



The future of the European space sector

How to leverage Europe's
technological leadership and boost
investments for space ventures

Executive Summary



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Prepared for:
The European Commission
(DG Grow, DG Research and Innovation)

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part of the European Investment Bank's advisory services

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Consultancy support: SpaceTec Partners

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Executive Summary

Europe boasts a strong space sector. This is largely the legacy of successful space programmes, particularly those on satellite navigation and Earth observation, mostly built on public support. However, the space sector is undergoing unprecedented transformation and development on a global scale. Major technology advancements, a new entrepreneurial spirit and a renewed policy focus have put the space sector under the spotlight on the global innovation stage.

Such rapid and constant transformation calls for new approaches to funding and supporting space ventures.

The global space economy grew by 6.7% on average per year between 2005 and 2017, almost twice the average yearly growth of the global economy of 3.5%. One aspect that has contributed to this growth has been the "NewSpace" phenomenon, a series of technological and business model innovations that have led to a significant reduction in costs and have resulted in the provision of new products and services that have broadened the existing customer base.

Glossary

NewSpace: a global trend encompassing an emerging investment philosophy and a series of technological advancements leading to the development of a private space industry largely driven by commercial motivations.

The transformation of the space industry has seen space companies attract over EUR 14.8bn of investment since 2000. Moreover, it is picking up: the size of total investments into space companies grew 3.5x in 2012-2017 compared to the previous 6-year period. Additionally, since 2000, over 180 angel- and venture-backed space companies have been founded. Venture capital (VC) firms represent the largest number of investors for space companies, with around 46% of overall investments. Combined with angel investors, these two investor groups comprise around two thirds of the investors in space ventures. In fact, US-based investors account for around two thirds of the 400+ worldwide investors in space companies.

Space economy overview

In the global space economy, satellite services represent the largest sector (around 37%), closely followed by ground equipment. Earth observation is the biggest user of satellite manufacturing and launch services, and remains a key driver for the overall industry.

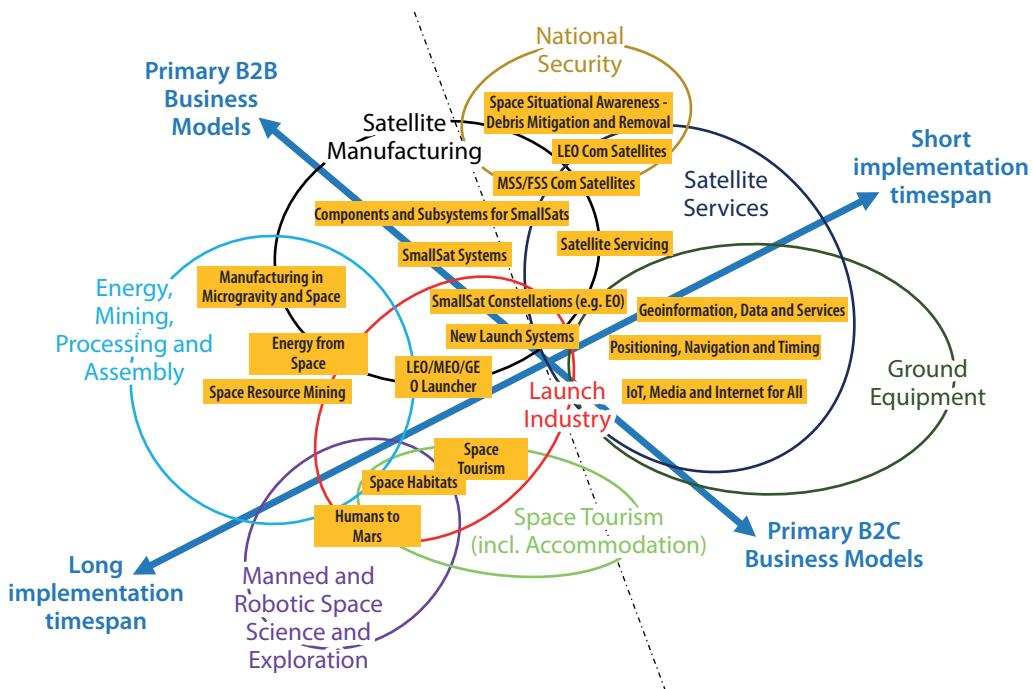


Figure 1: A landscape of space business services, business models and segments

Glossary

Space and ground segments: based on their location, space infrastructures can be divided into two segments: those with assets in space and those with assets on Earth. The ground segment includes launch facilities, mission control centres, and transmission and reception stations.

Space hardware and space applications have been important users of innovations in industries outside of the space industry. Advances in manufacturing technologies, miniaturisation, nanotechnology, artificial intelligence and reusable launch systems have driven market disruption in the space industry, for example through **falling costs in satellite manufacturing and launch**

vehicles. Scientific and technological progress go hand in hand and can lead to disruptive innovation, resulting in a new market with a radically different value proposition. **Space is therefore an enabler for several industry verticals.** For example, space-based infrastructure projects such as Galileo serve as precursors for many space-related applications in segments such as location-based services and agriculture. Thus, even though some of these technologies may be competing with the space industry for investment, the space industry in fact provides important incentives for other technologies.

The landscape of space services, along with their interdependent parties, provides a basis for a risk assessment of business segments, which is analysed in detail as part of this study. Generally speaking, business models predicated on a business-to-consumer (B2C) model, or with a **shorter implementation timespan, come with lower risk levels** than business-to-business (B2B) models or those with longer implementation timeframes.

Overall, while the prospects for the future development of the space market are positive, with growing investments from private sources signalling the increasing attractiveness of the commercial aspects of space, some market segments and business models remain significantly riskier than others due to the **high upfront investments, immature markets, and high technological and regulatory uncertainty.** At the other end of the spectrum, asset-light Value-Added-Services have become the **most attractive business segment**, as they offer the best market opportunities and the lowest risk levels.

The table below encapsulates the various risks associated with different market segments and business models.

Risk assessment of market segments and business models according to five discriminators								
	Launch industry	Satellite manufacturing	Satellite services	Ground equipment	National security	Manned and robotic space science and exploration	Space tourism (incl. habitation)	Energy, mining, processing and assembly
Product/technology	●	●	●	●	●	●	●	●
Asset intensity	●	●	●	●	●	●	●	●
Demand	●	●	●	○	●	●	●	●
Competitive landscape	●	●	●	●	●	●	●	●
Regulation	●	●	●	●	●	●	●	●
Risk summary	●	●	●	●	●	●	●	●

Table 1: Risk assessment of market segments and business models according to five discriminators
 Legend: ○ – Low Risk / ● – High Risk

While European firms remain competitive with regard to many innovations that have impacted the space industry, such as micro- and nanoelectronics, digital transformation and convergence, and optical and ubiquitous communications, **this leadership has rarely translated into a commercial advantage within the space sector.** One of the reasons for this dissonance between European innovation and competitive advantages is the lack of upstream activities in Europe, as US firms dominate the upstream sector. European technology leaders are not active enough in space themselves and the technology transfer is not effective enough. Additionally, risk capital funds are in limited supply for ventures that are looking to commercialise their innovative technologies. The scarcity of scale-up funding in Europe is a critical shortfall, which often leads to a flight of talent and companies to the US, where the financing landscape is currently more favourable.

Glossary

Upstream and downstream sectors: the upstream sector covers activities that lead to the development of space infrastructure, including R&D, production of satellites and launchers, and the deployment of such infrastructure. The downstream sector primarily relates to the commercial activities based on the use of data provided by space infrastructure, such as broadcasting, communication, navigation and Earth observation.¹

Funding landscape

When assessing the existing funding landscape for space companies in Europe, it is instructive to understand the current needs for, and uses of funding. To inform this study, a comprehensive sample of **over 40 space companies** were interviewed throughout the EU and beyond. The majority of companies highlighted the importance of public funds and public sector instruments, which often represent the only accessible source of capital. 40% of interviewees also note that public financing often served as a **precondition for accessing private risk capital.**

The European public funding landscape is relatively strong. New programmes such as Horizon Europe and InvestEU will build on the success of the previous Horizon 2020 and EFSI, which mobilised funds for research and innovation. A coherent and integrated suite of dedicated funding instruments for space companies is, however, lacking. While seed-stage support mechanisms have successful programmes such as the European Space Agency (ESA) Business Incubation and Acceleration Centres and the Copernicus Start-Up Programme, the total volume of early-stage investments is small and rather fragmented and only specific space segments are adequately covered.

¹ European Space Policy, European Parliament, Jan 2017.

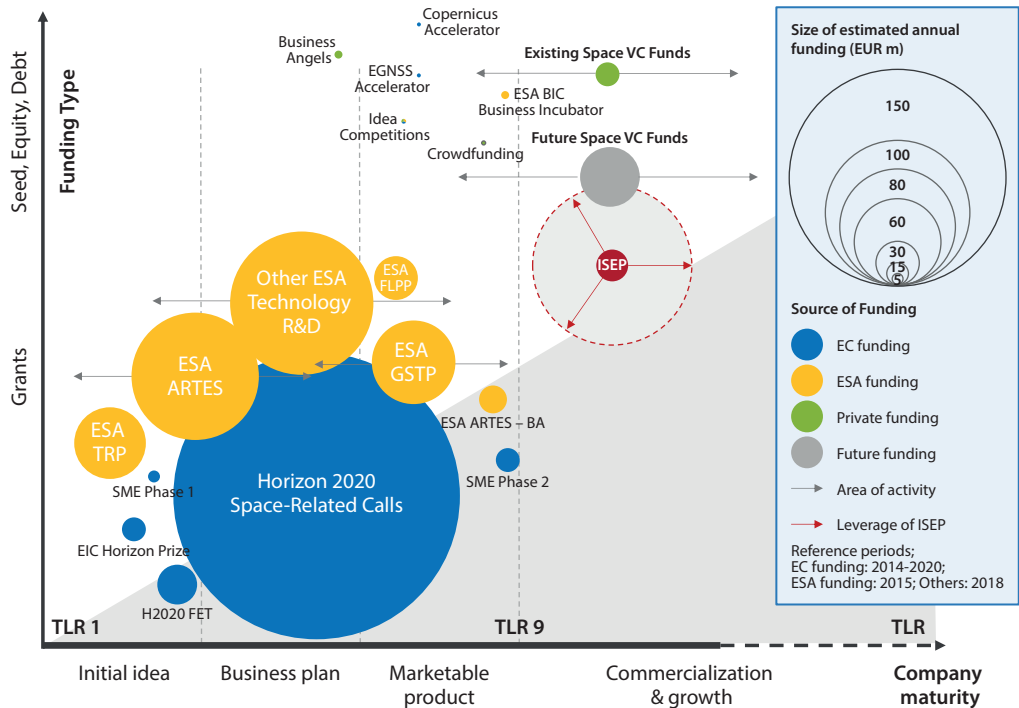


Figure 2: Overview of space-focused financial instruments in Europe and estimated annual funding volume *ESA funding represented here does not include technology developments carried out as integral part of specific development programmes.*

On the investor side, **more than 20 entities** were consulted. In their assessment of the space industry, a key difference noted in comparison to general tech is the **delayed inflection points of space businesses**, which are subsequently reflected by their higher capital need and the **general lack of market maturity**.

Most of the space companies interviewed seek financing for R&D and product development, relying on venture capital and private equity to meet their needs. However, as the figure above shows, a gap can be observed in space-focused private funding for the early-stage and growth phases. Additionally, the **total volume of investment lags far behind** when compared to private investment in the US. While funding conditions in early-stage finance are expected to improve thanks to, inter alia, the InnovFin Space Equity Pilot and national initiatives, the **investment landscape today is sub-optimal and poses a risk for the commercialisation of space technologies in Europe**.

11 findings

Through the various stakeholder interviews on both the demand and supply side, 11 key findings concerning funding hurdles for space companies in Europe were garnered and are summarised in the following table.

	Key finding	In detail
Financing challenges		
1	The European space sector experiences funding hurdles similar to those of other tech companies, particularly at scale-up phase	<ul style="list-style-type: none"> • Not only is the volume of European VC investment lower, VCs invest with smaller tickets, and growth capital is particularly hard to find • Business loans from commercial banks are nearly inaccessible
2	Companies in both the upstream and downstream sectors of the industry struggle with access to finance, but for different reasons	<ul style="list-style-type: none"> • Upstream companies face long development cycles, are capital-intensive and operate in a limited market with many business risks • Downstream companies sell to emerging markets (with predominantly governmental buyers) and to unsophisticated customers
3	The space eco-system lacks investors with a space background and space investment expertise	<ul style="list-style-type: none"> • It will still take years for the European space sector to exploit the full potential of the mobility of people between the triangle of corporate, entrepreneurship and investment roles
4	European space entrepreneurs feel there is a lack of private financing sources and keep an eye on the US	<ul style="list-style-type: none"> • The majority of the space entrepreneurs are looking for private capital outside of the EU • The wave of NewSpace investments in the US with larger funding rounds and investors with greater risk appetite are enticing to European firms
Market maturity and sector risks		
5	Space innovations have a longer development cycle than general tech	<ul style="list-style-type: none"> • The space hardware development cycle is considerably longer than in general tech, however, NewSpace is closing the gap
6	Investors are mostly concerned by market maturity	<ul style="list-style-type: none"> • Immature markets with questionable demand, technology risks and high capital needs are the key risks from the perspective of space investors
7	Investors do not see the exit opportunity (yet)	<ul style="list-style-type: none"> • Large system integrators do not yet have a tradition to invest in external innovation • Investors perceive the lack of exits as a sign of new or failing markets and therefore a risk for financial returns
8	The lack of follow-on finance has led to a number of early IPOs	<ul style="list-style-type: none"> • Europe has seen a few small space IPOs over the last 2 years despite a decline in the overall small IPO market • IPOs are seen by the entrepreneurs as a sizable funding source but also as a scalable funding source

Role of the public sector		
9	European public innovation instruments play an important role in unlocking private capital for the space sector	<ul style="list-style-type: none"> • 40% of the companies seek public funding as it is a precondition for private investment • Public funding serves as a seal of approval in the market
10	The landscape of space sector support mechanisms is rather fragmented, and procurement is geared towards the traditional value chain	<ul style="list-style-type: none"> • Entrepreneurs find it hard to navigate through the different possible funding options • The traditional European upstream space industry is used to a large institutional market of traditional public procurement and R&D grant programmes • Industry associations and entrepreneurs in both the up- and downstream sectors indicate a lack of public anchor tenants to stimulate the sector
11	Public authorities around the globe are stimulating the setting-up of venture capital funds dedicated to the space industry	<ul style="list-style-type: none"> • France, Luxembourg and Japan are examples of governments initiating VC funds to bridge the funding gap for space companies

Five recommendations

From the key findings laid out in the table above, five policy and finance-related recommendations were formulated.

SUPPORT FOR THE ECOSYSTEM

- 1 Strengthen the ecosystem of public support mechanisms by introducing more flexibility and more commercial orientation

INNOVATIVE PULL MECHANISMS FROM THE PUBLIC SECTOR

- 2 Develop and deploy innovative pull mechanisms from the public sector (e.g. innovative procurement and industrial policies) to stimulate technology development and its commercial uptake
- 3 Adopt a strengthened European defence policy as a driver for market development across all space business segments

ACCESS TO FINANCE

- 4 Increase the volume of risk capital and catalyse additional private investment into the sector

ADVISORY AND SOFT MEASURES

- 5 Establish a "finance for space" forum with representatives from the finance community, academia, policymakers and industry to bridge the information gap and develop innovative financing solutions for the space sector

Recommendation 1: Strengthen the ecosystem of public support mechanisms by introducing more flexibility and more commercial orientation

The European space strategy, set out in October 2016, highlights the importance and potential of the space industry as a catalyst for larger economic growth and calls for more market uptake, new commercial applications and services to maximise the socio-economic benefits of EU space programmes and EU space assets.

On the funding side for early stage companies, Europe has a rather wide array of grant programmes at EU and national level (such as ESA-BIC, Copernicus Start-Up Programme and E-GNSS accelerator). While they have been successful in supporting a number of space start-ups, not all market segments are adequately covered; upstream markets and NewSpace companies are often ineligible for several support mechanisms, with the general support environment remaining rather fragmented. Additionally, **identifying and accessing the right instrument can be rather time-consuming** and these programmes often present quite prescriptive terms for accessing their funds, which limit the ability of companies to react to new developments and pivot their business if needed.

This could be remedied by a **more open, less prescriptive and more integrated system of public support mechanisms**, both on the funding side, as well as for other supporting measures. Aside from covering more market segments and reducing information asymmetries between supply of and demand for finance, this could involve:

More flexibility in qualifying applicants. The existing support mechanisms could do more to keep their **programmes open and inclusive with respect to other tech entrepreneurs**. This would serve to attract serial entrepreneurs from ICT who would be able to transfer their entrepreneurial mentality and business knowledge to help with the maturation of the start-up space ecosystem.

More flexibility in grant allocation (in terms of timing, project scope and outcome, etc.) would enhance the economic impact of the grants and give firms the necessary flexibility in their development.

More flexibility in blending grants with other financial instruments. At the same time, to **reduce the risk profile** of space companies and improve their commercial focus, grants could be structured as a catalytic tool for private finance. Closer synchronisation of grants with private funding would **improve public grant allocation**.

Additionally, easily understandable, investor-oriented grant agreements would better prepare space firms in business and market aspects. In all these respects, the European Innovation Council – a new EU initiative to be rolled out as of 2019 – is poised to introduce a step change in the European landscape of finance for innovation. European space companies should take advantage of this.

The public sector has also a strong role to play in stimulating market demand and technology uptake by promoting more favourable policies and regulatory frameworks. With recommendations 2 and 3, we explore some of these solutions.

Recommendation 2: Develop and deploy innovative pull mechanisms from the public sector (e.g. innovative procurement and industrial policies) to stimulate technology development and its commercial uptake

The success of firms like SpaceX, Blue Origin and Sierra Nevada is largely due to industrial policies of innovative procurement, first customer approach and anchor tenancy, all models that have been employed in the US over the last few years (and are described in more detail in the report). Although Europe has a comparable model with innovation procurement (PCP/PPI), what has made the US model so successful is a commitment to being “**technology-agnostic**”. The government ultimately procures a service and not a product powered by a specific technology.

To foster a competitive space economy in a global context, European institutions and space agencies could consider similar roles and policies. By defining **projects in terms of well-established KPIs**, such as availability, performance levels, cost per unit, etc., European and national space institutions would, inter alia, engage more actively with NewSpace and promote space entrepreneurship as a means of growing the sector. For example, potential projects could focus on bridging the digital divide by ensuring Internet access for all, developing a mobile distress communication service for the EU population, or even establishing and operating an Earth observation service that could provide updated information within visible, infrared and ultraviolet spectra, etc. on a (e.g.) 10-minute basis, accessible by mobile phone.

Recommendation 3: Adopt a strengthened European defence policy as a driver for market development across all space business segments

The transformation of Earth observation services from purely military to partially commercial emphasises the potential **dual-use character of space services**. Due to the strong overlap of military, safety and security user needs, any system which serves one of these users will likely be able to prevail in the other sectors as the business conditions will be more favourable for such undertakings than for a total “outsider/newcomer”, with no or limited exposure to the safety/security/military requirements. As such, an appropriately **reinforced European defence policy** could provide many opportunities for space companies across all segments and may allow more innovative space products to flourish and be prepared for scaling-up for commercial markets more rapidly. In addition, such a move would also help to avert negative effects that may emerge if the International Traffic in Arms Regulations are restricted by the US and certain technologies suddenly become unavailable to European companies and institutions.

The proposed budget for the next Multiannual Financial Framework presents a **new European Defence Fund**, with an overall budget of EUR 13bn, to boost Europe's ability to protect and defend its citizens.

The fund is poised to offer EU-funded grants for collaborative projects which address emerging and future defence and security threats and bridge technological gaps. While the fund is modest compared to the Member States' national defence budgets, it opens the doors for more strategic cooperation on space programmes as well, in addition to existing cooperation such as on governmental satellite communications.

Beyond industrial policies, access to finance remains a critical challenge for the sector. In the report, we will see how, despite the improving financing conditions, lack of financing hinders the growth of promising European companies and technologies. Recommendation 4 looks at how to address this shortfall.

Recommendation 4: Increase the volume of risk capital and catalyse additional private investment into the sector

Accessing risk capital at scale remains a challenge for European space companies and even more so for the NewSpace segment, being less mature and with still largely unproven business models. The lack of specialised investors, the limited size of European VC funds and their relative risk aversion compound the challenge.

For all these reasons, more risk capital is needed. European institutions are well positioned to bring about change and stimulate further investments into the sector. A number of possible directions, all complementary and not mutually exclusive, are as follows:

- Expand and, to the extent possible, replicate the **Fund-of-Funds (FoF) model spearheaded by the InnovFin Space Equity Pilot (ISEP)**. ISEP will channel EUR 50m of the EU budget, potentially matched by additional EIB Group financing, to invest into and co-invest with a number of space-related VC funds. Assuming that ISEP will invest on average in a third of a VC fund, the initiative could unlock over EUR 300m of fresh equity investments into space and space-related businesses.
- Build on the experience of the **European Fund for Strategic Investments (EFSI) and InvestEU, its successor programme** in the post-2020 programming period to further cater for the financing needs of space companies and projects.
- Support and, to the extent feasible, contribute financially to **Member States-driven initiatives addressing the risk capital shortage in the space sector**. The financing programmes recently announced by Luxembourg and France are good examples, and not the only ones. EU institutions are also well placed to provide ex-ante coordination mechanisms among such initiatives and share best practices for others to replicate these models.

- Consider establishing **co-investment programmes with the corporate venture** arms of European aerospace companies. Funding by the EIB Group and national promotional banks could be leveraged in this way.
- Consider the deployment of more (public, or public and private) **project-finance risk-sharing** solutions to finance space assets. The EIB already successfully deploys such schemes across a number of sectors, whereby it shares the risks and rewards of the development of one or a portfolio of assets.
- Consider the use of Member States' **EU Structural Funds** by way of risk finance in support of the space sector.

As we will see in the following sections, the European space sector requires new approaches and models to address the financing and information gaps among its stakeholders. Recommendation 5 aims to tackle this challenge by establishing common grounds among different communities of stakeholders.

Recommendation 5: Establish a “finance for space” forum with representatives from the finance community, academia, policymakers and industry to bridge the information gap and develop innovative financing solutions for the space sector.

The information gap between the space sector and the finance sector is mutual – **space lacks knowledge about finance and finance lacks knowledge about space**. A regular **“finance for space” forum** could help bridge the gap by convening key stakeholders, identifying specific financing needs, and discussing/developing potentially new models and (co)financing solutions for the European space sector, as well as raising awareness of existing funding instruments. It could also contribute to an exchange of knowledge and technical expertise between investors and space companies and identify projects that could benefit from available funding instruments. **The EC and/or the EIB Group would be well placed to play this advisory and federating role.**

Particular focus could be given to the identification, raising awareness and development of innovative funding models and other supporting instruments targeting the specificities of the space sector and its risks. To name just a few areas that would require further thought and consideration:

- Access to satellite insurance for entrepreneurs with limited or no flight heritage;
- Financing solutions such as export credit, factoring, alternative solutions (vs equity) to alleviate the burden associated with pre-funding of launch costs for young satellite companies, etc.;
- Brokering and financing access to space for European small sat companies to aggregate demand and increase bargaining power vis-à-vis launch providers, while also diminishing the risks that the launch companies face;
- Advisory functions and soft measures in support of the European space sector, etc.

The future of the European space sector

Summing up, more must be done to cement Europe's role as a global player and influencer in the current industrial climate in space tech. Accordingly, EU institutions have the responsibility of not only setting ambitious goals but also of developing innovative industrial policies, instruments and models to support the space sector going forward.

This report assesses the current investment landscape, identifies gaps in financing across the space value chain and proposes key recommendations and solutions to improve the existing conditions. The full report will be available on www.eib.org

Recent examples of the EIB group's commitment to the space sector

InnovFin Space Equity Pilot

InnovFin Space Equity Pilot (ISEP) is a funding programme supported by the European Commission to support the smart, sustainable and inclusive growth of European space SMEs.

Deployed via the European Investment Fund, the programme will invest in venture capital and other risk-capital funds targeting companies that aim to commercialise new products and services linked to space data and space technologies. This support will be provided via fund investments and potentially other mechanisms.

ISEP should incentivise the private sector to show more appetite for investments in the space domain and encourage businesses to develop more innovative, space-related products and services. This programme should complement the already existing measures in support of SMEs, start-ups and young entrepreneurs through the use of prizes and competitions (such as Copernicus and Galileo Masters), and through initiatives covering the other cycles of business development (for example, business incubators, or space technology accelerators providing seed-stage support). ISEP will contribute to the implementation of the Space Strategy for Europe.

Loan to Avio

The EIB has provided EUR 40m to the Italian company Avio to support the development of new products and technologies related to space propulsion systems. The loan will cover research and development activities, as well as the modernisation and expansion of production capacity at facilities in Colleferro (Rome), the company's main industrial site in Italy.

Quasi equity loan to Skeleton

The EIB has signed a EUR 15m "quasi equity" financing agreement with Skeleton Technologies, Europe's leading producer of ultracapacitors and ultracapacitor-based energy storage solutions, which are being used by the European Space Agency, amongst others.

While batteries can only undergo a limited number of discharge-recharge cycles, supercapacitors can do this a million times, making them practical for capturing solar energy in space for moving solar panels and adjusting antennae on satellites.

The EIB loan is guaranteed under the European Fund for Strategic Investments, the heart of the Investment Plan for Europe.

The financing will allow the company to finance the R&D for the further development of its products and systems to better serve its customer base, which also includes German automotive manufacturers and leading global engineering companies.

Advisory support for the SpaceResources.lu initiative

EIB's Advisory services are also working on Luxembourg's SpaceResources.lu initiative. This initiative promotes and supports i.a. the exploration and commercial utilisation of resources from celestial bodies, such as asteroids or the moon. The Luxembourg Government supports innovative R&D projects under the SpaceResources.lu initiative, including direct investments in companies active in advanced space technologies with operations in the Grand Duchy.

As part of the agreement with Luxembourg's Ministry of the Economy, EIB Advisory services share information on the relevant financing products of the EIB Group, meet with companies establishing operations in Luxembourg to understand their bankability prospects, and provide guidance on positioning the initiative with relevant potential investors (including the EIB Group).



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