



2023

NATIONAL
SPACE
STRATEGY

2027

Action Plan



LUXEMBOURG
SPACE AGENCY



Luxembourg's commitment to developing a space sector dates back to the 1980s with the formation of Société Européenne des Satellites (SES). The policy objective was clear at the time, and remains so today: to make spacetechnology one of the pillars of the Luxembourg economy.

Since 2016, the space ecosystem has developed significantly. Nowadays the Grand Duchy of Luxembourg is home to more than 70 space-related public and private enterprises, together employing over 1400 people.

Moreover, the space sector has discovered a new sense of dynamism in recent years. Developments in technology, miniaturisation and lower launch prices are among the factors which ultimately have facilitated and driven new business initiatives in this field. These developments resulted in the increased use of Earth orbits, presenting new risks of congestion. A meeting of the ESA Council at Ministerial Level led to a renewal of Luxembourg's strategy and its ambitions to develop the civil space sector, backed by a commensurate financial package.

01

Sustainability at the heart of space strategy

The aim of the strategy, and the action plan deriving from it, is to continue developing Luxembourg's space sector. In doing so, Luxembourg will diversify its economy and assure its long-term future, while making major contributions to the sustainability of activities on Earth and in space.

Luxembourg's space strategy 2023–2027 centres on sustainability.

Sustainability always played a role in Luxembourg's space strategy. Now, the strategy centers around sustainability, compatible with the adoption by Luxembourg and the international community of the 17 Sustainable Development Goals and the National Plan "Luxembourg 2030" for sustainable development.

The 2023–2027 strategy will consolidate existing competences and develop new ones in order to seize opportunities presented by major trends in the sector. These are relevant to Luxembourg both in terms of economic prospects and compatibility with its ecosystem.

The international community recognises space as one of the essential drivers of sustainable development.

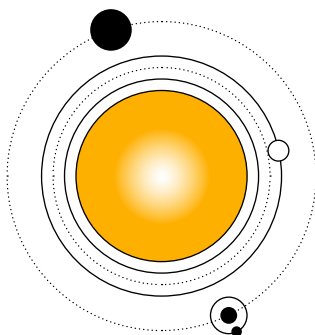
The United Nations General Assembly, at its 76th session, adopted resolution 76/3 on 25 October 2021 on "the Space 2030 Agenda: space as a driver of sustainable development." Essentially this resolution seeks to reaffirm and strengthen the contribution of space activities to the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction (2015–2030) and the Paris Agreement.

THE FOUR LINES OF APPROACH TO SUSTAINABILITY:

Economic sustainability

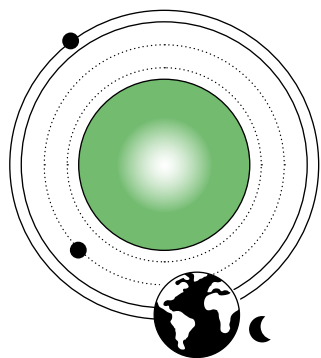
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Economic diversification is the primary objective of the commercial space sector in Luxembourg. The sustainability of space-related economic activities is directly linked to the sector's continued skills development. The aim will therefore be to develop Luxembourg's preferred market segments, but also to position the country on new segments offering attractive commercial prospects.



Sustainability of activities on Earth

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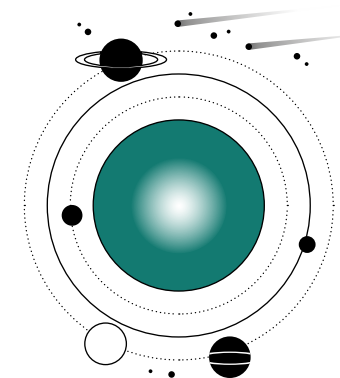


Spacetechnology today makes it possible to offer answers, or serious contributions, to societal and environmental issues. Making activities on Earth sustainable will require building bridges between the space sector and the terrestrial sector, and strengthening national competences between sectors. There will be a more specific focus on sectors of interest to Luxembourg, to prompt a multiplier effect and simultaneously contribute to the economic sustainability of Luxembourg's space sector. The development of expertise will also concentrate on the segments likely to contribute to some of the sustainable development goals, with a special focus on the segments of relevance to development cooperation and Luxembourg's humanitarian action.

Sustainability of activities in space

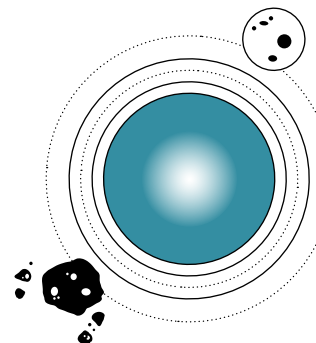
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Space infrastructure has commercial, security, environmental, and societal implications. However, the growing use of Earth orbits will present operational risks and more debris in space. It is therefore urgent and vital to promote responsible long-term use of space. Luxembourg's commitment will take effect at both national and international levels, and through the development of national competences in space traffic management and services in orbit.



Sustainable and responsible use of space resources

4



The SpaceResources.lu initiative aims to promote peaceful exploration and a sustainable development approach to the use of space resources.

Business and public research will devote R&D resources to tackling the issues of sustainability, circularity, and resource management, while ensuring the economic viability of the activities being developed.

Luxembourg will continue its international engagement, especially at the UN, in order to create a respectful international framework and develop these new space activities for the benefit of humankind as a whole. Technological developments in space may also make certain activities on Earth more sustainable, especially in the mining industry.

Finally, the development of space activities cannot fail to consider the ethical aspects of human activity in space. The sector will promote positive change in this area by consulting with experts in applied ethics and implementing partnership initiatives, such as events and research posts on astroethics.

Sustainability of activities on Earth

DEVELOPMENTS 2023-2027

Space in support of sustainable activities on Earth

> Contribution to sustainable development goals

The vast majority of space applications are usable to support most, if not all, of the goals of sustainable development. For a number of years now, Luxembourg has supported the development of applications within the satellite telecommunications sector and the downstream sector using data of space origin via the LSA Data Center.

Pursuing this strategy we shall:

- evaluate Luxembourg's positioning on resolution 76/3, "the Space 2030 Agenda: space as a driver of sustainable development;"
- continue the LSA Data Center's operations, with greater focus on its use to promote sustainable development;
- evaluate our potential to contribute to the sustainable development goals, especially those linked to our expertise:
- to consolidate and develop the necessary expertise to encourage this contribution;
- to launch a call for projects on this subject.

The renewed strategy will focus on developing industrial know-how in disciplines which will make a partial contribution to the sustainable development goals, support Luxembourg's development cooperation and humanitarian action, and contribute to the development of other economic sectors.

> Space at the service of development cooperation and humanitarian action

Development cooperation and humanitarian action occupy an important place in the policy of the Luxembourg Government. Space technologies have the potential to lend direct and powerful support to the implementation of development cooperation projects.

Examples of this support include facilitating access to space for developing countries, training and technical assistance to increase the necessary capacity for this purpose, and providing secure satellite telecommunications equipment.

The 2023-2027 strategy therefore seeks to identify the types of problem faced by the countries with which Luxembourg is engaged in development cooperation, ascertain which skills available in Luxembourg might contribute towards innovative solutions, and issue a call for projects, the ultimate purpose of which will be to deploy and demonstrate these solutions in the selected countries. The chosen topics might include the provision of secure connectivity services, management of freshwater resources, flood control, reclaiming land for farming, prevention of desertification, or surveillance of access corridors for humanitarian aid.

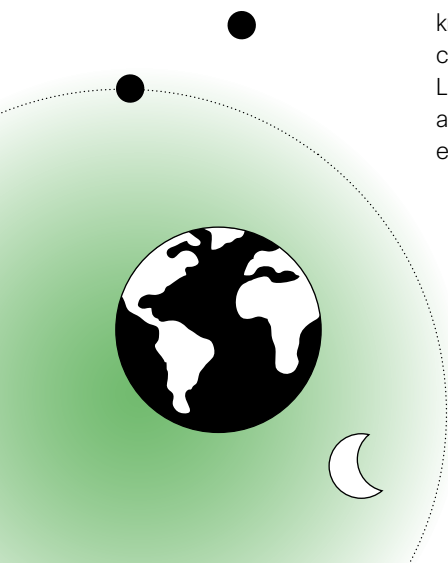
The LuxIMPULSE national programme will be one of the potential frameworks of support for the selected projects.

> Space at the service of other sectors

There are many examples of space infrastructure or data used in other economic sectors, such as transport, energy, agriculture, finance, or the environment. This potential is still far from fully tapped.

Space may also contribute to other aspects of national policy, such as digitalisation, sustainable development, energy, research or, defence. Continuous assessment will be set up to identify economic sectors with strong potential to benefit from services based on space infrastructure or data, monitor trends in these sectors, and suggest new lines of development. This approach will enable new opportunities to be seized in the corresponding markets.

For this purpose, it will be necessary to forge and develop links with other economic sectors and raise their awareness of the value added by the space sector. In this spirit, the Newspace Europe conference was devised. This initiative will also involve participation at events in these different sectors, contracts with professional organisations, and possibly the arrangement of invitations for cross-sector ideas.



Sustainability of activities in space

DEVELOPMENTS 2023-2027

Long-term activities in space

Space technologies have impinged on our daily lives for so many years that it would be neither conceivable nor reasonable to put the clock back. Who in today's world can imagine functioning without satellite navigation or telecommunications?

However, there are major security and economic threats associated with the exploitation of space infrastructure.

The advent of mega-constellations heralds the intensive use of Earth orbits, especially low orbits, which may disrupt or even imperil the operation of existing systems.

In addition, there is the threat of irresponsible practices leading to the proliferation of debris, increasing the danger to institutional and commercial space infrastructure. It is therefore

imperative to promote the responsible long-term use of space to prevent the congestion of orbits and the proliferation of debris, and secure the future use of frequencies.

Three types of action will be carried out:

- ensure the sustainability of Luxembourg's activities in outer space;
- develop and strengthen industrial competences in space traffic management;
- develop industrial expertise in relation to services in orbit.

› Ensure the sustainability of Luxembourg's activities in outer space

The aim is to promote the responsible use of space through good practices within our space ecosystem, while considering economic factors related to future regulations. This will consist specifically of:

- monitoring and evaluating initiatives in this field, and becoming a stakeholder when deemed appropriate;
- establishing the current positioning of the Luxembourg space sector in relation to the LTS Guidelines and identify avenues for potential progress;
- assessing the sustainability of activities extending into outer space by enterprises from the Luxembourg space ecosystem;
- issuing an open invitation for the development of tools and products promoting both the responsible use of space and the sector's economic progress.

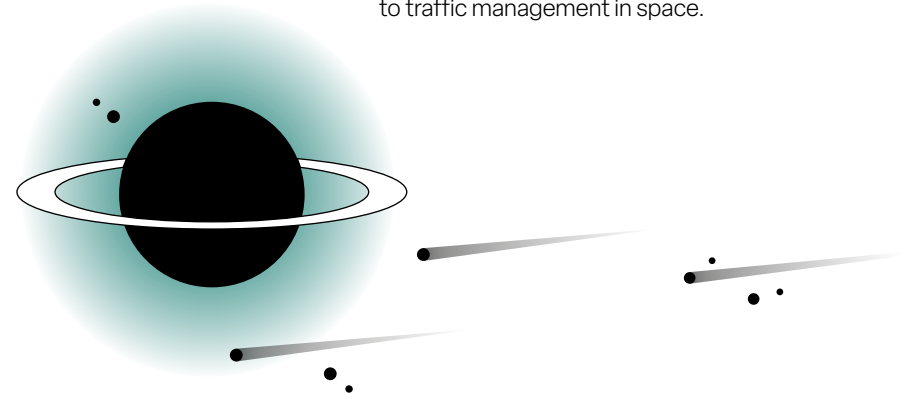
› Develop and strengthen industrial competences in space traffic management

Space traffic management requires detailed knowledge of active objects and debris of all sizes and their paths. So far this knowledge remains limited and relies essentially on surveillance and monitoring from Earth.

This limited knowledge leads to many alarms, mostly false. They are therefore either ignored, posing a hazard, or systematically responded to, resulting in serious operating losses for commercial operators or a drastic reduction of mission time for institutional operators.

It is therefore necessary to improve the accuracy of this data in order to better predict the conjunction of two objects, establish precise trajectories, and plan avoidance manoeuvres.

In 2019 Luxembourg took its first step by signing an agreement with the company NorthStar for the development of commercial traffic management in space. The objective is to continue supporting R&D work relevant to traffic management in space.



› Develop industrial expertise in relation to services in orbit

The sustainability of outer space activities will also entail the provision of services in orbit.

These services will encourage the development of a circular economy in space. They range from final release into orbit to manufacture and assembly in orbit, extension of mission duration, and debris removal. Luxembourg already supports the development of rendezvous technologies and a robotic arm, and will continue to support these activities and the development of additional technologies. Apart from technological developments, the 2023-2027 strategy envisages positioning in the supply of services which extend telecommunication missions in geostationary orbit.

Sustainable and responsible use of space resources

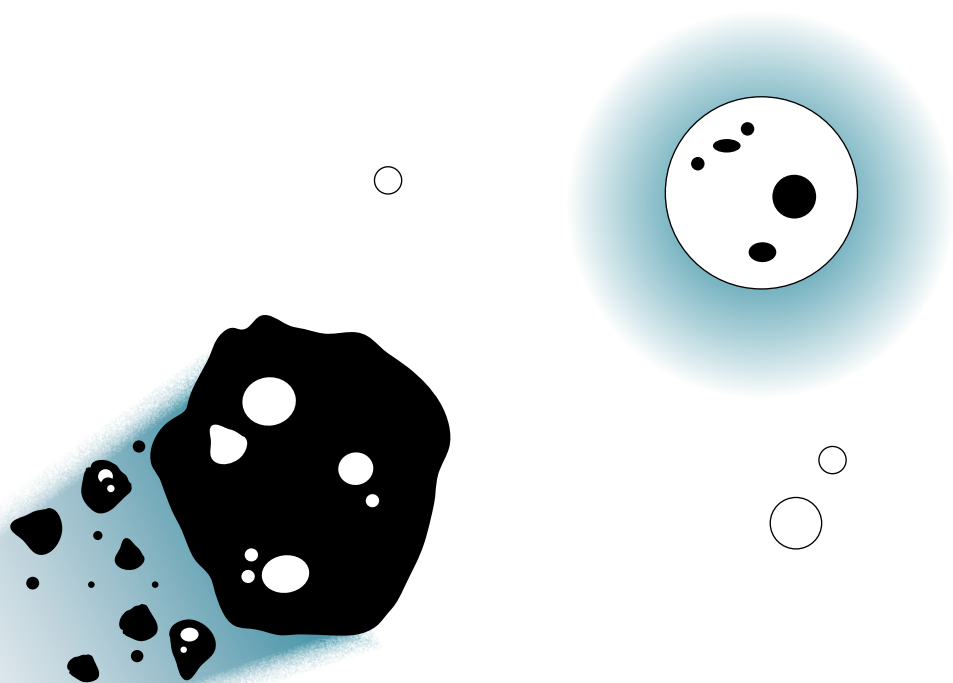
DEVELOPMENTS 2023-2027

Sustainable use of space resources

> SpaceResources.lu

The SpaceResources.lu initiative aims to develop a long-term vision, which can only be done using sustained effort and resources. The initiative is especially well-suited to issues of sustainability, circularity and resource management.

Acting on the Advisory Board's recommendations, the effort will continue with an emphasis on enabling national and international activities. These include the development of an international framework, contributions to government programmes, research, education, and the promotion of innovation and private investment.



> Role of ESRIC

ESRIC plays a key role in the achievement of the SpaceResource.lu objectives. ESRIC's development will continue in order to achieve the goals on which its partners have agreed. By 2024, ESRIC is going to number around 30 specialist researchers, especially in the context of the FNR PEARL programme, oriented towards sustainable utilisation of space resources.

Special emphasis will be placed on cooperation with private enterprises, such as Air Liquide, Airbus, and Maana Electric. The programme for start-ups will continue and possibly expand. A second edition of the ESA-ESRIC Space Resources Challenge will be held.

Luxembourg Space Resources Week is a conference to be held annually, since it has become an unmissable gathering point for the community. The knowledge management platform will continue to be improved in order to offer complete, easy access to knowledge in the field.

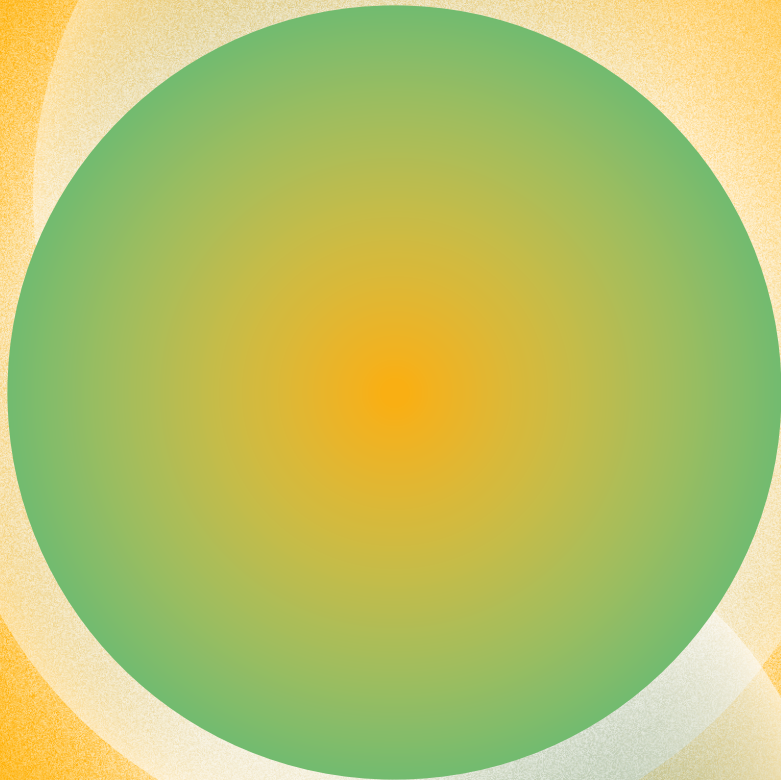
ESRIC's longer-term development will be clarified, in particular by updating the activities carried out in cooperation with the ESA. The first ESRIC building will be planned and constructed on the Space Campus in Belval. This will house the ESA's dusty vacuum thermal chamber (DTVC) and, in due course, a pilot line to test the extraction and processing of space resources. ESRIC will also handle building work using lunar regolith, e.g. for housing or infrastructure. In the longer term, flight opportunities will need to be identified to test these technologies in space.

As decided by the Government in 2020, it is planned to develop ESRIC into an independent European space research centre. This will enable closer integration of other European public and private partners in the development and management of the centre. Support for new enterprises will also be continued in order to develop and consolidate this new sector in Luxembourg.



30 specialist researchers

02

Implementation
and strategic projects

2.1

Finance

›
Financing RDI work

The ESA programmes are particularly interesting as a means to support the development of innovative space projects. The optional ESA programmes enable Luxembourg to invest in the projects of greatest interest in terms of global market trends and prospects of commensurate economic returns. The topics identified as being of interest to Luxembourg are: satellite communications, especially recent developments in secure communication services and quantum communications, Earth observation, surveillance from space, space traffic management, exploration and, more generally, advanced technological developments.

Supplementing these optional programmes, Luxembourg has entered into an agreement with the ESA to implement a national programme, LuxIMPULSE. This programme allows projects to go ahead outside the scope of the optional ESA programmes. This means quicker processes and enhanced protection of the intellectual property generated during the projects.

LuxIMPULSE
National programme

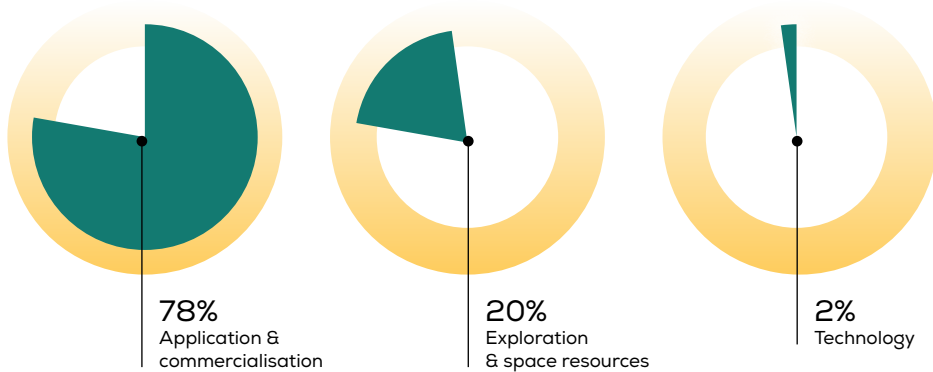
110 m€
Budget
(2023-2027)

To fund RDI activities in the field of space, Luxembourg will therefore continue to contribute to the ESA and LuxIMPULSE programmes. The national financial contributions to the ESA programmes were announced at the ESA Council at Ministerial Level on 22-23 November 2022.

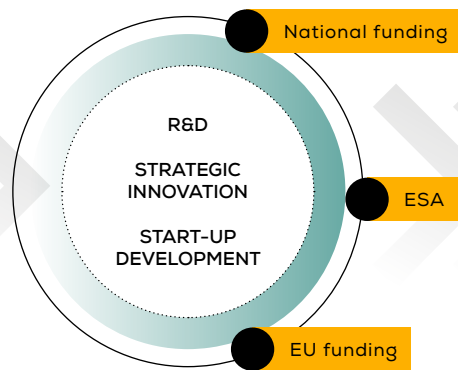
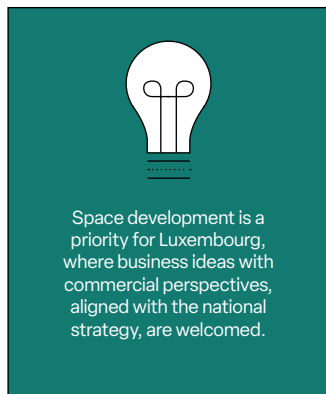
LUXEMBOURG 'S CONTRIBUTION IN ESA PROGRAMME

LEGENDE:

- Total 127 M€
- Percentage

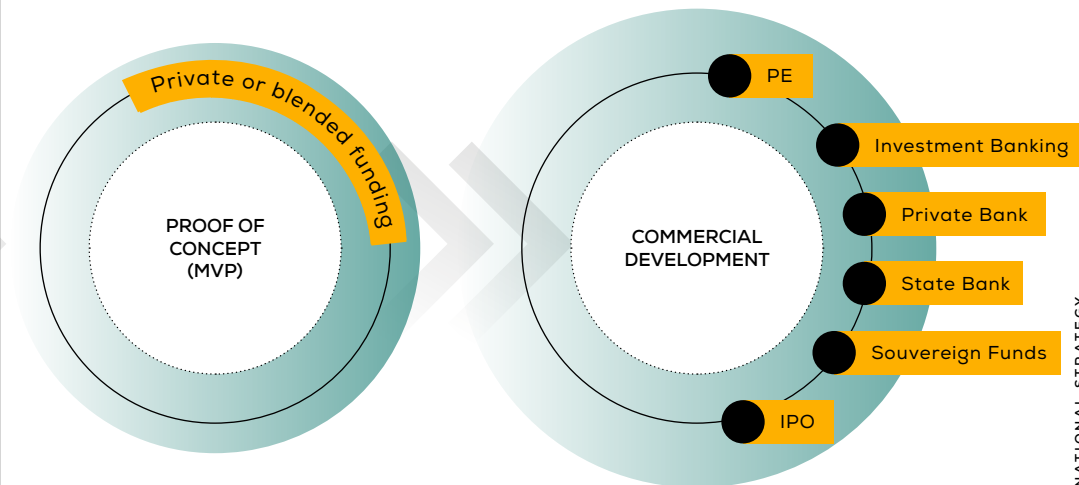


THE ROLE OF PRIVATE AND PUBLIC FUNDING IN DEVELOPING A SUSTAINABLE SPACE ECOSYSTEM



> Business finance

In addition to the necessary support for their technological developments, businesses require investment to develop their commercial activities. Helping businesses to locate private finance therefore remains an essential lever of the strategy, and depends especially on existing cooperation with financial institutions, such as the European Investment Bank or the European Investment Fund. Another aim will be to attract and involve more private investors, by arranging seminars and conferences on the subject. These will seek to forge new contacts with funds or investors. In this way, the LSA will continue to extend its network of contacts with funds and private investors. The LSA will encourage and facilitate the use of investment instruments already present in Luxembourg, such as the Orbital Ventures Fund, the Luxembourg Future Fund, the Digital Tech Fund, the SES Concession Fund, and the SNCI funds. The LSA will also facilitate access to financial instruments in the context of European initiatives, such as the European Union's CASSINI facility.



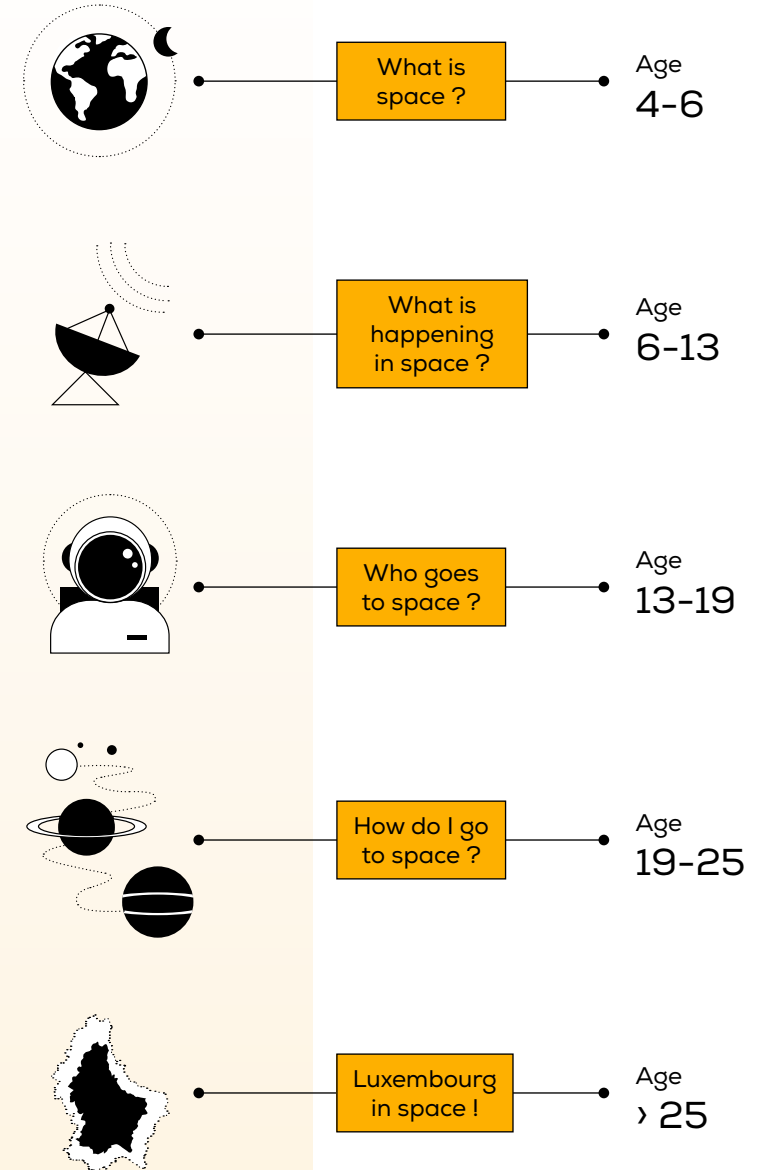
2.2 Talent development and public research

> Talent development

The question of attracting and developing talent is key to assuring the stable long-term development of the Luxembourg space sector. The LSA and its partners will therefore continue to support and develop work in schools and higher education institutions, such as ESERO, ISM, and Lux_YGT. This will take place in close cooperation with national institutional partners and the ESA. These activities, which seek to support and inspire the younger generations, will do so in a spirit of promotion of diversity. Furthermore, employment opportunities in Luxembourg will be made more visible by setting up a dedicated web portal bringing together all job offers in the Luxembourg space sector. A proactive outreach approach will include cooperation with student associations and an LSA presence on career days at relevant universities. Other initiatives will be considered, including recruitment of talents from less competitive markets than Europe and the USA or from other business sectors.

THE BUILDING BLOCKS LEADING TALENTS TO SPACE

Education will be key to raising awareness in the younger generations. The LSA intends to contribute by defining the right messages to be brought at the right age, and ensure these are disseminated in collaboration with partner institutions and projects.



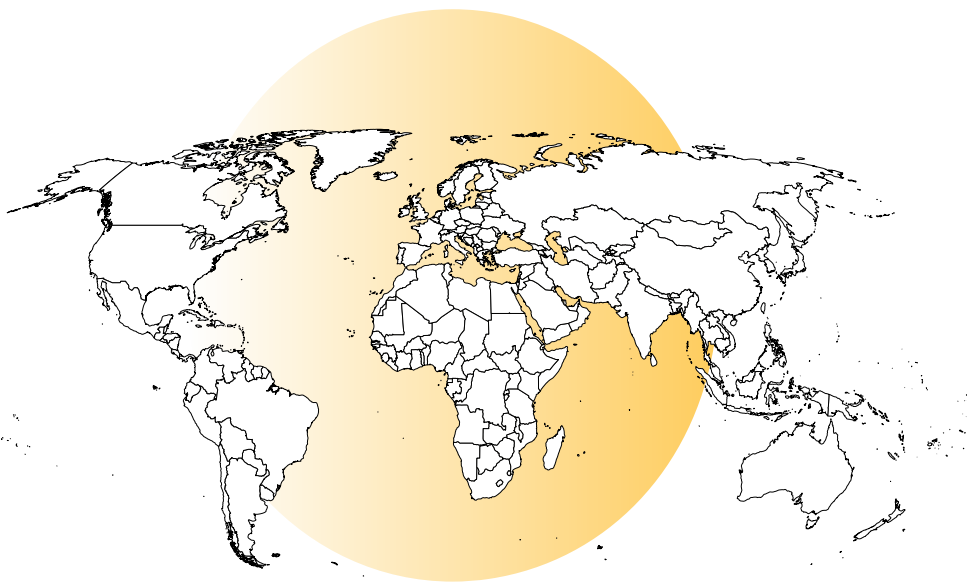
2.3

International cooperation

International cooperation is an essential part of the strategy. Luxembourg is open to an interconnected world where space technologies and their applications transform the economy and are emerging at ever-increasing speed. International cooperation enables the country to rise better to the economic and societal challenges surrounding the sustainable use of outer space.

Luxembourg is recognised for its general multilateral and international engagement, especially in relation to space.

All aspects of the new strategy hinge upon international cooperation.



> Bilateral cooperation

Luxembourg has signed a number of bilateral agreements at the governmental level and with space agencies. These agreements deal with various aspects and objectives, especially:

- **Economic development:** easier access to foreign markets, attraction of investment and new businesses to Luxembourg, access to technologies, promotion of the Luxembourg ecosystem;
- **Legal/regulatory:** better coordination in reinforcing the international legal framework, which may involve an exchange of good practices;
- **Talents:** identification and attraction of new talents to Luxembourg.

Priority will be given to identifying and deploying specific action with existing partners, e.g. via workshops or conferences. Special attention will be paid to the possibilities of accessing exploration programmes, so that **Luxembourg technologies can be taken to the Moon**. NASA's Artemis programme is one example.

> Multilateral cooperation

Beyond the cooperation at ESA and EU level, Luxembourg will remain involved in a number of discussion platforms, especially but not only at the UN, to strengthen "Luxembourg will maintain an active dialogue with European agencies on priority subjects. Beyond cooperation at the ESA and EU level, Luxembourg will remain involved in a number of discussion platforms at the UN. This will strengthen Luxembourg's position on the international scene, enhance its profile, and offer solutions conforming to our vision. Luxembourg will also contribute to certain multilateral programmes, the subjects of which will be aligned with the priorities of its space policy. It will try to participate in relevant working groups, e.g. on the regulatory aspects of space resources or the sustainability of space activities.

2.3

Development of the legal and regulatory framework

The legal and regulatory framework plays a key role in the development of space activities at the national and international levels. At national level, the legal and regulatory framework will be more precise following the adoption of the law of 20 July 2017 on space exploration and the use of space resources, and the law of 15 December 2020 on space activities. A system of authorisation of new operators is being set up and will be backed by Grand Ducal regulations and corresponding procedures. By the end of 2022, the activities of the current operators, authorised and supervised by the SMC via the law on electronic media, were revised in line with the law of 2020. In the past five years, Luxembourg has seen powerful growth in the number of objects registered. The LSA will maintain its national

register of Luxembourg space objects and will undertake to notify them to the UN. The experience gained will lead to improvement and streamlining of registration applications to take account of the international nature of space activities and the new technological developments in this context. Two draft laws will be proposed: one on sensitive very high-resolution Earth observation data; and another approving the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space.

At the international level, Luxembourg will remain involved in discussions seeking to develop the international framework for exploration and sustainable use of space at the UN and other forums in close cooperation with private enterprises.

NATIONAL REGULATORY FRAMEWORK

LAW 20 JULY 2017

Space exploration and the use of space resources

LAW 15 DECEMBER 2020

Space activities

FUTURE DRAFT LAWS

Sensitive very high-resolution Earth observation data

Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space

2.4

Promotion and communication

Communication activities play a key role in strategy implementation and positioning of Luxembourg's ecosystem. They are also vital to highlight and position of Luxembourg's ecosystem. In future years, several objectives will guide the development of communication activities. In line with the efforts made since 2018, communication will seek to position Luxembourg as a European cluster of space industry development. The international promotion of SpaceResources.lu will remain a priority. This will run parallel to the development of other key strategies, such as sustainability. The emphasis will be on raising awareness amongst non- specialist

professional audiences of the opportunities within the space sector. The aim is to leverage the space sector to help solve some of the world's most pressing problems, and to foster better economic sustainability. Finally, communication efforts will encourage the emergence of talent for the space industry by raising public awareness, especially amongst young people.

All these objectives will be pursued through a variety of communication activities and resources, including digital communication, the press, events and the use of objects in communication.



2.5

Strategic projects

> LSA Data Center

Created in 2017, the LSA Data Center is a key component of the LSA. It seeks to facilitate access to Copernicus data of Earth observations from space. This will expedite the development of value-added applications and services within the downstream sector. The LSA Data Center's overriding and ongoing purpose is to support the development of commercial services. Its development must respond to the trends and challenges of future data platforms, including intelligent storage of a constantly growing data volume, cloudification, and easy access to high-performance computing (HPC). Thus the Center will cooperate with the national data exchange platform and the HPC initiative. This will also further Luxembourg's transition to a digital economy and advance the sustainability objectives of our strategy.

> Space Campus

On 8 July 2022 the Council of Government of Luxembourg gave outline consent to the creation of a space campus in Luxembourg, spread across two sites: the Poudrierie site in Kockelscheuer and the Belval campus. This Space Campus will serve multiple purposes:

- It will offer an attractive working environment for the best talents,
- a place for discussion, cooperation, and synergy, a platform for public-private cooperation in the field of space,
- a shared research infrastructure accessible to all participants.

The Space Campus will help to make this sector permanent in Luxembourg.



NOTES:



Luxembourg Space Agency

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