



Science Year 2027 – Space

Concept summary with thematic fields of action

AI

1. THE SCIENCE YEARS

What is the idea and who supports it?

The Science Years are a joint initiative of the Federal Ministry of Research, Technology and Space (BMFTR) and Science in Dialogue (Wissenschaft im Dialog (WiD)). For more than 25 years they have offered a platform for exchange between society and research. Every Science Year is dedicated to an interdisciplinary future-oriented topic which addresses different aspects of innovation, key technologies and challenges facing society.

2. SCIENCE YEAR 2027 – SPACE

What is the starting point and what are the objectives?

The theme of Science Year 2027 is “Space” and addresses one of the strategic research fields of the High-Tech Agenda Germany (HTAD). The aim is to put the fundamental importance of space at the heart of social discourse.

In the public perception, space is mainly associated with astronauts and rocket launches. Behind the scenes, however, the space sector is an invisible but

indispensable infrastructure that ensures our everyday life. At the same time, the space sector has become an enormous economic factor which drives innovation and new markets.

Its dimensions highlight its relevance: The global space market will grow from approx. 207 billion euros today to over 270 billion euros in 2034. Today, more than 12,000 active satellites already orbit the Earth – a number that will multiply due to the creation of further satellite constellations in the years to come.

At the same time, the relevance of the space sector for security has increased. Precise navigation, secure communications and Earth observation have become indispensable for armed forces, disaster prevention and management and the protection of critical infrastructures. There are about 630 satellites used by military forces in orbit – a clear sign that the space sector has become indispensable from a defence and security policy perspective. The ability to securely monitor their orbit and to protect one's own systems has thus become one of the central prerequisites for sovereign action by the state and within Europe.

The aims of the Science Year which we want to achieve together with our partners are therefore as follows:

- **We will show how the space sector works**, what it can provide and we will discuss its added value for society. In doing so, we will increase acceptance and inspire public interest in science and research in this field. We will show how closely German space research and the German space industry cooperate with counterparts in Europe and internationally and what key areas the German and European space sectors cover.
- **We will put a focus on topics of the space sector with relevance for society and our daily lives** and make pioneering developments in this sector transparent and accessible. The aim is to provide a holistic view of the importance of the space sector for society and to firmly establish its role as an essential driver of innovation in everyday life.
- **We will motivate young people** to work in the space sector and provide insights into interesting career opportunities. Addressing girls and women is a particular focus of this Science Year.
- **We will present space as a growth industry** which – beyond its role as a strategic research field – is an enabler for other industries, provides impetus for new markets and new business models as well as contributing to resilience and ensuring the smooth operation of value chains (e.g. satellite infrastructure as a basis for logistics, agriculture, energy, medicine, digitalization/connectivity, security). Public investment will trigger private investment and innovation in many industries, thus providing a leverage effect. The multi-faceted benefits of the space sector can be presented, discussed and incorporated in many different formats for diverse target groups.

3. THEMATIC CONTEXT

What is the concept and what are the main issues?

The following fields are the main issues, while additional topics might be added during the course of the Science Year.

Issue 1:

Science and research – from Earth to the Universe

Spaceflight is often erroneously regarded as a costly adventure while space actually represents the most extreme and pure laboratory humanity can access to study the laws of nature. While experiments on Earth are always influenced by gravity and the dense atmosphere, space offers very different conditions which could never be artificially created in terrestrial facilities on such a large scale. Microgravitation plays a decisive role in both basic and in applied research: Processes such as the growth of crystals can be observed without disruptive effects like buoyancy or sedimentation.

Spaceflight would not be possible without basic research. Here, earth-bound astrophysics plays a decisive role: One central element of earth-bound astrophysics is scientific prioritization and mission preparation. Sky surveys, long-term observations and the creation of target object catalogues help identify those issues, sources and fields of observation that are particularly relevant for later space missions. Thus, missions can not only be given a more precise scientific orientation but also be planned more efficiently. The Earth's atmosphere absorbs information such as that in the form of X-ray, gamma or UV radiation. These areas are observed using space telescopes. Observations from Earth-based observatories with high resolution in the optical, near-infrared and radio spectra complement these space observations. They are also indispensable for long-term observations and large sky surveys.

Space provides additional opportunities for astronomical research which originated on the ground and is penetrating further and further into the far reaches of the universe. Earth-bound and space-based methods are complementary and only when taken together can their full potential be harnessed.

Most modern physics also relies heavily on space research, since Einstein's theory of relativity, for example, is continually confirmed under extreme conditions by means of high-precision clocks in satellite constellations.

In the materials sciences, weightless conditions facilitate the development of new alloys and ultra-pure semiconductor crystals. On Earth, their production would be almost impossible due to the physical effects here.

For the further development of robotics, space research serves as a turbo booster since the extreme environment (vacuum, radiation, temperature, communication delays, strict mass/energy limits) calls for autonomy and fault tolerance as well as lightweight and energy-efficient systems.

From a medical perspective, periods spent in space have a kind of time-lapse effect on the human ageing process: phenomena such as rapid bone degeneration and muscular atrophy occur within weeks with astronauts. This provides science with important data for osteoporosis research and the understanding of the human immune system. Similarly, gender-sensitive areas of research and innovations can be also communicated in a targeted way.

Entire branches of science, such as planetology or exoplanetology, would be inconceivable without interplanetary probes and specialized space telescopes since they rely on direct ground samples from distant celestial bodies or precise light measurements outside the Earth's atmospheric scintillation.

Ultimately, it is only the view from the outside that makes global Earth system research possible, allowing us to understand and monitor climate change, the ozone hole and global ocean currents as a fragile, interrelated system. Space research is therefore much more than a path to reach distant stars; it opens up new perspectives on the physical rules of our very existence. Science Year 2027 provides a great opportunity to communicate this significance more strongly, to discuss it with citizens as well as to spark enthusiasm for occupations in the STEM subjects among girls and boys.

Issue 2:

Space's contribution to the economy

The economic importance of the space sector is often underestimated by the general public, yet it has become a vital backbone of the modern global economy and a huge driver of industrial innovations, thus providing attractive jobs for women and men.

In fact, the satellite services sector provides the basis for global communications, modern broadcasting and, above all, worldwide navigation. Global logistics chains would collapse within a very short time without the highly precise time and position signals of systems like GPS or Galileo. Shipping routes, air traffic and even automated warehouses depend on these data. Even the international financial system uses such time signals to synchronize huge financial transactions within the space of milliseconds.

Besides these direct infrastructural services, the space sector generates a massive indirect benefit by means of technology transfer. Many achievements we take for granted today in our daily lives are rooted in managing the extreme challenges related to space: from miniaturizing computer chips and highly efficient solar cells to scratch-resistant eye glasses and modern thermal insulation as well as lifesaving systems in medical technology, such as improved heart pumps or digital imaging processes which were originally developed for the analysis of space images.

Materials research also benefits massively since composite materials and extremely heat-resistant alloys developed for the space sector have long been used in the automotive industry and civil aviation.

In agriculture, satellite-based Earth observation enables what is known as precision farming in which fertilizers, seeds and water are deployed exactly where they are needed, which not only cuts costs by the billions but also protects the environment.

In economic terms, the space sector is a high-tech incubator with an enormous multiplier effect; studies regularly show that every euro invested in the space sector generates an added value many times over in the national economy. While state agencies dominated in the past, the rise of “new space” with private-sector players has radically dynamized the market, reduced costs for access to Earth's orbit and paved the way for entirely new business fields such as industrial production in weightless conditions or space-based energy supply. Many fields of technology, such as robotics, directly benefit from developments for extreme environments and the need for predictive maintenance of the expensive systems. Examples are autonomous navigation (e.g. terrain recognition, mapping and safe path planning), high-precision robots for maintenance and refuelling in orbit (e.g. service robotics and Industrie 4.0, robots for surgery and industry). Space research is a field of science which has developed into a strategic key industry which secures the competitiveness of modern industrialized nations and is the technological basis for the digital transformation of our society.

Science Year 2027 will therefore provide a new economic dimension to science communication and can highlight the central importance of German space companies. This can increase the attractiveness of the industry among women and thereby increase the percentage of women working in the sector.

Issue 3:

International cooperation as a driver of diplomacy

For decades, the space sector has been one of the strongest drivers of international diplomacy and scientific cooperation because the enormous technological and financial challenges of space can hardly be addressed by small and medium-sized nations on their own. The most prominent example of this is the International Space Station (ISS), which was developed in the 1990s as a peaceful joint project of the formerly bitter rivals USA and Russia together with further partners from Europe, Japan and Canada, and has become a unique symbol of global cooperation. This collaboration automatically forced the development of common technical standards, such as universal docking mechanisms and communication protocols which create industrial synergies across national borders and reduce technological obstacles.

In addition, organizations like ESA and international agreements on Earth observation promote a free exchange of geodata which is of the essence for dealing with global crises such as climate change or for rapid disaster relief after natural disasters. The space sector therefore creates a unique, often neutral space for dialogue which, remarkably, often stays intact even if political relations on Earth are massively strained. Conditions set under international law like the Outer Space Treaty define space as the 'province' or 'common heritage' of all humanity which makes purely military or exclusive use difficult and instead puts the emphasis on collective research. Ultimately, the view of Earth from space – known as the overview effect – promotes a profound awareness of a shared global identity and the need to work together beyond national interests for a joint future and the protection of our planet.

The space sector can thus help build bridges between nations and is a central element of international science diplomacy. Science Year 2027 provides the opportunity to promote an interdisciplinary image of space policy that makes it accessible for citizens.

Issue 4:

The space sector as guarantor of sovereignty and resilience

The space sector has already developed from a purely scientific field into a critical infrastructure, which is indispensable for national and continental sovereignty as well as for societal resilience. In a highly integrated world, technological sovereignty in space translates directly into the ability to act politically on Earth.

One central element is independent access to navigation and timing systems such as Europe's Galileo. Without this independent infrastructure, modern armed forces, rescue services or even the global financial system would depend entirely on the goodwill and signals of other global powers.

Sovereignty manifests itself also in the ability to autonomously assess, evaluate and manage situations by means of high-resolution reconnaissance satellites which reveal crisis hot spots, migratory movements or environmental changes without relying on information from third parties. Secure and safe navigation and communication is vital for this. Parallel to this, the space sector massively strengthens resilience to disasters: satellite-based early warning systems for hurricanes, tsunamis or impending solar storms save thousands of lives while satellite-based communication is the only reliable fall-back when terrestrial networks fail due to natural disasters or cyber attacks. The protection of critical infrastructures, from power grids to logistics chains, is crucially dependent today on the integrity of space-based data. The space sector therefore secures not only a technological advantage but also acts as a vital insurance policy which guarantees the ability to act and the security and safety of modern societies in an increasingly unstable geopolitical situation.

Science Year 2027 will provide a view of the unavoidable need for space research for the security of citizens every day and in future.

4. TARGET GROUPS

Who are the target groups of Science Year 2027?

The overarching goal of Science Year 2027 – Space is to stimulate greater public interest in science and research and to engage people in dialogue in many different formats. Direct exchange and interaction – including participation – occur in the process. Research becomes transparent and understandable, which increases public trust in science and scientific empowerment among citizens.

Primary target groups

- The general public as a whole (for topics such as navigation, communication, weather, regional added value/good jobs, telemedicine, climate and security objectives)
- Young people: children, pupils, students and apprentices, young scientists. The focus will also be on girls and women in particular, as well as on target groups that have been difficult to reach, for example people in rural areas.
- Politicians/public authorities: with a stress on strategic sovereignty and the technological capacity to act, resilience, digitalization, competitiveness and the innovativeness of industry

Secondary target groups

- The interdisciplinary expert community
- Multipliers from science, education, industry and new space, civil society, media and politics
- Industry/associations: with a focus on new markets/business models, logistics/value chains. Investment and cooperation opportunities, the state as anchor customer

5. SCIENCE YEAR FORMATS

What are the major actions and activities?

The focus is on the following formats, while additional topics might be added during the course of the Science Year.

MS Wissenschaft

The floating science centre will once again set sail in Science Year 2027. On board the MS Wissenschaft, visitors can explore the world of science and what it can tell us about space in an interactive exhibition. The voyage starts in May 2027 in Berlin and will make calls at many ports in Germany along the way.

ms-wissenschaft.de

Forschungsbörse – Research Exchange

Whether for STEM subjects such as biology, maths and physics or for other subjects such as philosophy, German and politics, the forschungsboerse.de platform gives teachers access to more than 1,000 researchers from all over Germany whom they can select as appropriate for their lessons according to region, topic and school subject. The researchers deliver a casual, free talk about their work lives and spark listeners' enthusiasm for exciting careers! Arranging an appointment is easy and requires only a few clicks via the website.

forschungsboerse.de

SchulKinoWochen – School cinema weeks

School students will once again be invited to nationwide School Cinema Weeks under the Science Year 2027 initiative. They can look forward to an exciting film series on the topic of space. The programme is complemented by special events featuring well-known researchers. These film discussions enjoy great popularity – among researchers and young guests alike.

visionkino.de/schulkinowochen/

Funding projects

As a central element of the Science Years, select funded projects representing various disciplines will also address the topic of this Science Year. Whether science communication or public participation, interdisciplinary or creative approaches, digital or local – or something different entirely – the discourse about space for our future will occur on a broad basis and in a variety of ways.

Online formats

People will also have the opportunity to experience the topics of Science Year 2027 on their own digital devices. A wide variety of formats present a platform for experts and provide information about the subjects of Science Year 2027. The general public can take particular advantage of social media channels to follow current highlights and learn exciting news about space.

Formats for children and young people

Children discover and explore the world around them through play every day. This is why Science Year 2027 also features opportunities to spark curiosity among the very young and older age groups about STEM subjects related to space – and to make the fascinating world of knowledge come alive. A series of funded projects focuses explicitly on children and young people. The magazine titled “forscher – Das Magazin für Neugierige” is once again part and parcel of Science Year 2027. The magazine takes a look at issues and oddities in the world of research as well as select topics related to the Science Year.

forscher-online.de

6. CONTACT

Who can I contact?

Federal Ministry of Research, Technology and Space

Division S24 – Science Communication; Science Years

Dr. Carolin Rama

Kapelle-Ufer 1, 10117 Berlin

phone: +49 30 1857 5715

Carolin.Rama@bmfr.bund.de

Projektträger im Deutschen Zentrum für Luft-
und Raumfahrt e. V. (DLR-PT)

Kompetenzzentrum Wissenschaftskommunikation

Sophie Leukel

Sachsendamm 61, 10829 Berlin

Tel.: +49 30 67055-709

Sophie.Leukel@dlr.de



wissenschaftsjahr.de

AI



Bundesministerium
für Forschung, Technologie
und Raumfahrt

bmfr.de