space Policy Conference in January 2021, such as Broadband Connectivity/Quantum Communication, a central topic of the Digital Agenda for Europe. ESA has recently proposed the creation of digital twins of spacecraft, Earth, and the Universe, which could be implemented within the Digital Europe Agenda of the Commission. Other candidates include the establishment of Very High Resolution rapid response capability in Europe, integrating Earth observation with space-based communication and navigation infrastructure. Another candidate is Space Traffic Management, key to ensuring the safety and security of the European public and private space infrastructures. Another very inspirational ambition is to position Europe right now in the critical path of the first international interplanetary expedition by developing

the capabilities that will secure the participation of a European woman to step on Martian soil, and return her home safely to Earth in the next decade.

In view of these new flagships, the Space Summit shall also consider the various options for the evolution of the governance of space in Europe and decide on how ESA should develop its role as space agency of the EU for the implementation of its flagship programmes, while remaining the space agency of its Member States. This decision on a European governance evolution encompassing ESA, EUSPA and possibly the technical/operational capabilities and centres of national space agencies will be transformed into a proposal to be further developed and likely formalised in a follow-up summit, tentatively in 2023, to complement the existing intergovernmental dimension of ESA with a new dimension geared towards the development of new European space programmes. This would also ensure that the interests of all ESA Member States, including the non-EU members of ESA – the United Kingdom, Norway and Switzerland – are preserved. In a constructive spirit and with a can-do mentality, a way forward that respects the specific character of space in Europe can certainly be found and agreed upon.



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## 4 ESA IS READY FOR THE CHALLENGE

For more than four decades, ESA, its Member States and industry have been at the core of numerous European successes in space. ESA has refined its rules, procedures and governance to continuously adapt to changing boundary conditions, and has succeeded well in doing so. This proven ability to change when and if required is an asset of ESA.

In recent years, the world around ESA has changed dramatically. The European Commission, rightly, has taken up space as a priority for Europe. The US has reinforced its government space programme by creating a Space Force and by giving NASA a challenge of landing on the Moon again. China has chosen space as one of its means to reach superpower status by 2049 to celebrate the 100th anniversary of its revolution. Commercial space ventures, originally created in Silicon Valley but in the meantime established in most countries, offer vast untapped economic opportunities for the European space sector. Europe cannot afford to stand still. It needs a renewed ambition, a new drive and the desire to lift space to the next level. For this to happen, it needs a more dynamic and responsive ESA: an ESA that can once again adapt and evolve, for a fresh start.

Europe has always succeeded when under pressure. The EC as well as the EU and ESA Member States need to fully empower ESA to play its role in shaping and implementing Europe's ambition in space – an ambition of inspiration, exploration and realisation of Europe's political, societal and economic goals.

The new ESA must focus on the needs of all citizens to implement the agendas of today and the future. Tackling climate change, jump-starting the post-COVID economy and fully embracing new digital technologies require all of Europe's engineering and science ingenuity, something ESA is able to offer. But this can only be realised when combining the political strength of Europe – which the EU and ESA Member State governments can provide – with the undisputed and unique technical, engineering and scientific capabilities of ESA.

ESA – with its highly skilled and motivated workforce – is ready for this challenge.

Josef Aschbacher  
ESA Director General

31 March 2021