



ESSTC

Uplifting ESA Science Funding II

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Science: The Foundation of Progress

"More than ever, we need to stand up for science"
European Union President von der Leyen - 5th May 2025

Science is the bedrock of human progress. It creates knowledge and understanding, yielding myriad benefits for society. In today's technologically driven age, its contributions are indispensable.

The case for its support is compelling: science enhances security, drives economic growth, mitigates risks, and inspires future generations. By investing in science, we unlock the potential for ground-breaking discoveries, foster a culture of innovation, and build a more informed and resilient society. In a world where technological supremacy dictates geopolitical power, scientific advancement is nothing less than a societal imperative. In an increasingly AI-driven era, scientific integrity becomes the ultimate differentiator. The societies that thrive will be those whose artificial intelligence systems are built upon rigorous scientific truth. .

Yet science is under attack. A troubling array of anti-science forces is distorting public discourse, propagating misinformation, and eroding trust in evidence and expertise. If left unchecked, this erosion will leave societies vulnerable to crises they can neither recognise, understand, nor address.

Meanwhile, the global scientific landscape is being reshaped. Nations once at the forefront of scientific research are weakening their institutions, whilst others, after years of strategic investment, are rapidly ascending as leaders in pivotal fields.

Nowhere is this shift more consequential than in space science - a domain where breakthroughs redefine humanity's capabilities and ambitions. Mastery of space unlocks unparalleled advantages: from securing new insights into the Universe and our home planet, to harnessing extra-terrestrial resources and pioneering off-world habitats. It fuels advancements while offering a platform for global collaboration. To lead in space is to shape the infrastructure of the future, both on Earth and beyond.

The path forward is clear: For Europe to ensure societal resilience, lasting prosperity, and enduring global influence, it must champion science - particularly space science - as both a public good and a strategic imperative.

With Europe's future scientific leadership and technological sovereignty at stake in this way, we call upon Member States at CM25 to grasp the opportunity and to commit fully to the science elements of ESA's programme proposal - both mandatory and optional, including Earth Observation and Exploration. This is not just a funding decision but a strategic choice. By acting decisively, Europe can reaffirm its commitment to advancing knowledge, accelerating breakthrough technologies, and uniting behind a shared vision of progress.

Chris Rapley

Chair, European Space Sciences Committee

“First-class science is absolutely essential for the promotion of European interests and leadership, as it imparts a strong strategic drive to its technological and industrial system”.¹

The European Space Agency (ESA) has been central to developing Europe's capabilities in space science, technology, Earth observation, and human and robotic space exploration for over five decades. Through a combination of visionary leadership and skilful coordination, its achievements have far exceeded what would have been possible through the separate efforts of its member states.

This accomplishment has earned global recognition, with ESA's programs serving as benchmarks for international collaboration and its scientific output routinely ranked among the world's most influential space research. Scientific research within the Mandatory Programme, the Earth Observation programme, and the Human and Robotic exploration activities, has formed the bedrock upon which ESA's capabilities and successes have been built.

To ensure that in the next fifty years **Europe will remain in a leadership position**, we urge the delegations of the European Space Agency to **fully fund the ESA Director General's requested science element across the ESA programmes at the 2025 Ministerial Conference** and ensure robust development and evolution of the programmes. This isn't just an investment in ESA or space but an **investment in Europe's future and in our collective dream of a progressive and culturally vibrant society**. In the case of Earth Observation science there is **an additional dimension of urgency**, given the increasingly rapid and damaging changes taking place in the global climate system and environment, and the **need for informed societal action**.

The Case for Science – Advancing Knowledge and Society

Security: Scientific insights are foundational to national security capabilities. By investing in science, we enhance our ability to develop advanced technologies, skills, and capabilities that safeguard citizens and geopolitical interests. Research in fields such as cybersecurity, biotechnology, and materials science underpins the development of technologies that are crucial for national defence and security. Bolstering funding for science enhances our ability to respond to emerging threats and challenges. Advanced technologies developed through scientific research can provide strategic advantages, ensuring the safety and security of our nations.

Economic Growth, Innovation, and Prosperity: Scientific advancements are a major catalyst for economic growth and innovation. The development of new technologies and industries directly stems from scientific research, leading to job creation, increased prosperity, and the enhancement of technical and commercial capabilities. The resulting advancements foster resilience to future global developments, ensuring that economies can adapt and thrive in a rapidly changing world. Scientific innovation drives economic growth and societal well-being. Investing in science ensures that we continue to reap these benefits, promoting a cycle of innovation and prosperity.

Risk Mitigation: Scientific research is essential for understanding and managing risks, such as natural disasters and climate change. Through the study of environmental and climatic processes, science helps us anticipate, understand, and mitigate these threats. For example, researches in

¹ “The European White Paper on Space: Enough Support for Basic Science?” J.-C. Worms, G. Haerendel, *Space Policy*, 20 (2004,) pp73–77

meteorology, space weather, asteroid impact risk and seismology, provide critical insights that enable better preparation and response to natural disasters. Furthermore, scientific advancements in areas like environmental science and public health play a crucial role in addressing global challenges. By understanding the underlying mechanisms of these issues, we can develop effective strategies to manage and mitigate their impact.

Prestige: Scientific achievements captivate the public's imagination and showcase a nation's capabilities, fostering a sense of collective pride. These accomplishments command respect from global partners and competitors, enhancing a nation's prestige on the international stage. The discovery of new knowledge and the development of innovative technologies highlight the intellectual and technological prowess of a society. Europe's commitment to scientific excellence is exemplified by its contributions to global scientific endeavours. Achievements in space exploration, medical research, and technological innovation position Europe as a leader in the scientific community, garnering international respect and admiration.

Seeking Truth: At its core, science is a pursuit of truth. The scientific method offers a systematic approach to overcoming human biases and limitations, ensuring the pursuit of accurate and objective knowledge. Increased funding for science allows us to refine this method and unlock new frontiers of understanding. By continuously challenging existing knowledge and exploring new questions, science pushes the boundaries of what we know. This relentless pursuit of truth drives progress, enabling us to address complex challenges and improve our understanding of the world.

Satisfying Curiosity: Scientific research is driven by human curiosity. Throughout history, this curiosity has led to ground-breaking discoveries that have expanded our horizons and challenged our intellect. By investing in science, we can continue to push the boundaries of knowledge and enrich our collective understanding. From exploring the depths of the oceans to uncovering the mysteries of the universe, scientific inquiry satisfies our innate desire to know more about the world around us. This quest for knowledge not only drives innovation but also inspires awe and wonder.

Societal Vitality: The knowledge and capabilities generated by science are integral to a culturally vibrant and advanced society. Scientific research empowers us to address complex challenges, make informed decisions, and drive sustainable progress. By investing in science, we equip ourselves with the tools needed to navigate the future. Science also plays a crucial role in informing public policy and societal debates. By providing evidence-based insights, scientific research helps shape policies that promote societal well-being and sustainable development.

Inspiration and Education: Science has the unique power to inspire and engage people across age groups and backgrounds. By investing in this field, we can ignite interest in science, technology, engineering, and mathematics (STEM), building invaluable social capital for the future. Educational initiatives and outreach programs that promote scientific literacy are essential for nurturing the next generation of innovators and leaders. Inspiring young minds to pursue careers in STEM fields ensures a continuous pipeline of talent, driving future scientific and technological advancements. Additionally, public engagement with science fosters a culture of curiosity and lifelong learning.

Unifying Force: Science generates universal truths that transcend cultural, national, and language barriers. In doing so, it serves as a unifying force, fostering collaboration among professionals, organizations, institutions, and nations. Increased funding will strengthen international partnerships, driving cooperation and collective progress. Scientific collaboration across borders promotes the sharing of knowledge and resources, leading to more comprehensive and impactful research. By working together, nations can address global challenges more effectively and contribute to the common good.

Space Science: The Strategic Imperative in Summary

Vista: The perspective provided by space opens new windows on the Universe and our planet. It inspires new generations of scientists, engineers, and the general public, rewriting textbooks, altering worldviews and fostering 'out of the box' innovation.

Location: Space offers a unique laboratory for studying fundamental processes in microgravity, next-generation manufacturing, and testing cutting-edge ideas.

Engineering Challenges: The demanding conditions of space necessitate the development of cutting-edge, miniaturised, radiation hardened, autonomous instrumentation and facilities, driving technological advancements that benefit industries back on Earth.

Relevance: Observations from space are critical for tackling urgent societal issues such as climate change, disaster response, and resource management.

Virtuous Cycle: *Science enabled by access to space* unlocks discoveries impossible on Earth. Conversely, *science that enables access to space* creates the technological foundation for reaching further into the cosmos. Together, they form a virtuous cycle: one expands our understanding of the Universe, while the other expands our capacity to explore it

The Value of ESA Science

Europe's collaborative efforts in space science, uniting 23 member states, exemplify a remarkable achievement. This unity not only **reinforces political and industrial strength** but also **enhances collective purpose, international influence** and a **European sense of identity and pride**. Science plays a critical role across ESA's programmes in shaping inspiring discoveries, catalysing technological advancements, developing workforce talents, industrial competencies, and infrastructure assets, all of which lie at the leading edge of international space efforts:

Facilitating Scientific Discoveries and Advancements: The ESA mandatory and optional programmes have facilitated research that spans from understanding the origins of the Universe through astronomy and astrophysics to unravelling Earth's complex processes, enabling physical access to a growing number of solar system bodies and the scientific exploitation of the human occupation of zero gravity. The stream of results from missions such as Gaia, the James Web Space Telescope and EUCLID, the rich view from the Earth Observation programme of the planet as an integrated whole, and the bravado of human experimentation in Low Earth Orbit, have advanced human knowledge in ways inconceivable even decades ago. European scientific prowess, cultural richness, and worldwide prestige have been thus elevated.

Developing Skilled Workforce, Industrial, Technical, and Scientific Capabilities: The science enabled by the ESA Mandatory, Earth Observation and Exploration programmes has nurtured the growth of a European academic community at the global forefront, and a highly skilled space-based workforce, attracting and developing talent from across Europe and worldwide. In doing so, it has catalysed the creation of world leading scientific, industrial, technical, and programmatic capabilities. The development and execution of ambitious missions, exploring the realms of feasibility, have necessitated collaboration among various sectors, promoting cross-disciplinary expertise and the development of programmatic capabilities that have underpinned Europe's position as a global leader in space technology.

Creating Infrastructure for Hugely Technically Demanding Missions: The foundation laid by the demands of space science projects has played a pivotal role in building essential infrastructure for designing, testing, launching, and operating technically demanding missions. This has resulted in the establishment of world-class facilities, research centres, and manufacturing and programmatic capabilities. The collective experience gained from these endeavours has enabled ESA to undertake complex, technically challenging, and costly missions, such as robotic and human exploration of other celestial bodies, the pinpoint placing of hugely complex observatories at gravitational neutral points, and the construction of spacecraft capable of skimming the atmosphere of the Sun.

Benefiting the European Economy: The space industry has shown itself to be a significant economic driver, spawning entirely new and lucrative industries. Within Europe, studies have demonstrated a 'multiplier' of x6 to x10 in terms of Euros generated for Euros invested. Examples of spin-offs include Galileo for navigation, Copernicus for climate monitoring, and medical technologies from microgravity research. Companies such as Airbus, Thales-Alenia, OHB, Leonardo and BAE benefit directly from ESA contracts, with the *juste-retour* principle ensuring that all member states benefit according to their investments. Data and insights generated from Earth Observation missions especially have been leveraged for environmental monitoring, disaster management, agriculture, urban planning, and more, contributing to economic growth, sustainability, and informed decision-making. The technological successes and advancements resulting from the science missions have also stimulated the growth of commercial space ventures and innovation-driven industries.

Inspiring the public: The accomplishments of ESA's Science Programme and Exploration missions have not only advanced our understanding of the Universe and our planet, but have also served as a wellspring of inspiration for future generations. These endeavours ignite curiosity, drive STEM education, and inspire young minds to pursue careers in science, technology, engineering, and mathematics. Moreover, the iconic images and ground-breaking discoveries captured by these missions captivate the public's imagination, fostering a sense of wonder and unity.

Enhancing Influence and Security: ESA's achievements in space science, technology, and exploration contribute significantly to Europe's security and geopolitical influence. The agency's capabilities enable independent access to space, satellite-based communication, navigation, and observation, which are vital for national security, disaster response, and international collaboration. By advancing its space-based contributions to the Green Transition, ESA enhances its global standing and reinforces its role as a reliable partner in addressing global challenges.

The **European Space Agency's foundational programmes**, including the mandatory Science Programme, and the optional Earth Observation, and Exploration initiatives, have been **instrumental in shaping its capabilities and achievements**. These programmes have fuelled inspiring scientific discoveries, cultivated a skilled workforce, advanced industrial and technical capabilities, and established critical infrastructure. Recognizing the **paramount importance of ESA securing and sustaining ambitious, robust and long-term support for science in the programme** will ensure a continuing wellspring of innovation, enabling Europe to remain at the forefront of space technology, scientific exploration, and the realization of a sustainable, inspiring future.

By investing boldly in ESA's science programmes today, Europe will secure its place as a global leader in the space economy, a guardian of our planet, and a beacon of inspiration for future generations, uplifting European aspirations for a better tomorrow.

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