ESPI

European Space Policy Institute

Full Report

Space Venture Europe 2021

Entrepreneurship and Investment in the European Space Sector

Report:

Title: "ESPI Report 83 - Space Venture Europe 2021"

Published: June 2022

ISSN: 2218-0931 (print) • 2076-6688 (online)

Editor and publisher:

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1.1 About New Space

The global landscape of space activities is currently undergoing profound changes. Whereas the vast majority of space activities are still led by governments, with private industries acting as suppliers for public programmes and relying massively on public funding, a disruptive and commercially driven ecosystem has emerged over the last decade marked by ambitious private endeavours featuring innovative schemes and business models. In this new ecosystem, public actors are eager to explore new ways to conduct space programmes and to foster the development of the commercial space sector. In turn, private actors also seek to play a more prominent role, leveraging public funding and private investment to develop new business models and to address new markets.

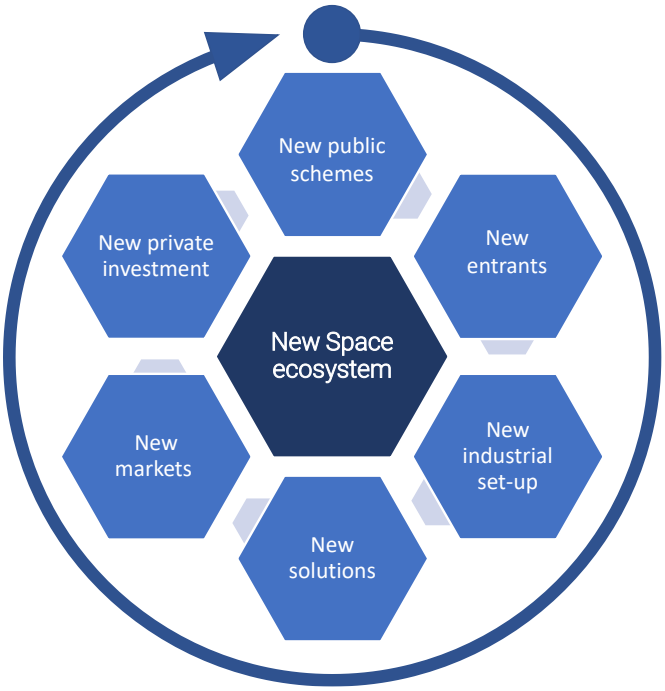

Figure 1: The New Space ecosystem

The underlying dynamics of this new ecosystem, usually referred to as New Space, feature a wide range of interrelated trends leading the space sector towards a more business and service-oriented step:

- New public schemes for space programmes, procurement and support to innovation involving new arrangements with the private sector and the development of new public instruments.
- New entrants including emerging spacefaring nations and new business ventures from space companies and start-ups as well as from non-space companies seeking to enter the space sector.
- New solutions including new products and services but also disruptive value propositions such as integrated solutions, lower prices, reduced lead times, lower complexity, and better flexibility.
- New markets under exploration or development in both the upstream and downstream segments of the space value chain (e.g., in-orbit servicing, satellite broadband, satellite imaging, micro-launchers…)
- New industrial set-ups and implementation of new industrial methods and processes for the development and production of space systems as part of innovative business models.
- New private investment from various sources and involving multiple financial instruments (e.g., venture capital, private equity, loans, prizes, crowdfunding…)

1.2 Growing public support to New Space

1.2.1 European Union: launch of new initiatives to foster New Space trends

With New Space increasingly high on its space agenda, the European Union (EU) is accelerating its support for entrepreneurship and investment in the European space sector, introducing new instruments and strengthening pre-existing ones.

The EU action to foster entrepreneurship and investment in the space sector mainly consists in dedicated instruments within general programmes such as InvestEU, which now includes the Competitive Space Start-ups for Innovation initiative (CASSINI), or the European Innovation Council Fund, part of Horizon Europe, which offers new opportunities for space start-ups. The EU approach also includes initiatives seeking to give a more prominent role to start-ups in the EU space programme such as dedicated calls for the EU Space-based Connectivity System. The EU's efforts to foster New Space trends in Europe has also translated into specific programmes towards direct investments originating from the EIB.

InvestEU Programme and the Competitive Space Start-ups for Innovation initiative (CASSINI)

InvestEU is an investment guarantee programme aimed at European SMEs and small mid-caps that centralises 14 previous European financial instruments. It has a budgetary guarantee of €26.2 billion, to be deployed through the EIB and national banks, aiming to mobilize more than €372 billion throughout 2021-2027.

- One of the previous instruments absorbed by InvestEU is the European Fund for Strategic Investment (EFSI), which backed investments made in the scope of the InnovFin Space Equity Pilot in the previous Multiannual Financial Framework.[1]
- Regarding start-ups and SMEs, the European Commission aims to use the InvestEU Fund to address "sub-optimal investment situations and reduce the investment gap in targeted sectors". Space is one of the sectors eligible for financing and investment operations, particularly if in line with the objectives of the Space Strategy for Europe, which include "underpinning space entrepreneurship".[2]

The Competitive Space Start-ups for innovation initiative (CASSINI) was officially established by officials from the European Commission, the EIB and the EIF on the 25th of January 2022 and will be managed by the Directorate-General for Defence Industry and Space. As a successor to the InnovFin space equity pilot[3], CASSINI aims to regroup support measures for start-ups and SMEs related to the space sector under a single €1 billion initiative to run until 2027.[4]

Accordingly, the initiative intends to generate investments in 60 start-ups per year. Moreover, CASSINI is to be complemented by a debt programme managed by the EIB to finance start-ups.[5] To achieve these goals, CASSINI has three key features. Prizes and Competitions, Access to Finance, and Business Development and Networks:

[1] European Union, InvestEU, (available at: https://europa.eu/investeu/about-investeu_en)
[2] European Parliament and European Council, REGULATION (EU) 2021/523 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 March 2021 establishing the InvestEU Programme and amending Regulation (EU) 2015/1017
[3] European Commission, Management Plan 2021 DG Defence Industry and Space (Available at: https://ec.europa.eu/info/system/files/management-plan-defis-2021_en.pdf)
[4] European Commission, EU Space: Further cooperation to support space entrepreneurship in Europe (Available at: https://ec.europa.eu/defence-industry-space/eu-space-further-cooperation-support-space-entrepreneurship-europe-2022-01-25_en)
[5] Space Intel Report, European Commission publishes 6-year, $1 billion Cassini space finance facility. Goal: 60 investments per year (available at: https://www.spaceintelreport.com/european-commission-publishes-6-year-1-billion-cassini-space-startup-finance-facility-goal-60-investments-per-year/)

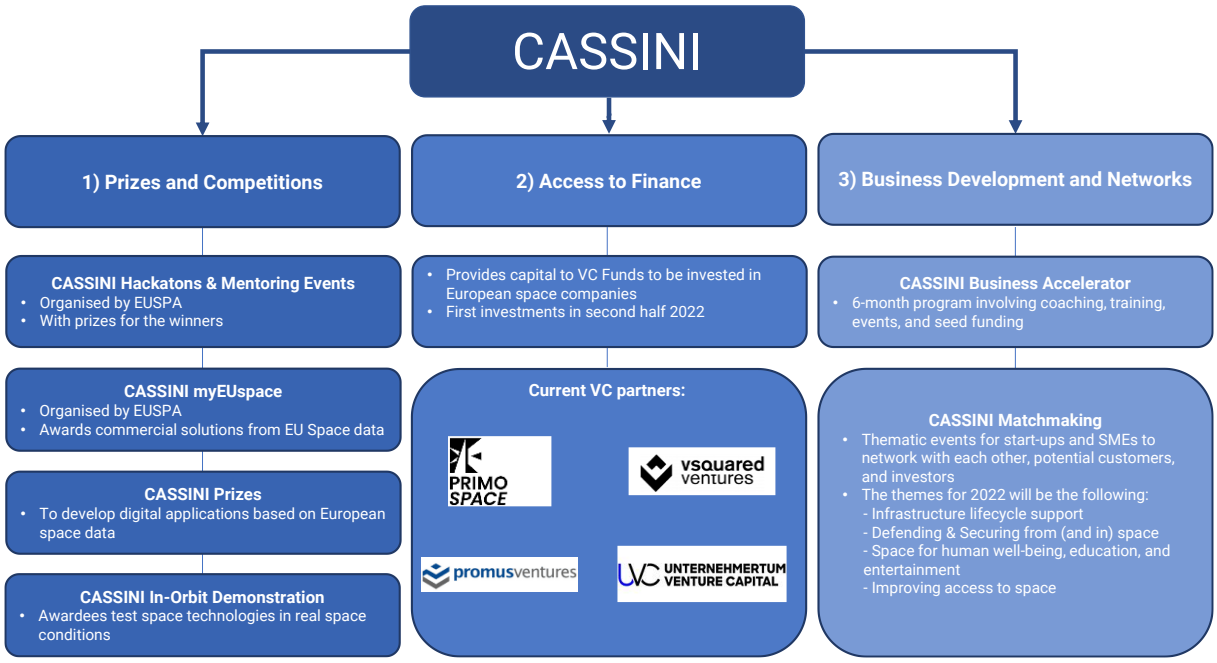

Figure 2: Cassini structure and organisation

Horizon Europe and the European Innovation Council

The Horizon Europe research and innovation funding programme was established in April 2021, with a budget of €86.1 billion in current prices for the period of 2021-2027. The programme has a component dedicated to space-related projects, under Pillar 2 "Global Challenges and European industrial competitiveness" within its Cluster 4 denominated "Digital, Industry and Space". Cluster 4 will receive a total of €13.5 billion for the duration of the Horizon Europe[6], plus an additional €1.35 billion from NextGenerationEU.[7] The funding made available through Horizon Europe is set to be "at least proportionally commensurate with that under Horizon 2020" and aims to "foster a globally competitive and innovative European space sector" in coherence with the European Union Space Programme.[8] Within this program, EUSPA is organising the Horizon Europe Calls, to foster the downstream space market in Europe.

Under the umbrella of Horizon Europe, the European Commission officially launched the European Innovation Council (EIC) in March 2021, with a budget of €10 billion (current prices) for 2021-2027.[9] This initiative aims to identify and support breakthrough technologies and innovations by providing financial support through various funding schemes.

The 2022 EIC Programme establishes a budget of €1.7 billion, to be distributed amongst various programmes, including:

- EIC Accelerator (€1.16 billion), provides blended finance (grants plus equity capital investments between 10% and 20%) to start-ups and SMEs, and small mid-caps, to be made through the EIC Fund,

[6] Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013 (available at: https://eur-lex.europa.eu/eli/reg/2021/695/oj)
[7] European Commission, Space Research and Innovation (available at: https://ec.europa.eu/defence-industry-space/eu-space-policy/space-research-and-innovation_en)
[8] European Council, Position of the Council at first reading with a view to the adoption of a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013
[9] European Commission, Commission launches European Innovation Council to help turn scientific ideas into breakthrough innovations, (March 2021)

an entity owned by the European Commission. The aim is to bridge the funding gap and encourage complementary private investment in these companies. One significant change concerning the previous year is that the investment under the EIC Accelerator can now be above €15 million if related to "technologies of strategic European interest". Importantly, some of the "key strategic areas" in this instrument are related to space: new applications of quantum technologies in space, innovative applications of data and signals from EU space infrastructures, and the development of space technologies.

  - So far there were three rounds of direct equity investment. The Dutch space IoT start-up Hiber[10], was one of the first companies benefitting from this new mechanism, closing a €26 million round led by the EIC Fund. Nevertheless, due to disputes between the Directorate-General for Research and Innovation and the Directorate-General for Budget on how to manage the EIC Accelerator companies that were selected in 2021 were still waiting for the equity investments in February 2022.[11]

- EIC Pathfinder (€350 million), for advanced scientific research, among others, in the development of information processing, communication or sensing components space applications for breakthrough technologies, which can be granted to entrepreneurial researchers from start-ups, high-tech SMEs and industrial stakeholders.
- EIC Prizes, *ad hoc* cash prizes worth between €5M and €10M for designated issues. In 2021, there was one competition themed "Low-Cost Space Launch", aiming to launch satellites into LEO with low-cost technology. The winner was the German start-up Isar Aerospace Technologies.[12] In 2022, there are no planned prizes for the space sector.

EU funding mechanisms as well as the type of investment/ size are summarized below:

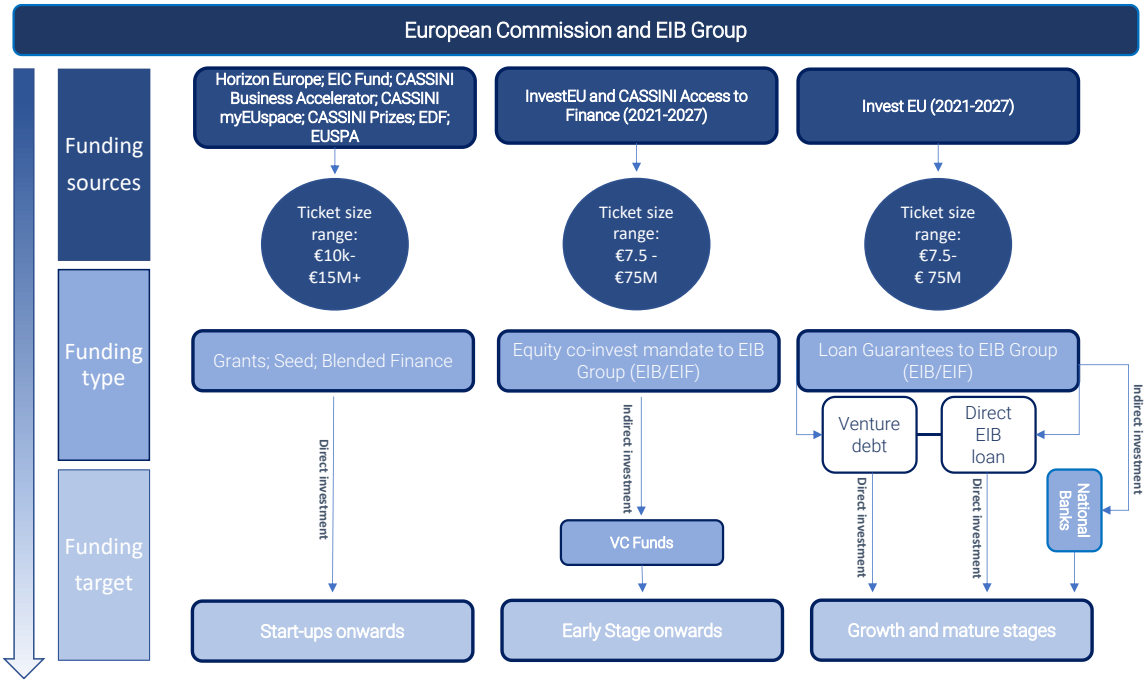

Figure 3: EU space investment mechanisms

[10] European Commission, European Innovation Council Fund: first equity investments of €178 million in breakthrough innovations
[11] Science Business, European Innovation Council fund is yet to start giving out money (available at: https://sciencebusiness.net/news/european-innovation-council-fund-yet-start-giving-out-money)
[12] European Commission, EIC Horizon Prize on a Low-Cost Space Launch: Commission awards € 10 million to Isar Aerospace Technologies GmbH (available at: https://ec.europa.eu/defence-industry-space/eic-horizon-prize-low-cost-space-launch-commission-awards-eu-10-million-isar-aerospace-technologies-2022-01-25_en)

European Investment Bank (EIB) and the space sector

In 2021, the EIB made considerable direct and indirect investments in the space sector. In July, it invested €50 million, guaranteed by the European Fund for Strategic Investments (EFSI), in Wachstumsfonds Bayern 2, a growth fund set up by the Bavarian Ministry of Economic Affairs. The fund then invested in OroraTech, a start-up that aims to develop an early warning system for wildfires using nanosatellites.[13]

Furthermore, in the following month, the EIB issued a €10 million loan to the Bulgarian company EnduroSat. The company will invest it in the development of nanosatellites, and in the growth of its Shared Satellite Service, a platform where customers can lease the start-up's space assets to collect the data they need.[14]

The EIB also loaned €15 million to the French company Kayrros, which will use the funds to improve its technologies for the analysis of earth observation data to quantify the climate externalities of economic activity. The deal was part of a financing round totalling €40 million.[15]

The place of start-ups in the EU Space-based Secure Connectivity System

On 15th February 2022, the European Commission proposed the secure connectivity initiative to safeguard access to secure governmental satellite communication services for the protection of critical infrastructure, surveillance, external actions and crisis management and to foster commercial high-speed availability throughout Europe.

To that end, the European Commission will cooperate with legacy industrial players and the New Space ecosystem.[16] Accordingly, the European Commission selected two consortiums to receive €1.4 million each, on a proposal for a future satellite constellation. The selected consortia were "New Symphonie", led by Unseenlabs and Euroconsult, and "UN:IO" led by Mynaric, Isar Aerospace, and Reflex Aerospace.[17]

[13] European Investment Bank, Germany: EIB boosts venture capital for innovative startups in Bavaria (available at: https://www.eib.org/en/press/all/2021-247-eib-boosts-venture-capital-for-innovative-startups-in-bavaria)
[14] European Investment Bank, Bulgaria: EIB invests €10 million in new space scaleup EnduroSat (available at: https://www.eib.org/en/press/all/2021-291-eib-invests-eur10-million-in-new-space-scaleup-endurosat)
[15] European Investment Bank, France: Climate technology specialist Kayrros receives €15 million EIB loan (available at: https://www.eib.org/en/press/all/2022-138-france-kayrros-specialise-dans-la-tech-climatique-beneficie-d-un-pret-de-15-millions-d-euros-de-la-bei)
[16] European Commission, Space: EU initiates a satellite-based connectivity system (available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_22_921)
[17] Via Satellite, Two Consortiums to Explore Future European Satellite Constellation (available at: https://www.satellitetoday.com/government-military/2021/12/13/two-consortiums-to-explore-future-european-satellite-constellation/)

1.2.2 ESA: commercialisation becomes a key strategic priority

The European Space Agency has long played a major role and been a driving force in the growth of the European start-up ecosystem by supporting entrepreneurship and investment through various mechanisms, ranging from incubation centres to new procurement schemes.

ESA Agenda 2025 and the new ESA Directorate for Commercialisation, Industry and Procurement

In March 2021, Josef Aschbacher was appointed as the new Director General at ESA. The new DG worked with the Member States to define the Agency's aspirations for the coming years. The resulting document established 5 main priorities for 2025:

- Strengthen ESA/EU relations;
- Facilitate commercial activity for green and digital space technologies;
- Expand safety and security activities;
- Address critical programme challenges;
- Complete the internal ESA transformation.

Regarding the point on facilitating commercial activity, ESA aims to simplify its programmes and activities and open the access to its facilities. By the end of 2022, ESA plans to significantly reduce the procurement process for contracts below €1 million. Moreover, the Agency intends to boost its Technology Strategy to be 30% faster in the development and implementation of new technologies. It is further stated that "ESA will strongly support New Space involvement and commercialisation" in Earth observation.[18]

On the 21st of October 2021, the ESA Council appointed Géraldine Naja as Director for Commercialisation, Industry and Procurement. The newly established Directorate aims to help European businesses thrive in the space industry by focusing on three key elements: talent, access to capital and fast innovation.

Accordingly, the new Director is responsible for, *inter alia*, the execution of ESA's industrial policy, putting forward and implementing new procurement rules, expanding the European space industry on the global markets, and facilitating its access to investments and finance.[19]

ESA support mechanisms targeted to start-ups and SMEs

There are currently a variety of support programmes and initiatives sustained by ESA that are particularly relevant for start-ups and SMEs:

The ESA Business Incubation Centres (BICs), through which the agency offers incubation solutions as well as funding for start-ups seeking to turn ideas into commercial solutions. To this end, BICs not only offer pecuniary support of up to €50.000 for product and IP development but also mentoring, legal advice, and technical support, among others. As of 2020, the programme now counts 22 centres and over 60 locations across Europe. The latest BIC was inaugurated in Turin, Italy, in November 2021. During the inauguration, the BIC Turin released its first call for three start-ups and each winner will be awarded €50.000 for product development and intellectual property management.[20]

The Commercial Space Transportation Services and Support Programme (ESA Boost!) has a €54.5 million budget running from 2020 to 2022, with seven countries having committed to it. The ESA Boost! contracts represent a means for ESA to supply co-funding to scale up activities and include types of non-financial

[18] ESA, ESA Agenda 2025 (available at: https://esamultimedia.esa.int/docs/ESA_Agenda_2025_final.pdf)
[19] ESA, N° 33–2021: ESA welcomes three new directors (available at: https://www.esa.int/Newsroom/Press_Releases/ESA_welcomes_three_new_directors)
[20] ASI, Space Economy: the ESA BIC turn opens the call to support space related startups (available at: https://www.asi.it/en/2021/11/space-economy-the-esa-bic-turin-opens-the-call-to-support-space-related-startups/)

support such as project guidance and access to state-of-the-art facilities. Some of the awards under ESA Boost! in 2021:

- In March, UK small launcher companies Orbex and Skyrora were selected for funding. Orbex received €7.5 million in co-funding to support the development of its Prime launcher, while Skyrora was awarded €3 million for the development of its Skyrora XL three-stage launch vehicle.[21] The UK is the second-largest contributor to ESA Boost! with approx. 26% of the programme's total budget.[22]
- In April, the German micro launcher company Isar Aerospace won the second phase of the DLR Microlauncher competition. The start-up was expected to receive a letter of recommendation to advance in the Boost! Programme and potentially be eligible for ESA launch contracts.[23] Moreover, following a national selection process by DLR, ESA signed a co-funding contract worth €11 million with the company in November, to conduct two flight demonstrations of its orbital launch vehicle Spectrum.[24]
- In September, the UK-based D-Orbit signed a contract with ESA to offer end-to-end transportation services and increase opportunities for small satellite companies.[25] Another British company, SpaceForge, also signed a 2-year contract worth €2 million, to develop a new commercial space vehicle.[26]

The Global Space Markets Challenge, which aims to promote SMEs in the space sector whose purpose is to propel themselves to markets outside the EU, ESA member states or Canada, took place in 2021, with three winners selected for each upstream and downstream space sectors. In both instances, the first place had a prize of 15.000€, the second 10.000€ and the third 5.000€, plus other benefits, such as a mentoring programme. In the upstream segment, DCubed came in first place in the competition, Lios second and Lens R&D third, while in the downstream segment, Detektia achieved first place, SatADSL second and Airborne Underwater Geophysical Signals third. The initiative is managed with the support of EURISY, a European non-profit association of more than 15 national space agencies and other organisations and sponsored by Venture Capital Funds such as SERAPHIM Capital and Primo Space.

[21] Via Satellite, UK's Orbex and Skyrora Win ESA 'Boost' Launch Contracts (available at: https://www.satellitetoday.com/launch/2021/03/24/uks-orbex-and-skyrora-win-esa-boost-launch-contracts/)
[22] Peter B. De Selding, ESA, with UK funds, awards $12.4M to launch startups Orbex & Skyrora; Scotland sees $6.3B 10-year market for UK (available at: https://www.spaceintelreport.com/esa-with-uk-funds-awards-12-4m-to-launch-startups-orbex-scotland-sees-6-3b-10-year-market-for-uk/)
[23] Peter B. De Selding, German small-launcher plot thickens: After OHB signing with RFA, Airbus contracts with Isar Aerospace (available at: https://www.spaceintelreport.com/german-small-launcher-plot-thickens-after-ohb-signing-with-rfa-airbus-contracts-with-isar-aerospace/)
[24] ESA, ESA Boost! contract for flight demonstration of Spectrum launch vehicle (available at: https://www.esa.int/Enabling_Support/Space_Transportation/Boost/ESA_Boost!_contract_for_flight_demonstration_of_Spectrum_launch_vehicle)
[25] ESA, ESA's Boost! fosters new launch and in-orbit services (https://www.esa.int/Enabling_Support/Space_Transportation/Boost/ESA_s_Boost%21_fosters_new_launch_and_in-orbit_services)
[26] ESA, Microgravity on demand with Earth return through ESA's Boost! (available at: https://www.esa.int/Enabling_Support/Space_Transportation/Boost/Microgravity_on_demand_with_Earth_return_through_ESA_s_Boost)

Other ESA support mechanisms relevant to start-ups and SMEs

There are also other support programmes and initiatives sustained by ESA that address industrial competitiveness and R&D at large and from which start-ups and SMEs can also benefit from:

ESA targeted and applicable funding mechanisms to start-ups and SMEs:

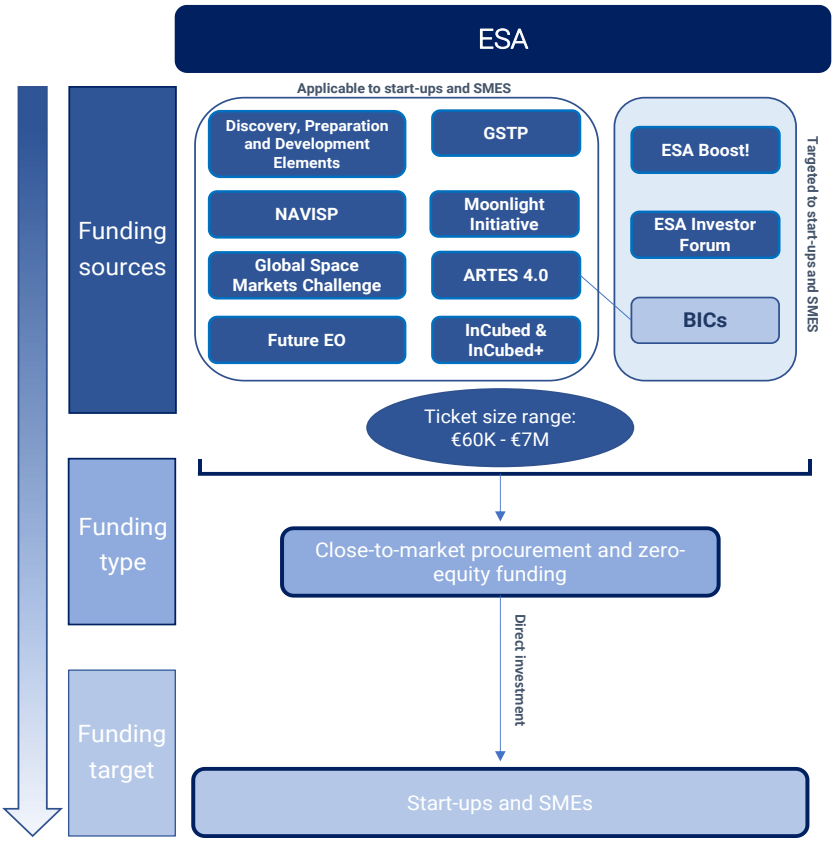

Figure 4: ESA space start-up and SMEs funding mechanisms

- The ESA ARTES 4.0 programme offers varying degrees of support and funding opportunities to all businesses focused on Satcom technologies. It contains various generic programme lines (GPLs) that enable the agency to enhance the activities of start-ups and SMEs present along with different development levels and developing technologies or services across the Technology Readiness Level (TRL) spectrum. Among these GPLs, the following can be found:
    - The ESA Business Applications and Space Services (BASS), containing the previously mentioned BICs, and the ESA Business Applications (BA), through which companies can find ways to use space data and technology for their benefit. The BA programme funds various space-related projects through zero-equity funding between €60.000 and €2 million and has invested over €190 million in more than 500 businesses.[27] Under the BA there are:
        - Kick-Start activities, through which the agency offers co-funding for innovative space-related activities. The grant can be up to 80% with a maximum of €64.000 for SMEs and 75% with a maximum of €60.000 for non-SMEs innovative space-related activities.
        - Feasibility Studies, through which the agency proposes funding between 50% and 100% depending on whether the company is an SME and if the study is approved under a direct negotiation or through an open competition. It is aimed at studies seeking to offer a

[27] European Investment Bank, The future of the European space sector (available at: https://www.eib.org/attachments/thematic/future_of_european_space_sector_en.pdf)

preparatory framework to define potential applications and services in ESA's Business Application programme.

- Demonstration Projects, through which the Agency can support the funding of activities aiming to implement pre-operational demonstration services. Activities undertaken under this element receive between 50% and 80% in ESA funding depending on the nature of the type of activity funded and the nature of the institution undertaking the activity.[28]

- The ARTES Core Competitiveness (CC) programme, through which the agency provides both financial and non-financial support to companies developing solutions across the technology development process. The CC programme is a combination of the previous ARTES Advanced Technology element, which provides up to 100% in funding for projects, and the ARTES Competitiveness and Growth (C&G) element, which provides up to 80% in funding for SMEs.[29] Under this programme, in January 2022, the UK-based companies Methera and Sofant Technologies received funding and expertise to make satellite user terminal technology more accessible by reducing costs and complexity.[30]
- The ARTES Partnership Projects (PP), which support end-to-end services from the start-up level to in-orbit validation and federates members of the industry around large-scale projects to foster the competitiveness of the European Satcom industry and allow a greater risk-sharing among operators and ESA.[31]
- The Future Preparation (FP) element represents the strategic component of the ARTEs programme and focuses on identifying new opportunities and future needs for the European space industry. In terms of funding, the element provides opportunities to finance studies by members of the industry and other institutions.[32]

- Future EO, is a programme under the umbrella of the Earth Observation Programme (EOP) dedicated to the development of these EO capabilities by providing a range of tools, such as zero equity funding, help secure additional private investments and programmatic support.[33]
- The InCubed programme, also under the EOP, is a Public-Private Partnership co-funding programme of up to 80% to SMEs, supervised by the ESA Φ-lab that aims to support companies developing innovative and commercially viable solutions that harness Earth Observation data.[34] Accordingly, in 2021, ESA Φ-lab signed an agreement with the Italian-based venture capital firm Primo Ventures to collaborate in facilitating the growth of start-ups connected with the Earth observation space economy commercial sector.[35] Currently, this programme manages a portfolio of around 70 co-funded activities, ranging between €150.000 and €17 million.[36] One such example is ESA's co-investment in the seed round of the Finnish start-up Kuva Space in October 2021, which raised €4.2M to help establish a constellation of commercial hyperspectral CubeSats.[37]

[28] European Space Agency, Funding schemes (available at: https://business.esa.int/funding-schemes)
[29] European Space Agency, Artes 4.0 Core Competitiveness : An overview (available at: https://artes.esa.int/sites/default/files/ARTES%20CC%204.0%20overview%20-%20public%20-%20Nov%202020%20RP.pdf)
[30] ESA, New entrants look forward to making a global impact in satellite communications accessibility, fuelled by ESA support (available at: https://artes.esa.int/news/new-entrants-look-forward-making-global-impact-satellite-communications-accessibility-fuelled-esa-support)
[31] European Space Agency, ARTES Partnership Projects (available at: https://artes.esa.int/partnership-projects)
[32] European Space Agency, Future preparation (available at: https://artes.esa.int/future-preparation)
[33] European Space Agency, Future EO (available: https://indd.adobe.com/view/a3fbcc56-df64-4e68-afc9-1667f7e84eed)
[34] European Space Agency, InCubed is an ESA programme managed by ϕ-lab (available: https://incubed.phi.esa.int/)
[35] Primo Ventures, Primo Space Fund and ESA Φ-Lab sign an agreement to boost new space economy (available at: https://www.primo.vc/en/post/primo-space-fund-and-esa-f-lab-sign-an-agreement-to-boost-new-space-economy)
[36] European Space Agency, Φ-Lab & the Investing in Industrial Innovation (InCubed) Programme (available at: https://esamultimedia.esa.int/docs/business_with_esa/2.Intro_to_Phi-Lab_and_InCubed.pdf)
[37] SpaceNews, Finland's Kuva Space raises funds for hyperspectral constellation (available at: https://spacenews.com/kuva-space-seed-funding/)

- The Discovery & Preparation Elements, which aim to finance research on space technology, while encouraging small companies and universities to contribute to these studies. The Discovery Element funds around 150 activities per year, and the Preparation Element funds around 30 mission studies. Similarly, both allocate around €17 million yearly.[38]
- The Technology Development Element, a cornerstone of the agency's innovation efforts, grants an average of €60 million over around 120 industrial contracts to businesses and universities every year across all technical disciplines.
- The General Support and Technology Programme (GSTP), which is divided into three main elements (GSTP "Develop", GSTP "Make" and GSTP "Fly") and covers all technical disciplines and applications except for those covered by ARTES. The GTSP is one of ESA's programmes that focuses more on SMEs with an average annual commitment of €100 million allocated across 150 to 200 activities.[39] An example of investments under the GTSP was ESA awarding a total of €4.5 million in the guidance, design, assembly, and commissioning of the UK's National Space Propulsion Facility, inaugurated in 2021.[40] In 2021, the "Develop" element had 42 activities under procurement an allocated budget of €11 million. Furthermore, this element has specific frameworks to implement projects faster:
    - De-risk aims to help future space technologies achieve maturation by analysing possible shortcomings and critical issues. It can finance up to €200.000 per activity.
    - Advanced Manufacturing enables space-related entities to explore how to make use of innovative manufacturing processes in their output, financing up to €250.000 in the process.
    - Building Blocks focuses on supporting the development of capabilities in each Member State or across multiple. It can finance up to €500.000 per activity.[41]
- The Navigation Innovation and Support Programme (NAVISP), further divided into three main elements (Innovation in Satellite Navigation, Competitiveness and Support to the Member States), aims to foster Member States' industrial competitiveness and innovation priorities in the navigation and positioning, navigation and timing market sectors. To this end, it provides investments with zero equity, as well as other support mechanisms, such as technical expertise. The Programme has so far financed around 200 activities with €100 million, while 65% of its participants are SMEs.
- The ESA Moonlight Initiative, which aims to expand satnav and communication links to the Moon by encouraging European space companies to take part in the mission. Within this framework, two consortiums led by Telespazio and Surrey Satellite Technology Ltd. (SSTL), won a contract of approx. €2.4 million.[42] Additionally, SSTL won another contract worth €20 million for a period of five years, under which ESA will buy its communications services and fly its payloads on the company's Lunar Pathfinder.

[38] European Space Agency, Discovery, Preparation & Technology Development Elements Industry Space Day 2021 (available at: https://esamultimedia.esa.int/docs/business_with_esa/10a.Discovery_Preparation_Technology_Development_Elements.pdf)
[39] European Space Agency, General Support Technology Programme (available at: https://esamultimedia.esa.int/docs/business_with_esa/10b.GSTP_presentation.pdf)
[40] European Space Agency, ESA-led space propulsion test facility passed to UK owner (available at: https://www.esa.int/Enabling_Support/Space_Engineering_Technology/ESA-led_space_propulsion_test_facility_passed_to_UK_owner)
[41] European Space Agency, GSTP Element 1: Develop (available at: https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/GSTP_Element_1_Develop)
[42] UK Space, New government funding helps UK companies lead the way for future Moon missions (available at: https://www.ukspace.org/new-government-funding-helps-uk-companies-lead-way-for-future-moon-missions/)

1.2.3 European states: rising efforts to boost national New Space ecosystems

In addition to the new initiatives undertaken by the EU and ESA, the year has also been marked by major new national efforts in support of investment and entrepreneurship. The following list does not provide a comprehensive list of national initiatives.

France

In France, 2021 was marked by two major developments concerning the country's public policy and action in support of entrepreneurship and investment in the space sector.

The first one was President Emmanuel Macron's announcement of "France 2030", a €30 billion long-term investment plan to support innovation and the revitalization of the industry across 10 key sectors of the future, with a specific focus on green and sustainable growth and the support to small and medium enterprises.[43] Space ranks among the 10 selected sectors:

- The French Government is set to invest €1.5 billion in space-related technologies, with €500 million allocated towards New Space actors, €200 million for reusable micro-launchers, and €500 million towards financing a Satcom constellation.[44]
- Regarding New Space, President Macron highlighted the importance of collaboration between public actors, traditional space actors and emerging actors. Moreover, the President set 3 short-term objectives:
    - The development of reusable small launch vehicles by 2026.
    - Innovation in microsatellites and future satellite constellations.
    - The development of technological and service innovations that will be at the heart of this New Space.[45]

The second highlight was the launch of France Relance, a recovery plan to help the French economy counter the impacts of COVID-19. The plan includes a space component with a budget of €515 million to be operated by CNES. The recovery plan includes three main elements:

- "French Innovation", dedicated to supporting space manufacturers impacted by Covid-19 and stimulating innovation and competitiveness. Within this element there are different components:
    - Public investments on the ArianeGroup's Vernon site, which will amount to €30 million[46];
    - "Thematic calls for tenders", focused on SMEs to develop innovative dual technologies and strengthen critical national skills. 22 projects were selected to receive more than €80 million, 62% of which are SMEs.
    - "Calls for collaborative projects", aiming to structure R&D projects around the priority themes defined by the State-Industry Space Consultation Committee (COSPACE). 5 projects were selected to receive more than €75 million, 60% of which are SMEs and start-ups.

[43] Élysée, Présentation du plan France 2030 (available at : https://www.elysee.fr/emmanuel-macron/2021/10/12/presentation-du-plan-france-2030)
[44] La Tribune, Plan "France 2030" : Macron met sur la table 1,5 milliard d'euros pour le spatial (available at: https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/plan-france-2030-macron-met-sur-la-table-1-5-milliard-d-euros-pour-le-spatial-894259.html)
[45] Élysée, Présentation du plan France 2030 (available at: https://www.elysee.fr/emmanuel-macron/2021/10/12/presentation-du-plan-france-2030)
[46] Le Figaro, La France doit rester un «grand pays du spatial», dit Macron (available at: https://www.lefigaro.fr/conjoncture/la-france-doit-rester-un-grand-pays-du-spatial-dit-macron-20210112)

- "Space Tour 2021", consisting of support for start-ups and SMEs with projects for new services and products using space data. 33 selected project leaders won a prize of €100.000, €75.000 or €50.000.[47]
- "Nanosatellite Plan", fostering the French nano-satellite industry and accelerating the in-orbit validation of new technologies. So far, more than 100 applicants were selected from the call for expressions of interest, which is open until May 2022. A maximum of 20 projects will be selected with a limit of €150.000 per each in financing.[48]

Other major New Space related developments in France in 2021 include:

- CosmiCapital, a space-focused venture capital fund established in 2021, led by Karista and managed by Bpifrance in partnership with ESA, closed a €38 million fund to initiate its operations.[49] The main objective will be to support French and European New Space start-ups through Seed and Series A funding in the range of €1 to €5 million. The fund expects to invest about 75% of its investment capacity in downstream companies offering space services and the remainder in the upstream manufacturing sector. Bpifrance and CNES committed €15 million and €12 million, respectively, in the first closing, with the former planning to invest an additional €5 million upon the arrival of additional limited partners.[50]
- CNES and the Bundeswehr University Munich partnered to launch the SpaceFounders acceleration programme. The new programme supports European space start-ups mainly through non-financial means, such as mentoring, infrastructure and networking from CNES and partner Agencies like DLR and ESA. The programme also envisages two demo days to help start-ups find funding and investors.[51]

United Kingdom

The first National Space Strategy of the United Kingdom was released by the U.K. Department for Business, Energy & Industrial Strategy and the Ministry of Defence. It highlights New Space as an opportunity to grow the UK space sector, namely by pursuing new trade partnerships, leading the new space markets of the future, and creating modern space regulations.[52]

Accordingly, the Space Industry Act entered into force in 2021. The document provides for future licencing and regulation of spaceports and was developed by the Government, in collaboration with UKSA and the UK Civil Aviation Authority. The first commercial launches from the UK are expected to begin in early 2022.[53] Following the UK's decision to contribute approx. €15 million to ESA's Boost! Commercial Space Transportation Services and Support Program, both Orbex and Skyrora received development contracts

[47] Ministère de L´Économie des Finances et de la Relance, Lauréats du volet spatial de France Relance 17 décembre 2021 (avaliable at: https://www.entreprises.gouv.fr/files/files/enjeux/france-relance/dossier-de-presse-plan-de-relance-spatial-17dec2021.pdf)
[48] Ministère de L´Économie des Finances et de la Relance, AAP plan nanosatellites: concepts scientifiques et technologiques innovants (available at: https://www.entreprises.gouv.fr/fr/aap/aap-plan-nanosatellites-concepts-scientifiques-et-technologiques-innovants)
[49] Karista, CosmiCapital, Karista's Newspace fund announces its first closing at €38 million with CNES and Bpifrance (available at: https://presse.bpifrance.fr/download?id=35746&pn=aac110cb095e360e976a28ae8a8d3ec3-pdf)
[50] Space Intel Report, French CosmiCapital fund opens with $44 million, led by Bpifrance & CNES; tie-in with ESA startup network (available at: https://www.spaceintelreport.com/french-cosmicapital-fund-opens-with-44-million-led-by-bpifrance-tie-in-with-esa-startup-network/)
[51] CNES, Spacefounders CNES launches accelerator programme for European space tech start-ups (available at: https://presse.cnes.fr/en/spacefounders-cnes-launches-accelerator-programme-european-space-tech-start-ups)
[52] National Space Strategy of the United Kingdom (available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1034313/national-space-strategy.pdf)
[53] Space Industry Act 2018 (available at: http://publicapps.caa.co.uk/docs/33/Applying%20for%20a%20licence%20under%20the%20Space%20Industry%20Act%202018%20(CAP2209)%20(1).pdf)

from UKSA, with the former obtaining €7.5 million and the latter receiving €3 million.[54] Moreover, the Agency also awarded the UK-based company Reaction Engines €4.6 million to continue to development of SABRE, a low-carbon space propulsion technology.[55]

The Scottish Government also released a landmark document for its space policy, the "Scottish Space Strategy". Overall, it aims to position Scotland as a leader in the commercial space sector, establish launch and orbital services, transition towards an environmentally friendly space industry, and increase economic opportunities. The strategy outlines specific plans for the development of multiple satellite launch sites, green technology initiatives, and continued investment in data analysis and research.[56] Moreover, the Scottish Prestwick Spaceport and the UK-based company Astraius signed a MoU to prepare for the orbital launch of small satellites starting from 2023. Astraius is aiming to carry out multiple launches per day in the Spaceport. The agreement was well received by the Scottish and UK Governments since the deal has the potential to boost the above-mentioned ambitions of the Scottish space industry and create an important strategic asset for the UK.[57]

Germany

Although the German space industry has continued to develop, the German Government is still trying to find the best way to support it. One illustrative episode is the Government's endorsement of the North Sea spaceport, a small satellite launch platform located onboard a ship in German territorial waters in the North Sea. In line with its policy on small-launch vehicles, the Government limited its financial involvement to compensate part of the costs sustained to obtain regulatory approval.[58]

The Federation of German Industries (BDI) released a position paper in August 2021, with recommendations for the German small satellite industry. It highlights how 60% of small satellites between 2012 and 2019 were produced in the US, while Germany sits behind the likes of Japan, China and Russia with a share of 3%. Therefore, BDI proposes a programme by the German Government to develop a small satellite value chain, taking advantage of the existing competencies and in combination with the micro launchers industry and the proposed launch platform in the North Sea. To this end, it is suggested an annual €50 million over five years, to achieve a budget level similar to that of France, which is €750 million per year.[59]

In 2021, the DLR hosted its annual INNOspace Master with the support of the Federal Ministry of Education and Research (BMBF).[60] DLR partners with various stakeholders such as Airbus, OHB and ESA in order to create "Challenges" and offer prizes. The 2021 edition focused on space travel, innovation and technology transfer, counting with 330 participants, 80% of which are from non-space industries. Among this year's winners are quantum processors for satellite communications, precision farming, and small satellites to clean up space debris.[61]

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[54] European Space Agency, ESA boost for UK space transportation initiatives (available at : https://www.esa.int/Enabling_Support/Space_Transportation/ESA_boost_for_UK_space_transportation_initiatives)
[55] UK Space Agency, Reaction Engines secures new UK Government funding for Space Access Programme (available at: https://www.gov.uk/government/news/reaction-engines-secures-new-uk-government-funding-for-space-access-programme)
[56] Scottish Government, Scottish Space Strategy launched (available at: https://www.gov.scot/news/scottish-space-strategy-launched/)
[57] Astraius, Prestwick Spaceport Moves Closer to Lift Off with Astraius Partnership (available at: https://www.astraius.com/2021/09/prestwick-spaceport-moves-closer-to-lift-off-with-astraius-partnership/)
[58] Space Intel Report, German government gives benediction to North Sea orbital spaceport, but won't finance its development (available at: https://www.spaceintelreport.com/german-government-gives-benediction-to-north-sea-orbital-spaceport-but-wont-finance-its-development/)
[59] BDI, Schlüsselkomponente Kleinsatelliten (available at: https://bdi.eu/publikation/news/schluesselkomponente-kleinsatelliten/)
[60] Deutsches Zentrum für Luft und Raumfahrt, DLR INNOspace Masters (available at: https://www.dlr-innospace.de/innospace/innospace-masters/)
[61] German Aerospace Center, INNOspace Masters 2021: Innovation comes from competition (available at: https://www.dlr.de/content/de/artikel/news/2021/03/20210729_innospace-masters-2021.html)

Spain

The Spanish Government's Centre for the Development of Industrial Technology (CDTI) participated in Satlantis' second round of investment through its co-investment initiative of the Innvierte programme. The company raised a total of €16.5 million, which it will invest in its internationalisation in the US, UK, Central Asia and UAE.

Similarly, the Spanish company PLD Space also saw CDTI invest in its Series B funding round through the Innvierte programme. PLD Space aims to use the new funding to support upcoming launch plans by expanding its production capabilities and growing its team. The company is currently developing its MIURA 1 suborbital and MIURA 5 orbital rockets and seeks to offer orbital and suborbital launch services for small payloads and satellites.[62]

Furthermore, the Ministry of Economic Affairs and Digital Transformation emitted a provisional authorization allowing the Spain-based Sateliot to connect its terminals in Spanish territory with its satellite. This will enable the company to start testing its technology in real environments with companies and organisations with which it signed agreements, such as Alén Space.[63]

Italy

In Italy, a range of activities in the New Space sector continued to be put into place and supported, notably by Primo Space, a venture capital fund backed by the Italian Space Agency. The fund reached a total size of €85 million in October 2021 and led investments into New Space companies, such as Leaf Space (€2 million)[64] and Apogeo Space (€5 million).[65] Moreover, Primo Space and G-nous, a private Italian company providing business and technology services in the space sector, released an open call for the acceleration programme "Quasar", which is dedicated to Italian start-ups operating in the space economy.[66]

[62] EU-Startups, Elche-based PLD Space closes €25 million and looks to rocket-launch further expansion (available at: https://www.eu-startups.com/2021/12/elche-based-pld-space-closes-e25-million-and-looks-to-rocket-launch-further-expansion/)
[63] Aeroespacial, Sateliot obtiene la autorización del Gobierno para iniciar comunicaciones 5G-IoT desde el espacio (available at: https://actualidadaeroespacial.com/sateliot-obtiene-la-autorizacion-del-gobierno-para-iniciar-comunicaciones-5g-iot-desde-el-espacio/)
[64] Primo Space, Primo Space & Whysol Investments lead a €5m Series A round in Leaf Space (available at: https://www.primo.vc/en/post/primo-space-and-whysol-lead-eur5m-series-a-round-in-leaf-space)
[65] Primo Space, Primo Space invests 5 million euros in Apogeo Space for the development of the first Italian private satellite constellation for the IoT (available at: https://www.primo.vc/en/post/apogeo-space-investment)
[66] Primo Space, Quasar, the acceleration program for Italian space startups (available at: https://www.primo.vc/en/post/al-via-quasar)

2 Investment in European Space Start-ups

2.1 Top 5 European investment deals

The top five deals constituted 44% of the total volume invested in 2021, totalling approx. €270 million. Whereas this represents a decrease compared to the previous year in terms of value (€324 million in 2020), it is much higher than the total in 2019 (€71 million). Where 2021 marks a change from the previous years is that while total investment volume has increased, the percentage of the overall share of the top 5 deals in the total invested volume has significantly decreased (the top 5 deals represented 65% in 2020, 62% in 2018, and 65% in 2017). This highlights a more homogenous year in terms of deals in Europe with an ecosystem that is steadily maturing.

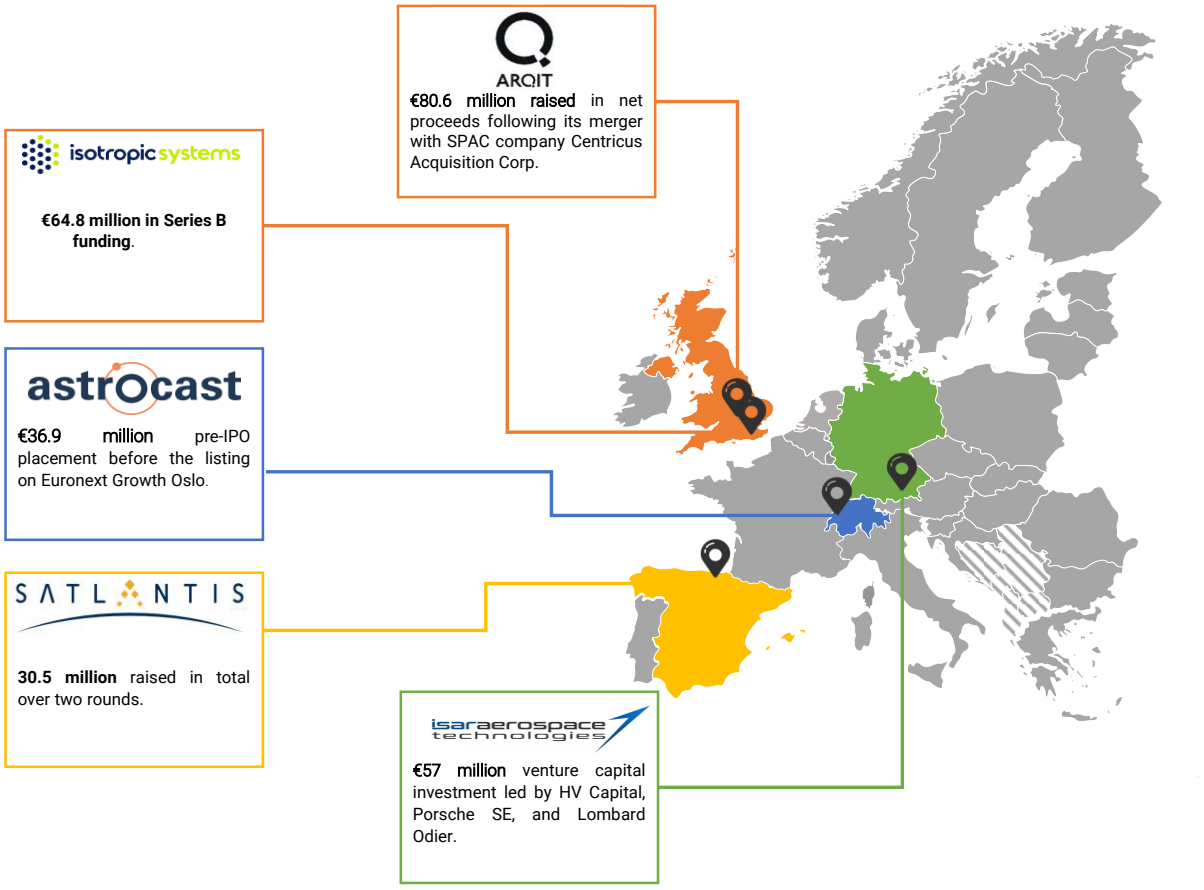


Figure 5: Top five European investment deals in 2021

- Arqit (€80.6 million): The UK-based quantum encryption company raised €80.6 million (from an initial €370 million planned) in net proceeds following its SPAC merger with Centricus Acquisition Corp in September. Arqit was founded in 2017 with the objective of providing new secure communications solutions based on their patented satellite-based quantum encryption methods. The company is targeting both public and private customers and aims to serve the defence, telecoms, financial services, and Industrial IoT sectors. With its new funds, Arqit plans to finance the initial deployment phase of its commercial services and is scheduled to launch its first two quantum satellites in 2023.

- Isotropic Systems (€64.8 million): The UK-based start-up Isotropic Systems secured over €64 million in Series B funding in 2021, raising funds in February and September. Whereas the first round was led by Luxembourg's SES, the second one was led by the newly publicly listed Seraphim Space Investment Fund. The company received strong support from the UK government in its Series B, with both the UK Space Agency and the UK Government's Future Funds participating in the February raise. The new capital will ensure that the company is fully funded ahead of the product launch of its multi-link antennas, currently projected to take place in 2022.

- Isar Aerospace (€57 million): The German small launcher start-up Isar Aerospace raised an additional €57 million in a new Venture capital funding round led by the venture capital firm HV Capital, who also participated in the company's €75 million Series B round in December 2020. The company's pre-money valuation stood at approx. €500 million following the round, as it accelerates the development of Spectrum, its small launch vehicle. The company was founded in 2018 as a spin-off from TU Munich and is now one of the most well-funded space start-ups in Europe, having raised more than €140 million since its inception. The additional funding will serve to finance the final development phases of the Spectrum, which is scheduled to have its maiden flight in 2022.

- Astrocast (€41.2 million): The Swiss IoT satellite company completed its IPO on August 25th by listing on the Euronext Growth Market in Oslo. Before its public listing, the company issued new shares to investors and successfully raised €42.2 million in a pre-IPO placement. The new funding was principally led by a syndicate managed by Adit Ventures and included Venture Capital firm Primo Space as well as Palantir. The Swiss company currently operates 10 satellites in LEO and expects to use the additional funds raised to continue the development of its planned constellation, as it seeks to reach the 100 satellites milestone in 2024. Astrocast forecasts to hold an estimated market share of 25% for satellite IoT devices in 2025 and plans to be EBITDA positive by 2024.

- Satlantis (€30.5 million): The Spanish Earth Observation start-up Satlantis raised €30.5 million in Series B funding over two rounds in 2021. The first financing round was led by Enagás through its corporate venture capital arm and included participation from the State-owned SEPIDES. The second was led by the Spanish Ministry of Science and Innovation's Centre for the Development of Industrial Technology (CDTI) and included additional investments from Enagás as well as other previous investors. Satlantis aims to cement itself as one of the leading suppliers of small satellite solutions, especially focused on environmental challenges such as the detection of methane. The start-up plans to use its new funding to scale up its production capabilities and begin its internalisation phase, as it projects to expand in the U.S., the UK, Central Asia, and the United Arab Emirates.

2.2 Overview and key indicators

Over the period 2014-2021, 370 private investment deals involving European space start-ups were recorded, amounting to a total of €1.901 million. In 2021, investment in European space start-ups reached a new high of €611.5 million spread over a record high of 86 deals.

This figure represents a rather conservative estimate of the total volume of investment and does not include deals involving ventures that do not qualify as" European space start-ups" according to the ESPI definition (Annex A). Noticeably, this total does not include investment in OneWeb whose special case is discussed in more detail hereafter. Furthermore, the value of 15 transactions were not disclosed this year.

Following a plateauing of investments at around €200 million per year in 2017-2019, 2021 confirms the new upside trend that started in 2020 with a new record high and a 14% year-on-year increase in investment volume. In addition, the sheer number of deals recorded in 2021 breaks away from the flat number of deals that had characterised the European space investment landscape since 2017 which oscillated between 50 and 60 deals per year.

As such, Europe witnessed an increase in both average value and number of deals in the past three years.

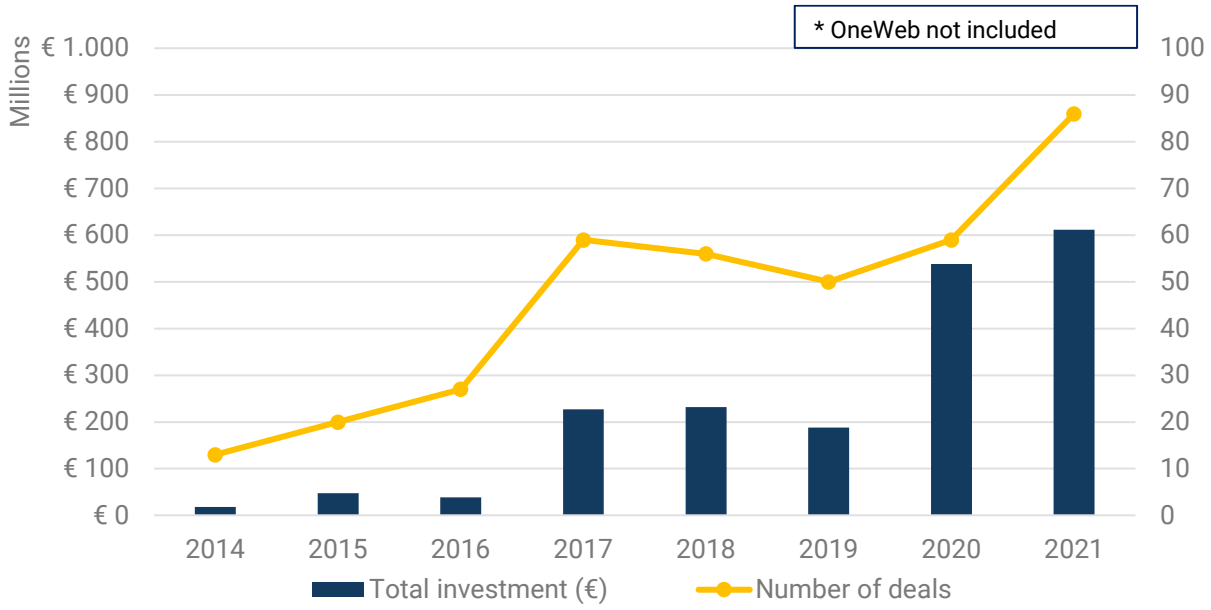


Figure 6: Investment value and number of deals per year 2014-2021

As of the 1st of January 2022, the cumulative investment into European space start-ups since 2014 has reached €1.9 billion through a total of 370 deals. The growth of investment into European New Space is even more striking when realising that 2021 alone represents more than the total invested from 2014 to 2018.

About OneWeb

ESPI has historically not included OneWeb within the "European space start-up" category for two overarching reasons:

- OneWeb operations mainly take place outside Europe: although OneWeb is headquartered in London, a vast majority of the company's activities, in particular related to satellite manufacturing, take place in the United States under the umbrella of its subsidiary OneWeb Satellites, a joint venture between OneWeb and Airbus. Europe has stakes in OneWeb but, until now, the investment in the company cannot be considered as an investment in the "European space sector". ESPI monitors the development of the situation following the investment by the UK Government and European companies after OneWeb bankruptcy, in particular with regards to a relocation of OneWeb activities.
- OneWeb is no longer a start-up according to common definitions: although OneWeb is still focusing on the deployment of its constellation and provision of initial services, the company cannot be qualified as a "start-up" from a structural standpoint. Until filing for bankruptcy, OneWeb and OneWeb satellites counted with almost 1000 employees, far above the threshold of an SME (250) which is usually considered as a criteria to qualify as a start-up in Europe. While the company has scaled down since 2020, they still employ approx. 600 employees to this day.

Although the "European" and "start-up" nature of OneWeb could be argued, ESPI decided to keep investments in the company separate from the general estimation to account for the specific case of OneWeb and to focus on the situation of European space start-ups.

OneWeb has raised over €5 billion to date, a completely different order of magnitude when compared to private (and public) capital raised by other space companies in Europe. The following figure shows the evolution of investment when including OneWeb.

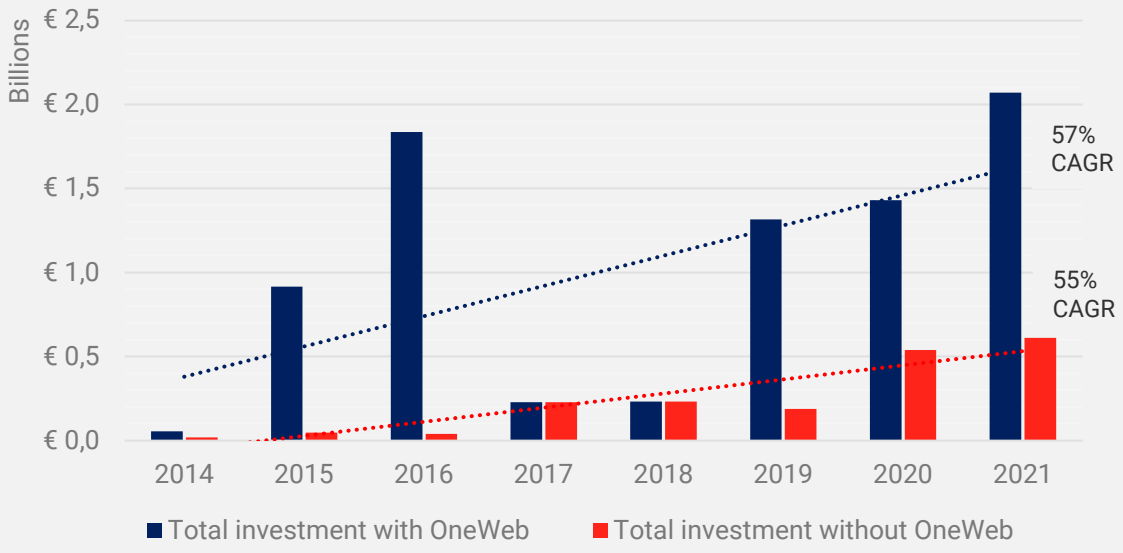


Figure 7: Total Investment including OneWeb

Venture Capital accounted for a vast majority of the investments in European space start-ups in the 2014-2021 timeframe, constituting 63% of the total invested. In 2021 again, Venture Capital deals again made up a majority of the transactions in number (67) and accounted for 79% of the total volume invested.

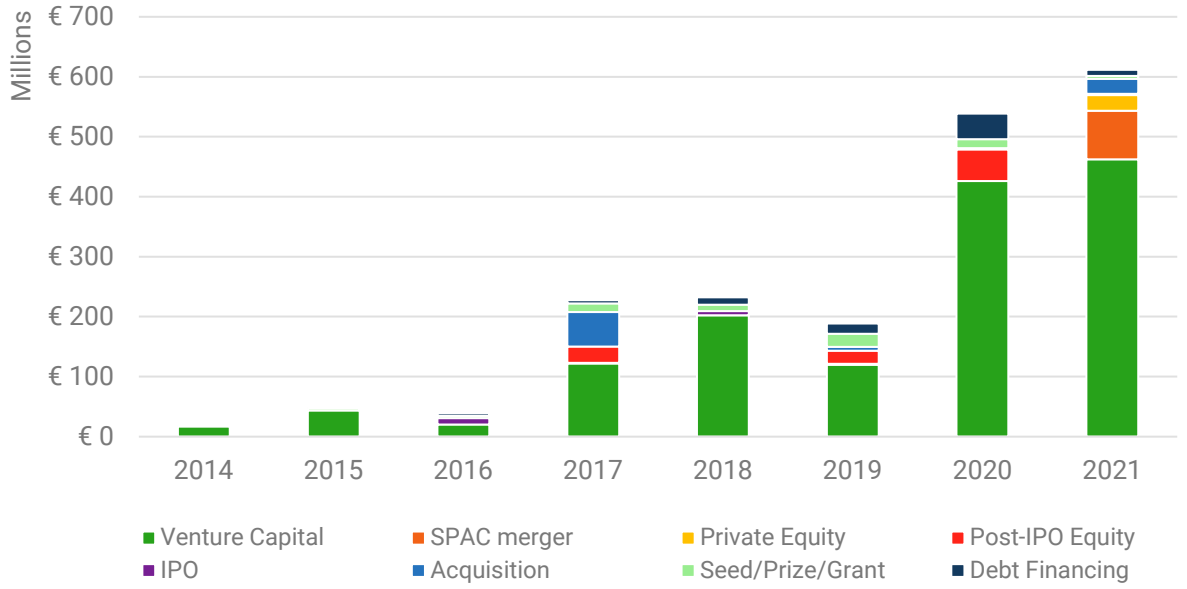


Figure 8: Investment type 2014-2021

Whereas the value of Venture Capital investment is the same in 2020 and 2021 (around €420 million), the number of VC deals more than doubled year-over-year. This indicates a continued increase in the use of this type of funding to finance space start-ups in Europe.

Following Venture Capital, the second-largest type of investment in terms of volume is SPAC mergers. Although the category only includes one deal, Arqit's successful SPAC merger in September was valued at €80.6 million when considering only net proceeds, which provides a better value of the actual investment in the start-up. Net proceeds account for what the company effectively receives from the transaction when summing trust proceeds from the merger with the SPAC (following the redemption of original investors) and the associated PIPE proceeds, net of eventual transaction fees and other expenses.

In 2021, Venture Capital constituted the largest share of the total invested in both volume and number.

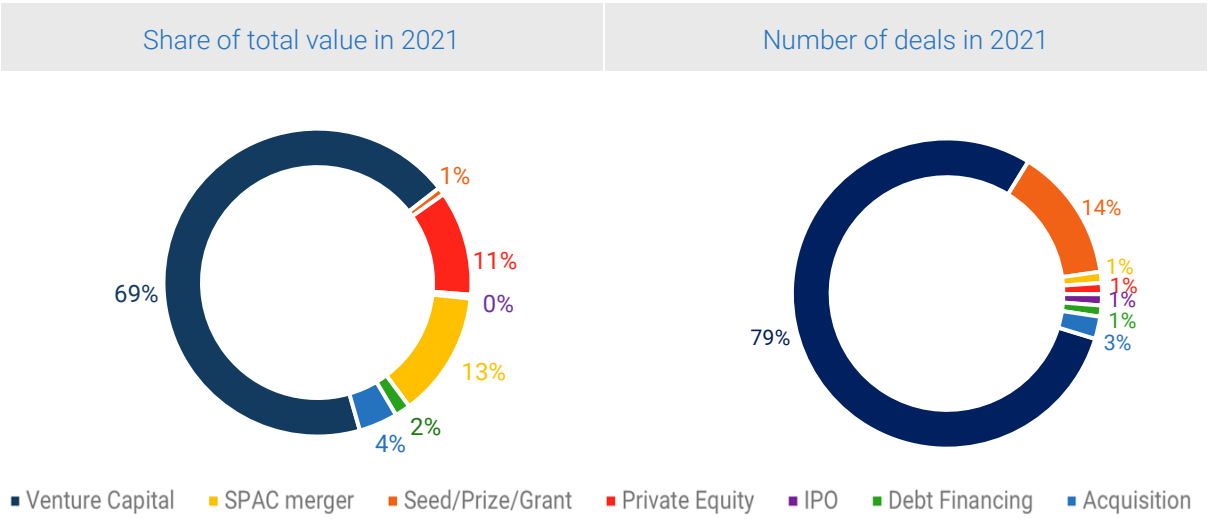


Figure 9: Distribution of investment by category in 2021

Private Equity deals represented the third most important type of investment in European space start-ups in terms of volume. Two private equity deals worth a total of €67.2 million were recorded in 2021. The first was a €41.2 million pre-IPO placement of the Swiss company Astrocast, while the second was the €26 million equity investment led by the European Commission in Dutch start-up Hiber through the European Innovation Council's blended finance instrument. Although it is only spread over two deals, the sum represents an annual record for private equity investments in European space start-ups.

Acquisitions constituted the fourth type of deal in terms of volume in 2021. Planet's acquisition of Dutch start-up Vandersat, valued at approx. €24.8 million, makes up the bulk of the volume in this category as the value of Seven Solutions' acquisition by Orolia was not disclosed. Vandersat's acquisition is the second largest in value for a European space start-up since 2014, behind Clyde Space's (2017). In terms of exits, 2021 was also notable due to the public listing of Polish start-up Creotech on the Euronext.

Finally, although it is second in the number of deals (12 deals), the Seed/Prize/Grant category only represented €4.8 million or 0.6% of the total volume in 2021.

The total value of VC rounds has gradually increased year-over-year in the 2014-2021 period.

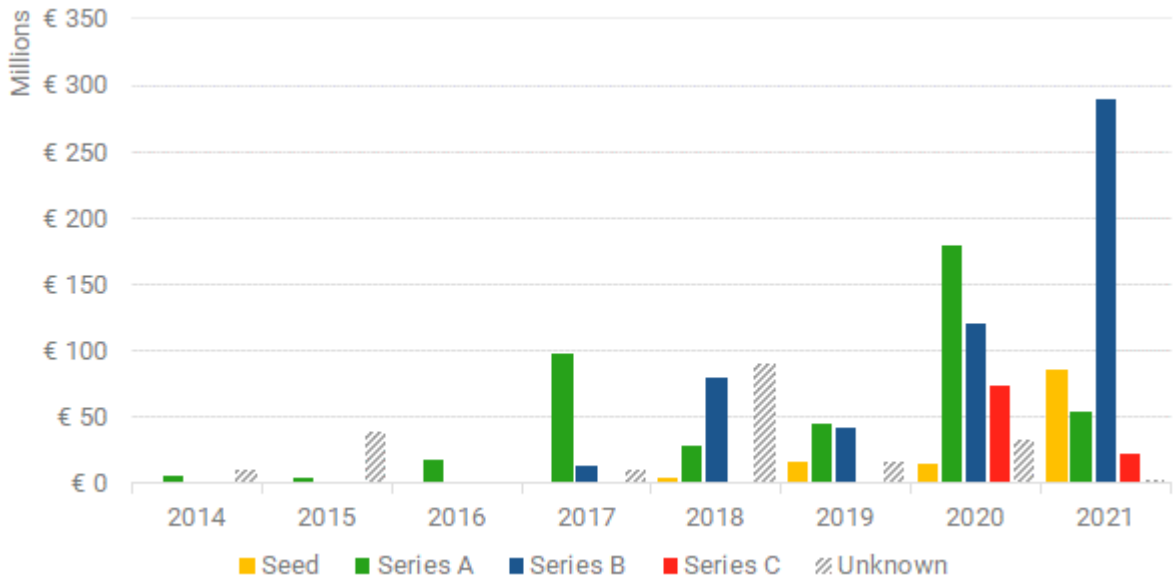


Figure 10: Yearly volume of Venture Capital investments by round from 2014-2021

With regards to the relative distribution of rounds within Venture Capital financing, two main observations can be made over the 2014-2021 period. The first is that the value of Seed, Series A and Series B funding have seen an upwards trend year-on-year, with the latter in particular constituting the largest share of Venture Capital funding in three of the last four years. The total yearly value of Series B funding has been increasing at a CAGR of approx. 78% since 2017 and reached a record €248M in 2021.

On the other hand, while early-stage VC investments in European space start-ups have steadily increased in volume over the last years, the number of late-stage VC rounds remains relatively low. Only two Series C funding rounds have been recorded, both coming from Iceye. In 2021, the lack of late rounds for more mature start-ups has been offset in some measure by those companies either raising private equity (Astrocast, Hiber), or exiting through acquisitions (Vandersat, Seven Solutions) and public listings (Arqit, Creotech). An additional notable observation is that the average value of Seed rounds has steadily increased every year in the 2014-2021 period, increasing threefold from €700k in 2014 to €2.6M in 2021.

2.3 Support to investment from public institutions

European and national public institutions continued to develop financial instruments to foster entrepreneurship and accelerate investment into space start-ups in 2021. With these instruments, public institutions have shown their ambition in having a progressively more prominent role in supporting the growth and development of the European space start-up ecosystem.

While funding rounds coming from purely institutional investors or funds represented only approx. 2% of the total funding in terms of volume (Endurosat, Venture Orbital Systems and Terrabotics), public institutions increased their involvement in funding rounds by participating in more deals alongside private investment firms. This carries over a trend observed in 2020, where investments made by consortia composed of mixed private and public actors constituted 52% of the total volume invested. An investment is considered mixed when the investment round counts with at least one public institution and one private firm.

Although the overall year-on-year share of mixed investments decreased to 34%, the actual number of mixed investments doubled from 2020 to 2021 (from 14 to 29). Public institutions also took on greater roles within these consortia, as highlighted by the number of mixed investments led by a public investor, which increased from one in 2020 to seven in 2021. Notably, out of the €211 million invested in rounds backed by at least one public institution, €75 million came from mixed investments led by a public institution.

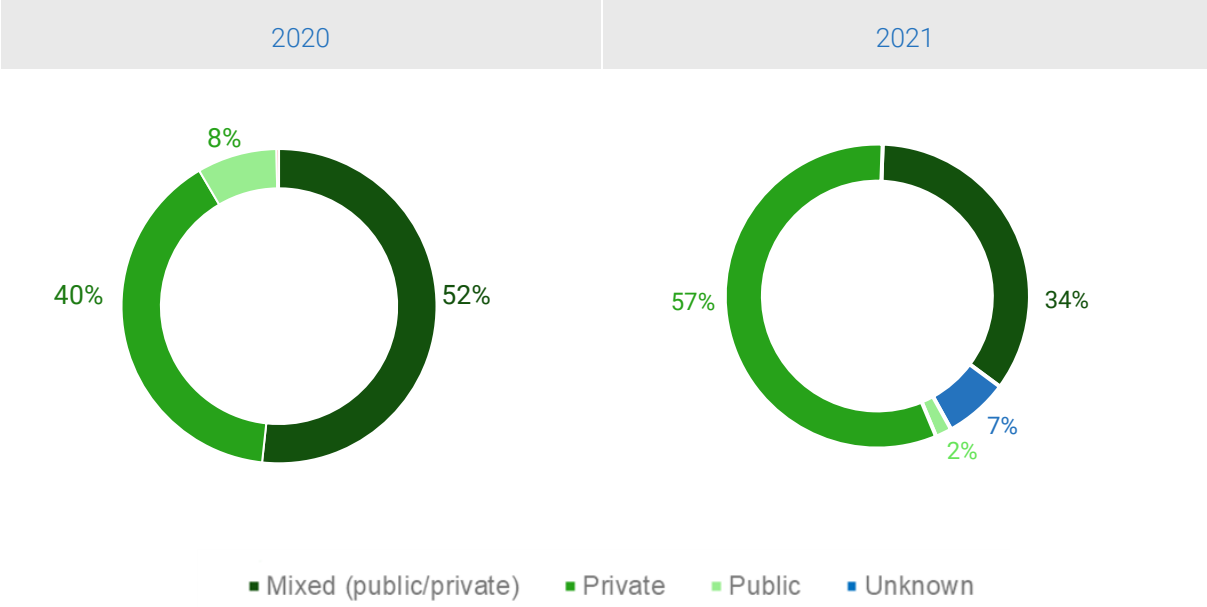


Figure 11: Public support to New Space investments

Although this trend will have to be confirmed in the coming years, it appears to be a direct consequence of the new public approach and ambition adopted by institutional stakeholders at a European and National level towards investment in the space sector. This approach strongly relies on ambitious partnerships between public and private actors with the aim of fostering new investment dynamics in the European New Space ecosystem. With public funding serving as a market source of approval, the European Investment Bank anticipates that the usage of public instruments to unlock private capital will increase in the years to come.[67]

[67] European Investment Bank, The future of the European space sector (available at: https://www.eib.org/attachments/thematic/future_of_european_space_sector_summary_en.pdf)

2.4 Distribution of recipients

The figure below shows the geographical distribution of the total value of investment operations in space start-ups according to the location of their headquarters. The figure does not include recorded deals with an undisclosed amount (15 in 2021).

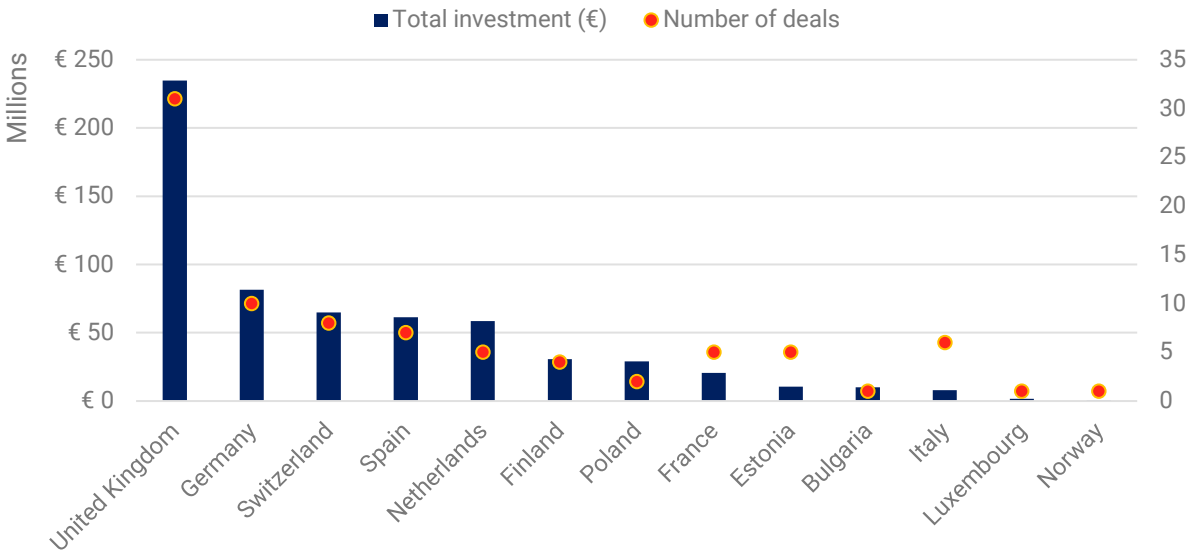


Figure 12: Share of investment in Europe in 2021

Although investment remains widespread across European countries, the majority of deals and volume in 2021 continued to take place in countries that have historically invested heavily in the space sector (66% of the total volume went to companies in the UK, France, Germany, Italy, Spain).

- United-Kingdom: 2021 was another strong year in terms of financing for the UK space start-up ecosystem, with €234.8 million in total funding raised over 31 recorded deals. It also highlighted that the UK continues to be the leader in Europe in terms of New Space investments. While the €80.6 million raised by Arqit represents about one-third of the total value invested, the €154 million raised over the remaining 30 deals still constitutes a record high for the country, which shows a high distribution across deals. Both the number of deals and the amount invested doubled from 2020. In addition to Arqit, Isotropic Systems raised €64.8 million, Satellite Vu raised €17.7 million, and Vortexa €15.7 million.
- Germany: Germany continued to stand out in 2021 with €81 million invested over 10 deals. While this represents a decrease compared to the record levels invested in 2020, Germany remains in the second position in Europe with regards to the total number a value of deals. Success stories in 2021 include micro-launcher start-up Isar Aerospace, which raised €57 million, OroraTech with €5.8 million in early-stage funding, and the Franco-German small launcher company The Exploration Company securing €5.3 million in seed funding.
- Spain: Spain also embraced an exceptional year of funding for space start-ups, with €61.4 million recorded in 7 deals. Notable standouts include Satlantis' and PLD Space's corresponding Series B rounds, which were valued at €30.5 million and €25 million respectively.
- Switzerland: Swiss space start-ups also recorded an important year in 2021 in terms of investments, with €64.4 million raised over 8 deals. Astrocast's €41.2 million pre-IPO placement constitutes the largest share, followed by Embotech's €9.5 million Series A, and Fixposition's €5.1 million Seed round.

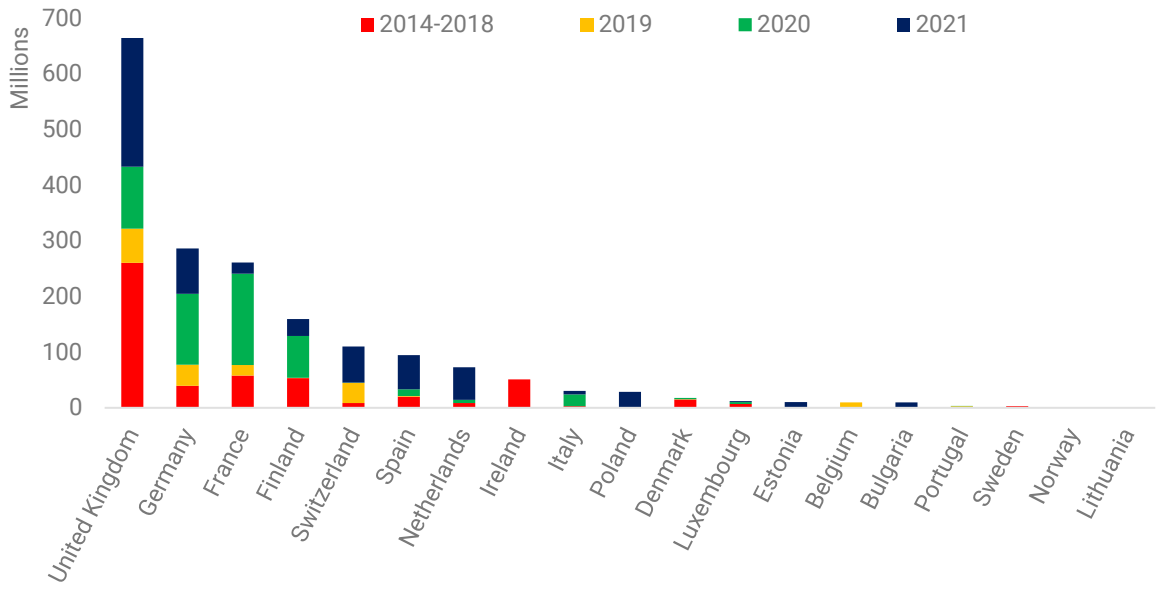


Figure 13: Share of European private space investments since 2014

Since 2014 the UK has outperformed all other European countries by a significant margin. Furthermore, it has been able to sustain private space investment on a regular basis year over year, reaching a total investment of €665 million since 2014.

- The second-best performing country in Europe is Germany in which New Space start-ups have raised a total of €286 million since 2014.
- The third best-performing country regarding New Space investments in Europe is France with a total raised of €261 million since 2014.
- Finland comes fourth in terms of investment since 2014 notably due to the large rounds upheld by Finnish company ICEYE: Finland has raised a total of €160 million since 2014.
- The fifth-best performer in Europe since 2014 is Switzerland with a total raised by New Space companies of €110 million.

2.5 Origin of lead investors

Another interesting metric to assess is the distribution of investments according to the origin of the lead investor. In the case of funding rounds involving more than one investor, only the origin of the lead investor is represented in this case.[68] The share of undisclosed investors in Europe was 9% in 2021.

The geographical distribution of investors offers insights on the weight of European and foreign funds in the overall private investments landscape for space start-ups in Europe. Recent years have been marked by growing concerns over the acquisition of strategic European start-ups by foreign organisations. One example of such an attempted takeover was by French geo-intelligence company Preligens, which in 2020 was aggressively approached by In-Q-Tel, the VC arm of the CIA[69]. The recent EU GNSS investment report from EUSPA and the EIB points out concerns over the foreign acquisition of European companies involved in the GNSS domain, which serves both commercial and military needs.[70]

While it still constitutes a comparatively small portion of the overall number and volume of investments, the share of investment deals led by foreign investors, in particular from the United States, has steadily increased in the past years. Deals led by foreign firms in 2021 grew to approx. 19% of the total in 2021, up from the 12% in 2020. Most of those investors originate from the U.S. This trend can then be assessed beyond deal number and into volume as the total value of deals led by U.S. firms reached €83 million in 2021, up from €78 million in 2020 and €16 million in 2019.

European investors still represent the most important source of financing for European space start-ups.

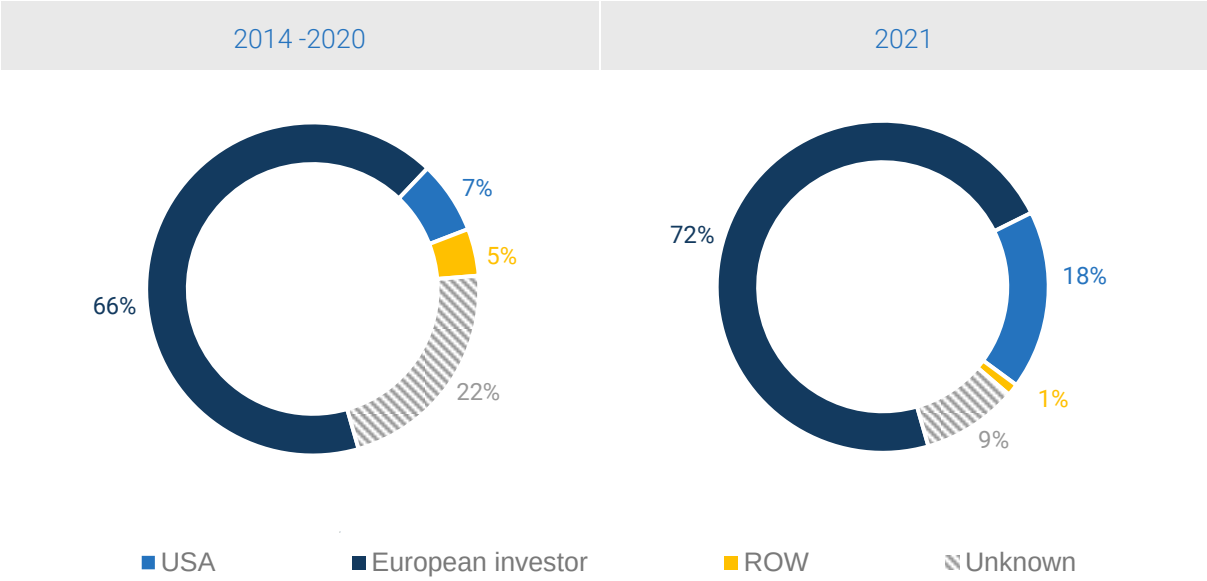


Figure 14: Geographical distribution of lead investors up to 2021

Notwithstanding, the majority of investments made in European space start-ups in 2021 were still mainly led by European investors, reaching 71% of the total. In context, this represents a higher share compared to the observed ratio over the 2014-2020 period, where 66% of all investments were led by European investors.

[68] The ESPI investment database records the list of all disclosed investors for each investment deal but does not record the respective investment shares of each investor.
[69] Les SPAC américains a la conquête des start-ups françaises du spatial (available at : https://www.epge.fr/les-spac-americains-a-la-conquete-des-start-ups-francaises-du-spatial/)
[70] EUSPA and EIB, GNSS Investment Report 2021 (available at: https://www.euspa.europa.eu/sites/default/files/uploads/gnss_investment_report_2021.pdf)

2.6 Investment across the Space value chain

The figure below shows the distribution of the total value of investment according to the core business of the start-up (bars) and the number of deals concerned (dots).[71]

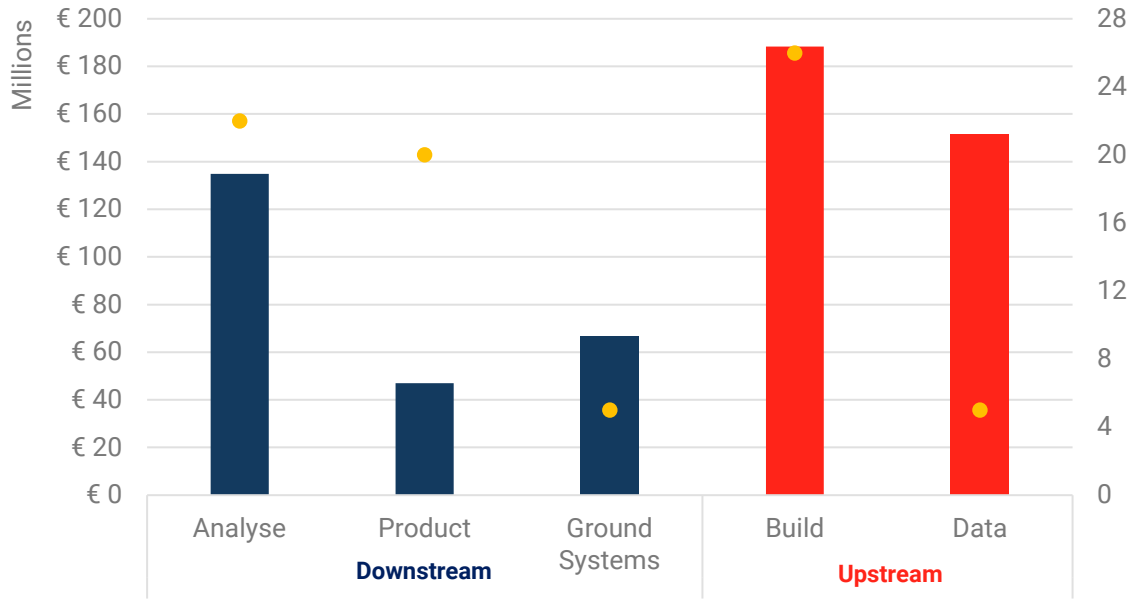


Figure 15: Volume and number of deals across the European space value chain in 2021

In 2021, the upstream sector accounted for 58% of the total investment (86% in 2020). With €339 million invested over 31 deals, the average value per deal for the upstream segment in 2021 was €11 million.

- The Build segment (i.e. development and manufacturing of space systems) accounted for the largest share of the deals both in number and volume in 2021, with €188 million raised over 26 deals. Within the segment, companies focused on the development and manufacturing of launch systems had the highest share, reaching €93.8 million. Key deals came from Isar Aerospace (€57 million) and PLD Space (€26 million).
- The Upstream Data segment (i.e. operation of space systems to lease or sell satellite capacity data) represented the second-largest share of investments in 2021, accounting for 25% of the total share. The value of deals was distributed in this category, with key deals coming from Arqit's SPAC merger raising €80.6 million, Astrocast through its €41.2 million pre-IPO placement and Hiber with its €26 million private equity funding.

The downstream sector accounted for 42% of the total investment in 2021, up from 14% in 2020 and closer to 48% in 2019. With €248 million invested over 47 deals, the avg. value of deal was €5.2 million.

- The largest downstream segment in 2021 was once again the Analyse segment (i.e. value-adding solutions for space data exploitation) representing 22% of the total volume with key deals for Vandersat (€24.8 million) and Unseenlabs (€20 million), and Satellite Vu (€17 million).
- The Ground Systems segment (i.e. development and manufacturing of the ground segment infrastructure or ground terminals) represented 11% of the total, mainly driven by investments in Isotropic Systems. The product segment (i.e. provision of space-enabled products to end-users) represented 7% of the total, with its value increasing 93% from 2020, reaching approx. €47 million.

[71] Note: the value of investment in downstream start-ups is probably underestimated due to the inherent difficulty to track investments in the downstream sector, which involves companies whose business is often only partially related to space. With a growing cross-fertilization between space and terrestrial technologies, the distinction between investments within and outside the space sector is poised to become increasingly blurred.

3 Space investment in a global context

This year, the ESPI Investment Database was expanded to cover global investment in space start-ups since 2019. Comparably to European deals, information on foreign deals is sourced from a combination of online public resources, financial databases such as Crunchbase and Pitchbook and private information sources. All deals are reported in euros using World Bank exchange rates averaged on monthly basis.

Just like the European segment of this report, a space company is defined as a company providing analytics originating primarily from space-based systems, manufacturing ground and or upstream equipment and provides services that rely on such systems.

To provide comparable metrics with already established sources such as BryceTech and Seraphim capital, ESPI uses a broader "New Space" perimeter in this chapter that features a less stringent definition of "start-ups" and includes companies such as SpaceX or OneWeb.

3.1 Global investment dynamics

Global investment into space ventures has been continuously growing from €5.2 billion in 2019 to €12.2 in 2021. The number of deals has seen similar growth going from 166 deals in 2019 to 268 deals in 2021.

An interesting index to look at is the percentage of the total global volume of investment that is taken by the top 5 deals. In 2019, the top 5 deals accounted for €1.1 billion or 21% of the total in 2019, in 2020 the top 5 deals accounted for a total of €2.2 billion or 33% of the total finally, in 2021, the top 5 deals accounted for a total of €3.8 billion or 31% of the total investment in 2021.

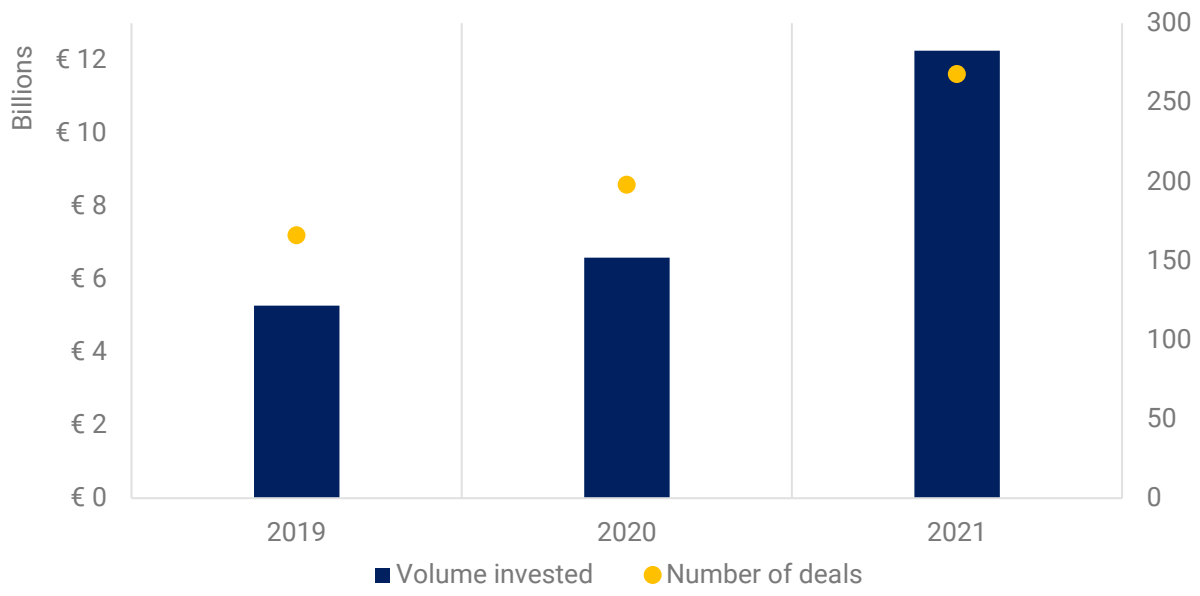


Figure 16: Global investment & deals

Venture Capital accounts for the largest share of financing worldwide. In 2019 this share was of 68%, slightly decreasing in 2020 to 64%. In 2021 this share remained very similar reaching €7.5 billion or 61% of the total. A major development in 2021 was the skyrocketing growth of SPAC mergers with 10 space 12s recorded during the year for a total of almost €3 billion. Top mergers in 2021 were Rocket lab, Planet

and Astra totaling €1.6 billion together. ESPI also accounts the self-capitalization into Blue Origin from Jeff Bezos which is approximately $1 billion per year and is included as an "Angel" investment.

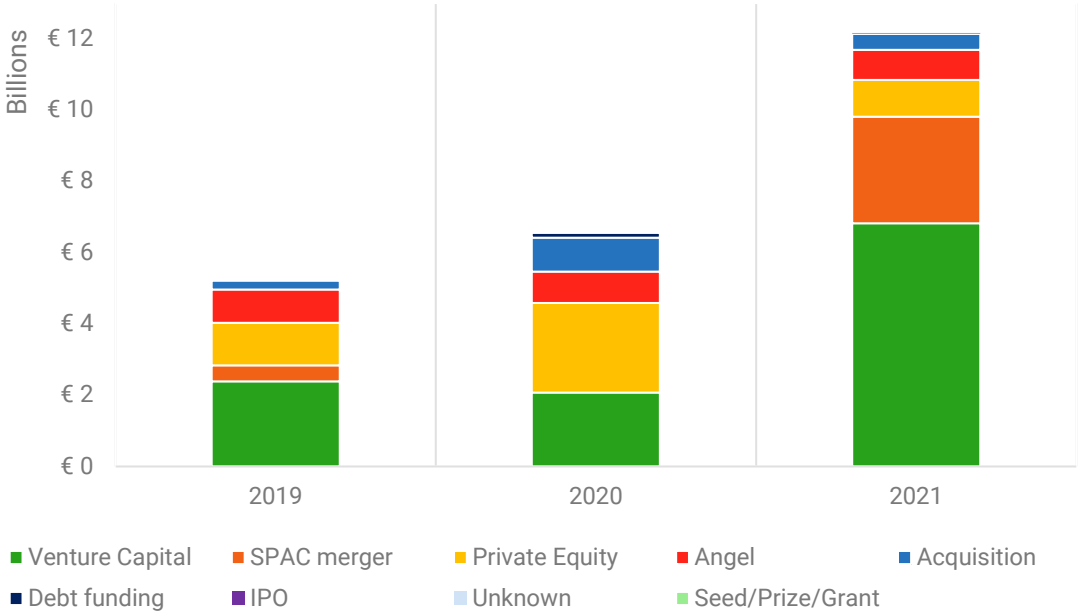


Figure 17: Investment type for Global New Space ventures

3.2 Global distribution of investment

The USA has historically been the most active country for New Space investment and ventures. The United States has also seen significant growth over the past three years, going from €3.2 billion in 2019 to €9 billion in 2021. This represents a 72% growth over 3 years.

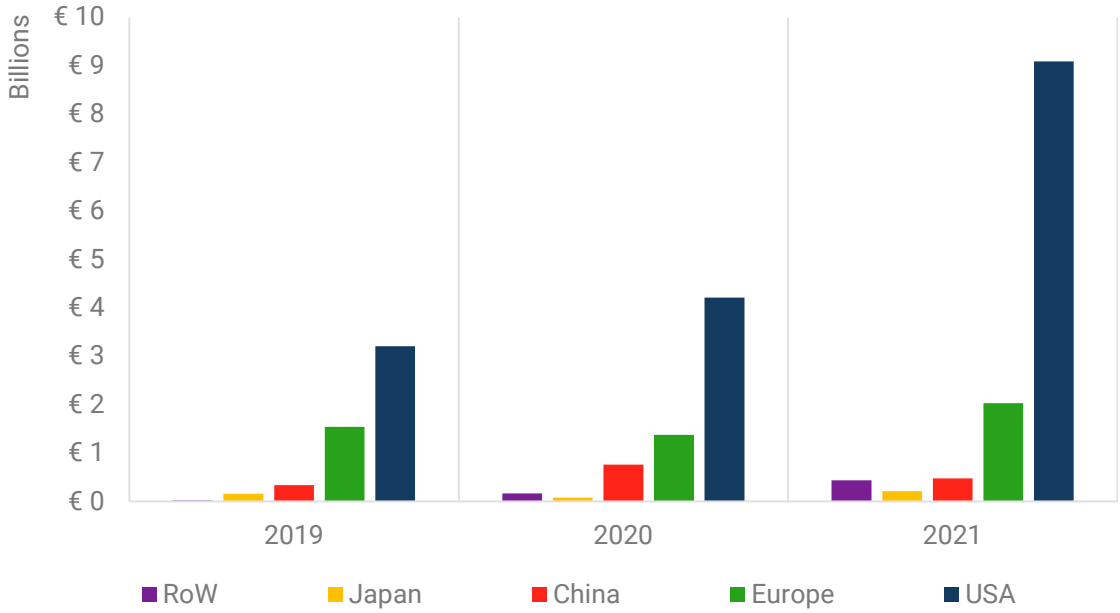


Figure 18: Investment volume per region

Europe remains the second region attracting the most investment into New Space ventures. Over the past three years, total investment has increased by 33% going from €1.5 billion in 2019 to €2 billion in 2021.

China and Japan have also seen healthy growth in terms of investment in New Space ventures. Japan has seen a 33% growth, with investments going from €161 million in 2019 to €214 in 2021. China saw a 41% increase over three years with investment growing from €337 million (2019) to €476 (2021).

Outside of the usual players the biggest growth in investment over the past couple of years has been seen throughout the rest of the world. Outside of the United States, European countries, China, and Japan, the total investment in space in the rest of the World increases from €24 million in 2019 to €434 million in 2021. This represents an incredible 1700% growth over three years. In 2021, countries like Canada, Australia, Israel, India, South-Korea and Singapore reached records in terms of investment.

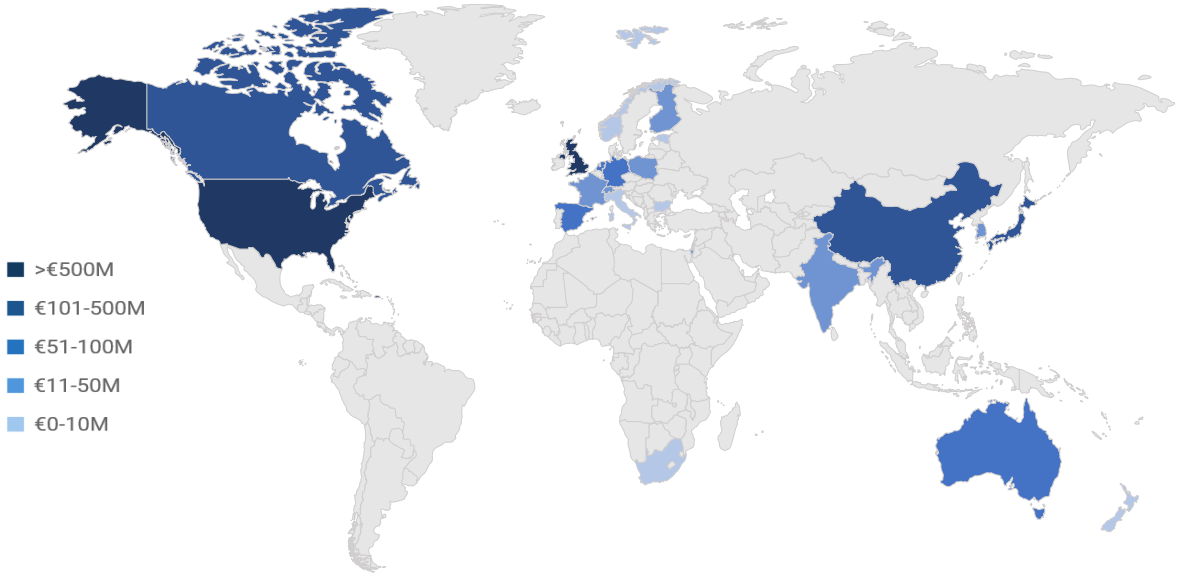


Figure 19: 2021 investment map

Another interesting factor to look at when considering the role of private investments globally, is the ratio between public space budgets and private sources of space financing. The ratio of public space budgets to private space investments has been continuously growing over the past three years. Reaching 20% in the US and 17% in Europe in 2021, both ecosystems increasingly complement each other well.

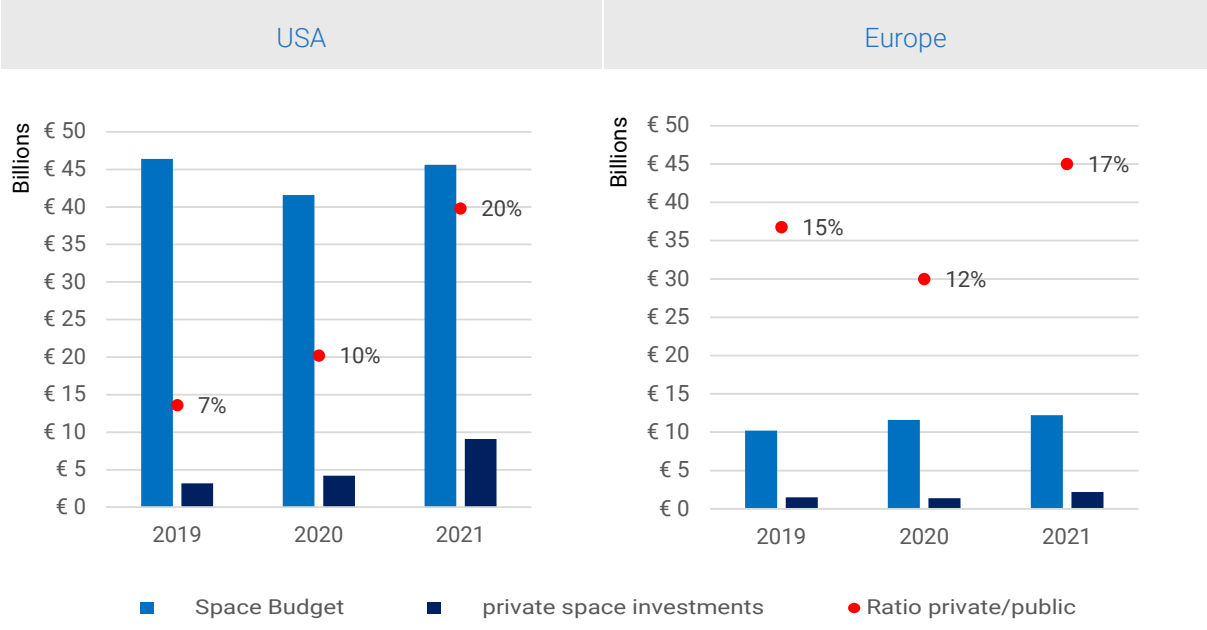


Figure 20: Ratio public budget to private investments

Europe has averaged 68 deals over the past 3 years compared to 88 for the USA. As such, while there is only a 25% difference in deal number between the EU and the US, there is a 108% difference in investment volume between both regions (Europe has averaged €1.6 billion over 3 years as compared to €5.5B for the USA).

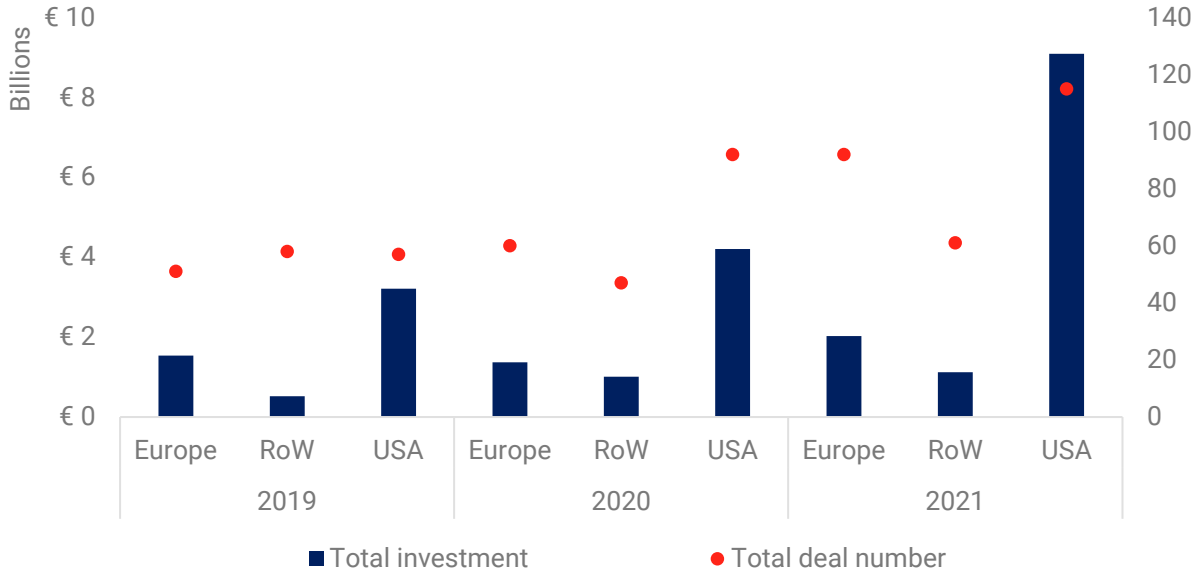


Figure 21: Number of deals per region

The US saw 115 deals in 2021 for a total of €9 billion. This makes an average deal size of €78 million. In comparison, Europe saw a total of 92 deals totalling approx. €2 billion, this makes an average deal size of €22 million. This extremely large difference in deal size (112%) is caused by a range of factors linked to the dynamics of the European and US investment ecosystems.

4 Perspectives from European Space Investors

This chapter provides an overview of the results of the ESPI Space investor interviews. The interviews were conducted with 6 European space investors and covered a range of different topics regarding their perspectives on issues at stake for start-ups, investors, and the space economy and business in general. These interviews provide insights into how European space investors are approaching the market, what they look for in the New Space sector and their concerns and hopes about the future, among other issues.

The interviews covered five major topics:

1. Investing in the space sector: the importance of understanding the space market as an investor, differences compared to other deep tech ecosystems. Bubble or no bubble?
2. Investing in Europe: investment landscape, market fragmentation, relationship with the public sector.
3. The differences between the US and European ecosystems: structural differences, valuations, and market maturity.
4. Investor recommendations to start-ups and to the public sector.

The following section provides a synthesis of the views of these investors, including quotes from interviews according to Chatham House rules.

	Location	Investor Type	Investment Stage	Investment Examples
Seraphim Space Capital	UK	Venture Capital	All stages	• Iceye • Satellite Vu • D-Orbit
Primo Space Fund	Italy	Venture Capital	Seed and Early-Stage	• Sidereus Space Dynamics • Pangea Aerospace
Karista	France	Venture Capital	Early-Stage	• Exotrail
E2MC	France	Venture Capital	Early-Stage	• Space Forge • Satellite Vu • Pangea Aerospace
Starburst Aerospace	Europe (Paris, Munich, Madrid)	Accelerator	Early-Stage	• Sen • Morpheus Space • Destinus
European Investment Fund	Luxembourg	Fund of Funds	Various, focuses on SMEs	• Orbital Ventures (early-stage fund)

Table 1: European investors interviewed

4.1 About investing in the space sector

The space sector remains attractive for investors despite specificities that must be taken into account…

Overall, investors foresee a great growth potential for the space sector that they perceive as still rather young and underdeveloped. "The space economy is not just aerospace business but also services for agriculture, transportation, internet and so on: various industries are placing their bets and building business models with a future-oriented mindset." In the current macro-economic context, space has become an attractive sector for high-risk / high-potential investment. The growth of investment in space is nested in major trends observed in global capital markets recently which exhibited a strong appetite for this type of investment.

From an investment perspective, investors also stress that there is a "less developed investor ecosystem for space, in comparison to other tech sectors, which makes it less competitive for investors". However, investing in space must take into account two key specificities of the sector which are "long R&D cycles and long lead times" which require to stretch investment cycles and strategies on one hand and "CAPEX intensive projects" which require large funding rounds that all investors are not able to provide or integrate in their portfolio.

Investing in space requires a specific expertise and adapted investment strategies…

In this landscape, investors with specific space expertise stand out by offering added value to start-up projects, not only through funding but also through business and technical support. An investor explained that "when looking at a constellation project, we go as far as to consider spectrum rights, best orbit, size of the constellation for best revisit time." Such evaluation requires a very specific knowledge and understanding of the space domain. Developing such expertise is challenging, in particular because there is a wide variety of space ventures, from space system technology businesses to data analytics and space service providers. "If you consider companies that operate in the upstream, they are typically more capital and tech-intensive, so you have to take more time to look at the technology as part of your investment evaluation. On the downstream, business issues are closer to those of the digital sector which allows investors to use comparable methods to evaluate companies and invest."

New trends are affecting return on investment and exit strategies…

It was noted that new trends in the space sector, such as investment growth and SPACs, are influencing return on investment and exit strategies. Accordingly, some investors underlined that the emergence of new pathways towards liquidity are leading to "a lot more companies with a lot of cash", meaning that there will be a tendency for "more acquisitions and a higher degree of consolidation (…) in particular for SATCOM and EO." Moreover, if a company goes through a SPAC, even if it "has no traction and has proved nothing on their technology, they still have a few hundreds of millions of dollars on their balance sheet to do whatever they want." Therefore, competitors will be pressured "into raising more money or a SPAC" to develop their products and services and be able to compete. For investment funds, if they had invested in the competitor company, they would now need to reconsider their positions, including their exit strategy.

Investors share different perspectives on the risk of a valuation bubble….

Investors recalled that there are now much higher prices for every asset domain and this increase has also translated into space technology and related assets. The rise of the price of space assets may be even higher than in other markets due to its "disruptive nature": "higher valuations also mirror higher ambitions". Some other factors contribute to this trend, for example "the very high salaries in Tech sectors in the United States also contribute to high valuations". Some investors also highlighted that these higher valuations do not concern every start-up and that it is also highly dependent on the founder's personality

and ambitions. An investor explained that "with limited high quality space companies, investors tend to take part in a self-reinforcing valuation cycle."

Some investors shared a much more bearish outlook: "similar to the dot-com one in the 2000s"; "We don't know when it will explode, and it could take up to 5 years to recover from it"; "The valuations are absolutely disproportionate compared to the number of employees and the revenues of companies"; "My experience is that you truly make good return-on-investments performances in the entry by buying cheap and not really at the exit"; "The use of SPACs to multiply the valuation of companies to absurd levels is something that worries us because of the risk of creating a market bubble."; "SPAC phenomenon is distorting the market even though they remain a valid reason to go public."… The consequences of a potential bubble burst may not be entirely negative. Interestingly, some investors anticipate that "there may be some good opportunities to pick-up high-quality assets at a much cheaper price." Others point out that top space start-ups have had time over the past years to aggregate financial assets that will probably allow them to weather the storm.

4.2 About investing in Europe

Investing in Europe is now easier; however, the market remains fragmented…

Most investors interviewed estimate that investing in the European space sector is becoming easier. A key factor is the significant progress in the development of a European integrated market which contributes to making investment easier in Europe notably due to the Eurozone and the Schengen area as well as to a reduction in trade barriers. However, the European market remains fragmented and the differences between European countries require investors to adopt different approaches, depending on "the development of the local market and the legal entities available". Market fragmentation also "raises barriers for the development of Europe-wide companies" that can address sizeable European markets beyond national demand. In this regard interviewees argued that this fragmentation "slows down the rate of European capital flows".

Another investor underlined the negative implications of growing concerns over sovereignty in Europe, in particular in terms of funds' exit strategies. "In New Space, there are a lot of projects that are very close to defence or security that have this concern, so we tend to make sure that we will not need a type of agreement from the government authorities to have an exit".

Some countries are easier to invest in than others…

Despite progress toward a more European integrated ecosystem for New Space, investment remains strongly tied to national dynamics.

On a governmental level, "certain countries have a significant amount of red tape, and bureaucratic processes can be particularly lengthy". This type of barrier can slow down the development of a company, limiting its growth potential and therefore affecting time to exit, which is what investors pay attention to. As a direct consequence, most investors draw hard lines on countries within which they invest.

"Some other countries like the UK are much easier to invest in. There is a difference with the UK in terms of deal flow quality." UK's capacity to attract investors does not depend on technology disruption but really on business mindset: "What we can observe is that even though they might not necessarily have superior technology, companies in the UK tend to have very good managers and salespeople focused on execution". Those companies do not only target their local markets but also the U.S. market. Overall, UK companies follow a strategy that "makes them more agile and grow faster than other companies".

The language barrier should not be underestimated, both with regard to documentation and investment processes but also for interactions between entrepreneurs and investors.

Investors' relationship with the public sector is peculiar in Europe...

On one hand, public support to start-ups offers some form of "legitimacy" and sends a positive message to private investors. Investors also point out that as the public sector has historically been more proactive at an early stage of growth, "it feeds into our pipeline at some point", it also contributes both in terms of "competencies" and "funding". On the other hand, the relationship with the public sector can be seen as a "double-edged" sword as it can often come with strings attached. Too close a relationship with the public sector can also limit ways of exit. Furthermore, private funds and entrepreneurs do not necessarily always target the public sector because sometimes "the rationale behind the grants offered are not always related to the technology or the maturity-to-market but to political reasons".

Some suggest to "put a lot of public money to build a New Space sector through a private logic, to use investors because they are more flexible." This type of "intermediate investment" allows to counter the rigidity of the public sector that is characterized by "slower actions".

4.3 About differences between U.S. and European ecosystems

U.S. public budgets and strategies offer start-ups more opportunities and accelerate their growth…

There is the major influence of institutions such as NASA and the Department of Defence: "there is more public support in the United States", "NASA and the DoD have a budget that dwarves that of their European counterparts." As such, start-ups can gain much larger governmental contracts than in Europe. These large contracts allow companies to leverage large capital investment rounds, and as a result allow them to de-risk early on. There is overall "a lot of more non-dilutive funding to match the existing funding in the United States."

It was extensively highlighted that the European market lags behind the American one in terms of maturity and product development. As such, "the Space Tech ecosystem in Europe is younger overall and its growth suffers from the current fragmentation of the capital and procurement markets." Although it is "easier to invest in Europe now than before", the United States still fosters more experienced investors, which also have a "higher risk-tolerance".

As a result, the United States continues to lead entrepreneurship and private investment trends…

Various structural but also cultural reasons lead to a gap between investments in the U.S and in Europe. The total volume invested in the U.S is much larger than in Europe and so is the average ticket size.

This gap exists notably because "the contracts that can be established with the sizeable U.S. budgets significantly change the capital allocation dynamic" furthermore, "the funds of funds dynamics are much larger in the US, which naturally flows into venture capital". A lot more money is being co-opted by big funds, in the US, which you normally would not see invest in space" which is rarer in Europe

Investors highlighted that the situation is not necessarily related to a lack of available funding but also to the way investing in space is perceived by investors: "The space sector in the US is increasingly more conceived as a mainstream sector for investment, leading to attract general investors; this dynamic remains at an early stage in Europe."

Finally, when looking at the bigger rounds (100 million and more) in Europe, more than 70% of them were led by non-European investors, showing that US and foreign investors are nowadays more able to fully deploy big funds. The fact that "larger rounds are usually led by investors outside of Europe could pose a challenge when it comes to technologies that have sovereignty implications".

Investment volume affects valuations…

While valuations are rising in Europe, they still "remain below U.S. companies which makes them more attractive to foreign investors" if we look at entry prices. On the other side, this implies differences in terms of exit: "it is overall statistically more likely to have a profitable exit in the U.S. because buyers are generally more ready to accept higher prices."

However, the valuation of space start-ups in Europe is slowly progressing: "European companies are becoming global champions in a more recurring way than they used to. A lot of innovation is coming from Europe, not only the UK, France and Germany but also from other countries like Romania or Bulgaria". "There are no borders to innovations. We have more engineers than US and Canada, but the problem is about moving from research to commercialisation."

4.4 Investors recommendations to start-ups and to the public sector

Key recommendations for space start-ups from investors:

1. Think big and think different: For those who wish to start in the space sector, investors advise to think out of the box and to focus on innovative and disruptive concepts: "Don't think about something that already exists in your local market."
2. De-risk technology early-on: Investors highlight the importance of de-risking early on and in an efficient manner. "Try to find an inventive way to motivate funding by showing the efficiency of your product. For example, Iceye flew their sensor on an aeroplane to show the value of their data."
3. Limit the number of proof-of-concepts: POC's can become redundant and a financial constraint when given too much importance. The company should privilege developing a commercial product as soon as possible to develop revenues. "The problem is that proof-of-concepts mean that the company works, delivers a product, and doesn't get paid".
4. Target the appropriate market and adapt your strategy: Defining key markets is critical at early and growth stages. It implies to "focus on your market" and to be "flexible when thinking about where to headquarter, in Europe or outside". As such, it is important for start-ups to attribute resources to properly assess the right target markets.
5. Propose a viable business model, fast: In Europe, investors expect start-ups to show a clear and sound business model after maximum 2- or 3-years contrary to the United States where start-ups can raise capital with a rather unclear business model, mostly thanks to the capital availability.
6. Build a team with "mixed skills" including a strong "commercial element": As the space sector can be CAPEX intensive, there is often a need to gather a large amount of money at an early stage. To accomplish that, a team with "mixed skills" is needed, with both technology and business acumen. A great start-up team should include "business savvy people". This will allow to raise money quickly at the early stages but also to target the right markets and sell to the right customers.
7. Find a "good" investor. Investors can and should play a key role beyond access to funds. Space investors should not only give money but also business and technical advice, which can be a real asset for the ventures.

Key recommendations for the public sector from investors:

1. Favour a European approach: The European member states need to agree on cooperating together instead of creating competition amongst European countries. "The emergence of a single and sizeable European space market is essential for future developments." A larger market generally means larger contracts which attracts large investments. To become more competitive this will be an essential step.
2. Rely on private investors: Investors advise public stakeholders to "put money in the market through private investment organizations because they know how to look at the market and to study the teams". Investors support that "funds of funds are typically among the best performing tools in terms of track records." Institutional actors can be seen as "too slow and burdensome for the market". Recent delays by the EIC have highlighted this issue.
3. Develop new public markets allowing start-ups to compete: Investors suggest that "there is a need for a harmonious balance between contracts and funding". In this context public stakeholders should "develop and use new procurement schemes that allow start-ups to compete, including for new markets"

5 European Space Entrepreneurship Survey

This chapter provides an overview of the results of the ESPI Space Entrepreneurship Survey. The survey was issued to 300+ European space start-ups and ESPI received more than 110 responses, out of which 74 individual, qualified responses were selected for statistical analysis.

This year, the ESPI entrepreneurship survey consisted of 30+ questions addressing 2 main themes:

- *Space start-up ecosystem*: geographical distribution, business and markets, workforce, foundation.
- *Business situation and prospects*: self-assessment in 2021, priorities and prospects for 2022, perception of public support and key priorities/challenges.

5.1 European space start-ups ecosystem

5.1.1 Geographical distribution

With responses from start-ups located in 19 European countries, the survey confirms again this year that entrepreneurship in the space sector is widespread throughout Europe.

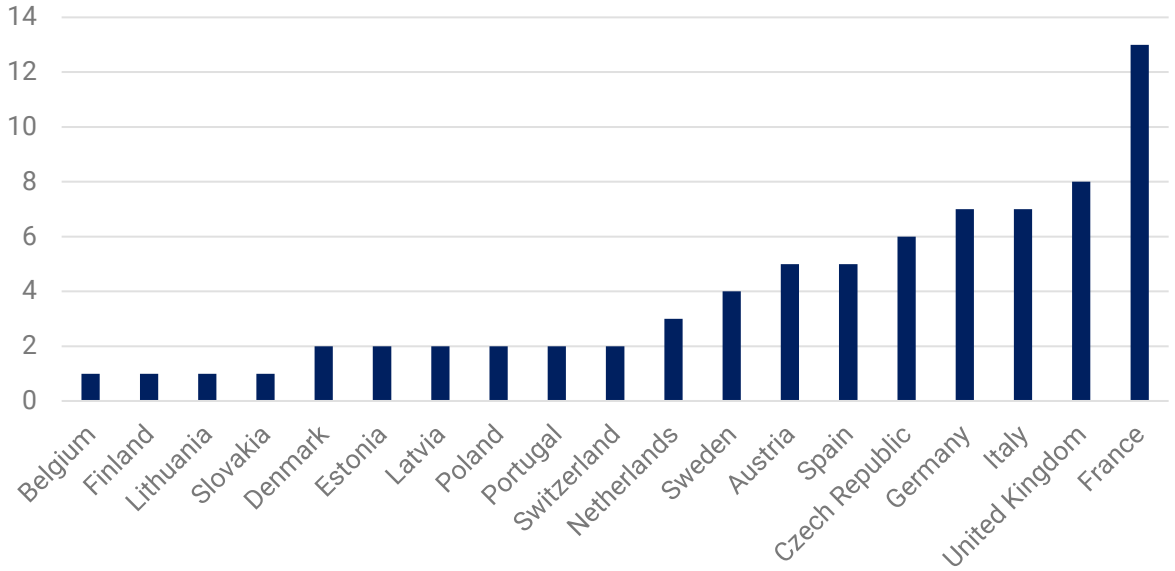


Figure 22: Geographical distribution of respondents to the ESPI survey 2021

France and the UK are more largely represented this year with more than 28% of respondents. The large volume of respondents from the UK and France could be a result of the multitude of initiatives launched by both governments and their space agencies to foster the emergence/acceleration of entrepreneurship and investment trends in their national space sectors.

Start-ups located in Germany and Italy also represent a large share of respondents with 19% of all respondents originating from both countries. This is also in line with what had been seen in previous years. Other countries with a significant number of respondents include the Czech Republic, Spain, Austria and Sweden, representing altogether 27% of survey respondents.

Out of the surveyed start-ups, over 62% are less than 5 years old, with around 27% of companies having been founded during the last 3 years. 28% were founded between 2010 and 2015 and 9% before 2010.

These results are very similar to previous surveys (2020, 2019) which highlighted a majority of European space start-ups being less than 5 years old. The consistency over the past 3 years points toward a recent (since 2015) ecosystem growth.

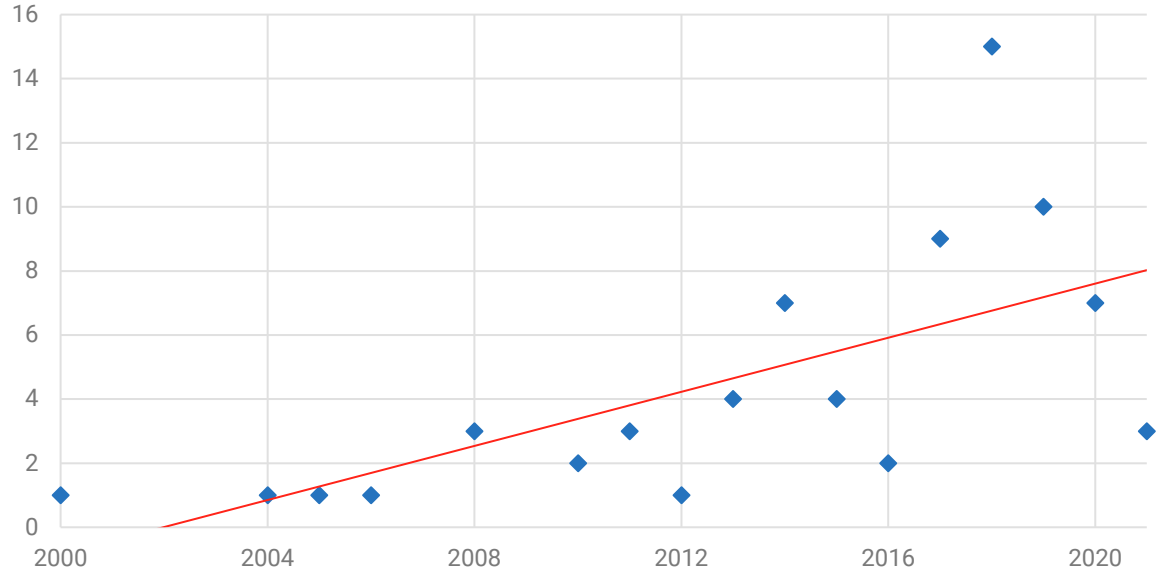


Figure 23: Year of foundation

57% of start-ups have less than 10 employees, 34% have between 11 - 50 employees while only 10% have between 21 and 250 employees. These outcomes echo the business stage of start-ups with 61% of start-ups still being in their initial phase of development (57% of start-ups had less than 10 employees), including seed and early stage. At this stage, the start-up activity is usually focused on concept and product development and commercial operations have not yet started or are just starting. At such an early stage, business viability is not yet established, and failure remains high. 25% of start-ups are in their growth stage and 11% are in their expansion stage. Finally, 3% of all respondents have reached maturity stage.

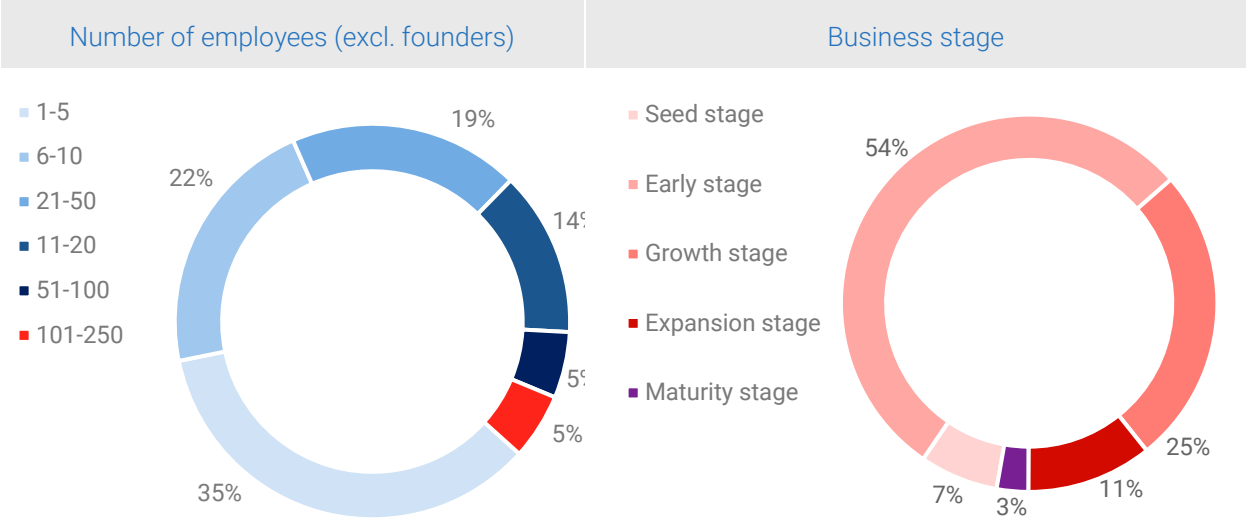


Figure 24: Number of employees and business stage

5.1.2 Products and innovation

Respondents to the survey are well distributed across the space value chain with 39% of companies in the "mostly upstream", 42% in the "mostly downstream" and 19% positioned in the mix upstream and downstream.

65% of start-ups consider that their business is fully related to space meaning that the company exclusively addresses space markets or that the products/services the company offers are fully dependent on space capabilities (e.g., satellite images, satellite bandwidth, PNT signals). 28% consider that their business portfolio is significantly but not fully connected to the space sector and 7% consider that space represents only a part of their business.

A vast majority of upstream start-ups are fully space businesses while it is the case of only half of downstream start-ups that rely significantly, but not only, on space capabilities for their business activities.

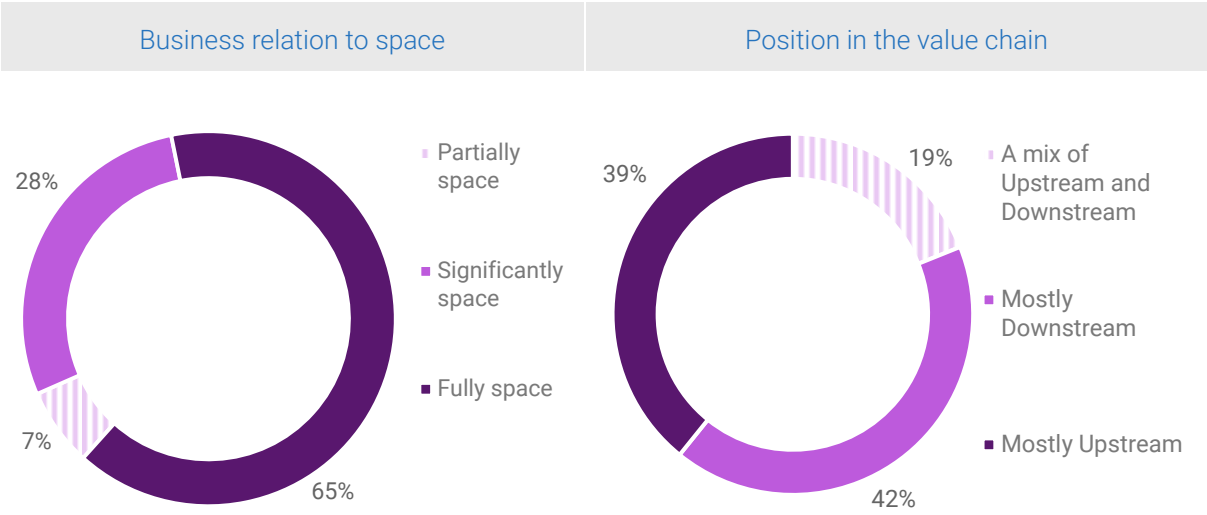


Figure 25: Relationship to space and position in the value chain

5.1.3 Revenues and target markets

Most European space start-ups already generate revenue (85%), with 59% declaring a revenue below €1 million and 26% of them declaring revenues above €1 million. On the other hand, 46% of the companies declare no revenues or a revenue inferior to €150.000. These companies are mainly composed of young start-ups that have been founded in the last five years and that are at an early stage of development with the majority of them at seed stage.

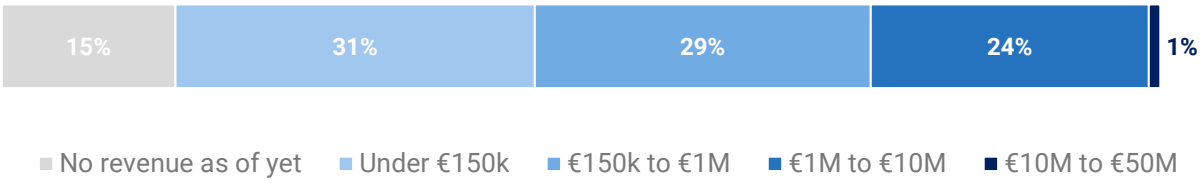


Figure 26: 2021 fiscal year revenues

Out of the companies having generated revenue between €150 thousand and €1 million, 48% are in their growth stage of development. On the other side of the spectrum, companies declaring a revenue higher than €1 million are usually in their expansion or maturity stage. In this category, 37% of companies were in their expansion phase and 30% of the companies were in their growth stage.

Another interesting aspect to assess is the core business target of respondents. The survey highlights that an overwhelming majority of start-ups are B2B businesses and therefore target other businesses as a priority. Only 9% are B2G start-ups and almost no start-ups (3%) target directly end customers. It is interesting to point out the low amount of B2G start-ups, which highlights the paradigm shift of New Space and space commerce in Europe.

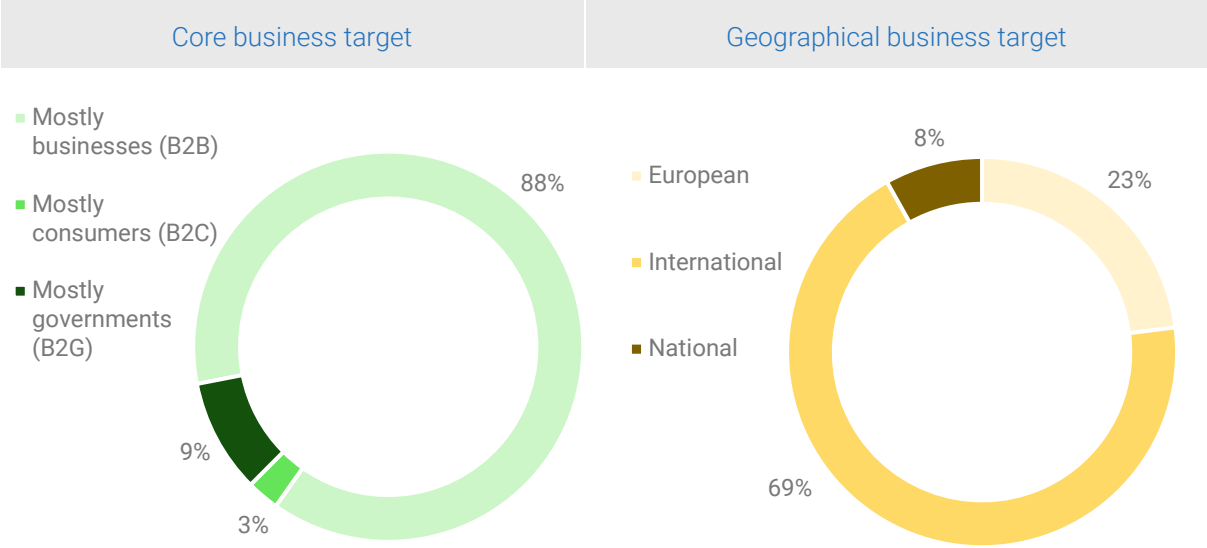


Figure 27: Core business and geographical targets

In line with the business target of respondents, it is important to look at the core geographical business target. An overwhelming majority of respondents appear to be targeting international markets (69%), approximately one quarter focus on European targets (23%) and only 8% focus on national markets.

5.2 Start-up's business situation, priorities, and prospects

5.2.1 Business outcome and expectations

When asked to assess their current business situation, European space start-ups have responded with a more balanced and often positive perspective than two years of pandemic would have led to expect.

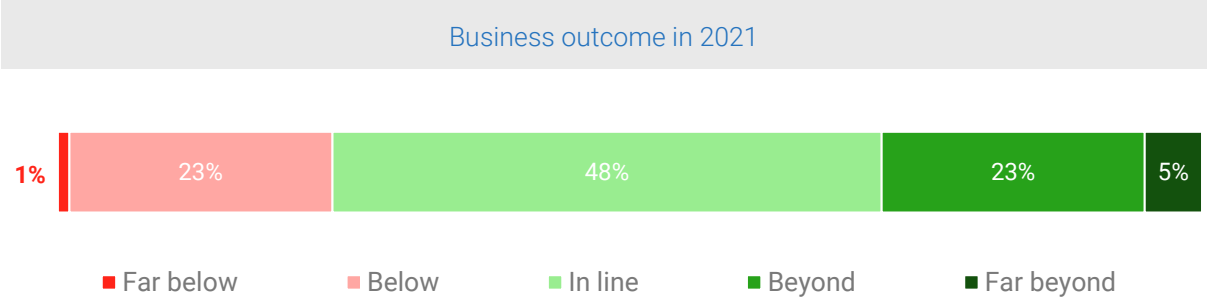


Figure 28: Rate of business expectation in 2021

When asked to rate their current business situation:

- 76% of start-ups answered that they had either met or exceeded their objectives for 2021 with a vast majority (48%) considering their business situation to be in line with their expectations. 23% consider that their situation was beyond expectations and 5% far beyond expectations.
- 24% of respondents answered that they had not met their expectations in 2021. In this group, 23% consider their business situation below expectations and 1% consider it far below expectations.

This represents a significant improvement in the overall situation compared to last year. In 2020, only 49% of start-ups considered their business situation good or satisfactory, whereas 51% considered the year to be below expectations.

Figure 29: Business situation expectation for 2022

With regards to European space start-ups prospects for 2022, the survey highlights a rather optimistic outlook for the up-and-coming year:

- 85% of start-ups answered that their business situation is expected to improve or greatly improve in 2022, with a vast majority (50%) considering that their business situation will improve and 35% consider that their situation will greatly improve.
- 14% of respondents responded that their business situation is expected to remain stable or deteriorate. In this group, 9% consider their business situation to remain in line with 2021 and only 5% assume that it will deteriorate.

5.2.2 Start-up priorities and challenges

Priorities

When looking at the priorities of European space start-ups, the results of the 2021 survey are very much in line with precedent editions (2018, 2019, 2020), where product development, sales growth and customer acquisition were consistently picked as the top 3 priorities. As such, most companies still prioritise goals related to the establishment of steady revenues and the development of a marketable solution as compared to those related to expansion or scaling of production.

Figure 30: Top three priorities for European space start-ups in 2022 (number of answers)

- The 2021 survey showed that most start-ups seek first and foremost to establish their business in terms of products and markets. The two priorities that ranked the highest for surveyed companies were "Marketing & customer acquisition" and "Product development/R&D" with over 50% of start-ups selecting these 2 priorities.
- Interestingly these priorities come before "Raising private capital" and "Accessing public funding", which are two important areas that European public institutions seek to further support in view of fostering entrepreneurship and business innovation in the space sector. Furthermore, raising private capital is a higher priority than access to public funding. These results mirror very closely those of our 2020 survey
- Goals prioritising growth and expansion were considered secondary by most start-ups, with expansion to new markets selected by 25% of respondents and scaling production and internationalisation each selected respectively 22 % and 7% of respondents

In addition to these priorities, survey respondents also mentioned that upward vertical integration was of importance to them as well as IoD/IoV or proof of concepts.

Challenges

In 2021, the ESPI survey on entrepreneurship also assessed the biggest challenges for European space start-ups. When looking at the challenges for European space start-ups, the results of the 2021 survey mirror to a certain extent the start-up priorities. Where product development, sales growth and customer acquisition were picked as the top 3 priorities, the top challenges point towards gaining access to public contracts, raising capital and sales/customer acquisition. As such, most companies underline that their priorities are most often challenges as well.

Figure 31: Top three challenges for European space start-ups in 2022 (number of answers)

- The 2021 survey showed that the top challenges concern establishing and growing revenue streams, either in terms of size or sources. The three challenges that ranked highest were "Gaining access to public contracts", "Raising capital" and "Sales/customer acquisition", with over 52% of start-up answers selecting these 3 challenges.
- Interestingly the challenges, unlike priorities, position "Raising private capital" as a bigger challenge than product development and R&D which was the biggest priority for start-ups.
- Product development is a priority but not necessarily a challenge while raising capital appears to be a challenge but not necessarily a priority. Customer acquisition is both a priority and a challenge.

Other challenges were also highlighted under "other", such as the anti-competitiveness of the geo-return mechanisms, the lack of firm fixed price contracts in Europe and supply chain issues in 2021.

Furthermore, respondents were able to expand on the challenge of raising capital: Many companies mentioned that there is a lack of understanding of the space domain from investors, that there is also a lack of appetite and familiarity for space technologies and that they are often bootstrapped by the limitations of their funds. Finally, EU investors present low risk appetite and are often overwhelmed when presented with space business cases (high capex, time to exit).

5.2.3 Past and future financing

Another interesting point of assessment is that of financing. This year the survey looked at past and planned future financing sources for European space start-ups:

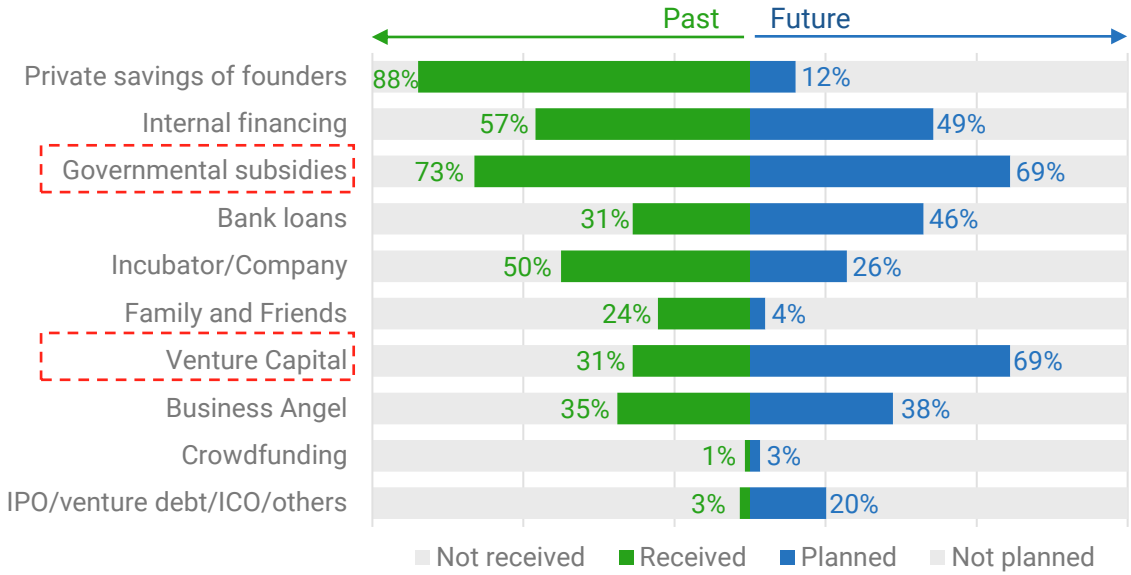


Figure 32: Received and planned financing

Most of the start-ups sampled in the survey declare having already received external financial support including governmental subsidies, bank loans, funding from incubator/company, venture capital, business angel, crowdfunding or others. Governmental subsidies and incubators/loans are the most common source of external financial support. Self-funding through private savings of founders remains the main source of initial start-up financing. 88% of start-ups were started using personal funds and only 12% did not have the recourse of self-fund or fund through family and friends. A vast majority of start-ups do not intend to use self-funding in the future

- A large majority of start-ups have received funding from private savings of founders (88%) as well as governmental subsidies (73%). Furthermore, 50% of start-ups have received funds from incubators. When asked the exact same question two years ago, 74% of start-ups had used private savings, 40% had received governmental subsidies and only 19% had received funding from incubators/companies.
- When looking towards the future, 69% of start-ups plan on seeking governmental subsidies and 69% will be seeking Venture Capital investments. In addition, 49% of start-ups mentioned that they will be seeking internal financing and 46% will be seeking bank loans.

As such, while the main past sources of financing for European space start-ups are private savings of founders and governmental subsidies, the future targeted funding are Venture Capital and Governmental subsidies. This highlights the increasing synergies between public and private sources of investment within the European landscape and how often they prove to be interdependent. However, limits remain. In the open-ended question, responders pointed out a significant lack of understanding of the space sector from investors as well as a high level of risk aversion. On the public side, start-ups feel that they should be more supported regarding product market demonstration rather than receiving grants.

5.3 Role of the public sector

5.3.1 Start-ups expectations from institutions

The approach of European governments and public institutions to entrepreneurship and investment in the space sector has considerably changed over the past few years. The fostering and development of New Space trends and ecosystems has become a growing priority for many actors, giving way to several new initiatives. However, it is often hard to assess where start-ups are the most in need of support from the public sector.

Interestingly, the survey shows that European start-ups have consistent views on where they uphold the most expectations from the public sector. Furthermore, the highest expectations are in line with the key priorities highlighted previously in the report (demand for products and services, public procurement mechanisms etc..).

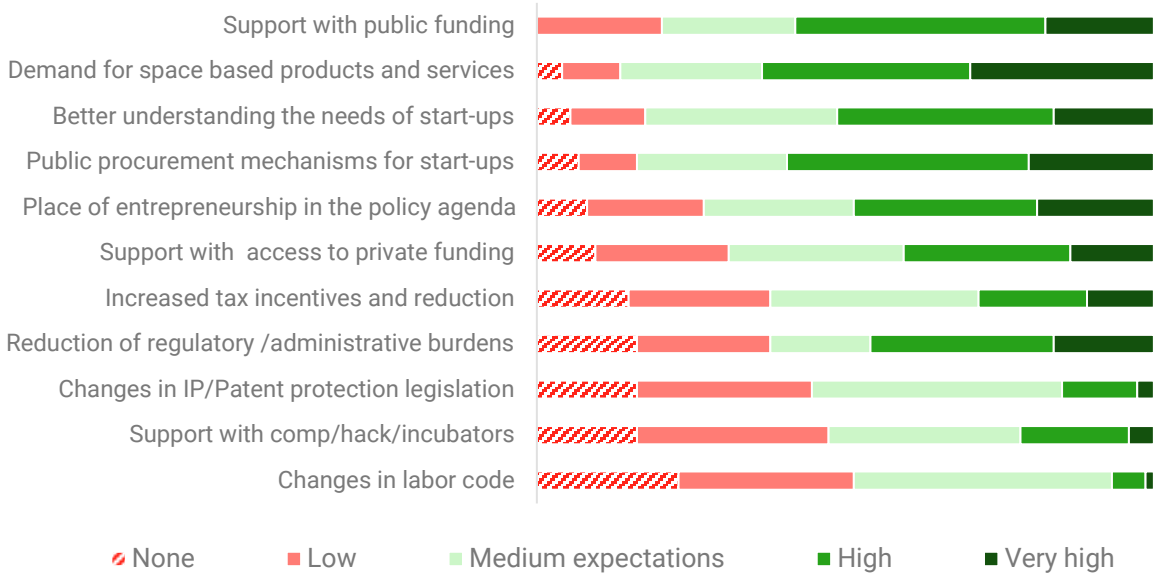


Figure 33: Expectations from the public sector

Some aspects of public support uphold high expectations from European space start-ups:

- 64% of start-ups mention having high or extremely high expectations from the public sector regarding the demand for space-based products and services. In line with this, 60% of start-ups uphold high or extremely high expectations regarding public procurement mechanisms for start-ups
- In addition, 58% of start-ups have high/extremely high expectations regarding support with public funding and 49% have the same expectations for the place of entrepreneurship in the policy agenda.

Interestingly, some aspects of public support are not as important to start-ups:

- According to the survey, 51% of respondents have low to no expectations concerning changes in the labour code, 45% have low to no expectations in changes in IP/patent protection legislation and 47% have low to no expectations regarding support with competitions/hackathons.

5.3.2 Satisfaction in public action

Interestingly, the survey shows that European start-ups have mixed views on the progress of public action in the New Space domain. While some actions have shown significant progress and underline the strong support offered by the European public sector, a range of measures such as demand, and public procurement mechanisms still show a need for additional improvement.

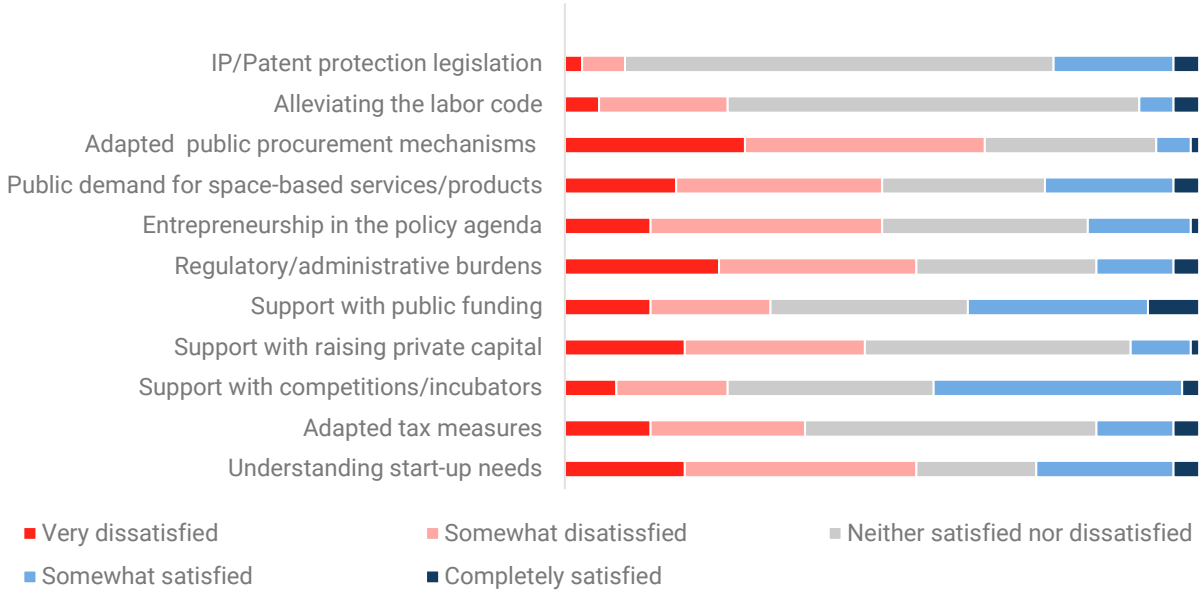


Figure 34: Rate of satisfaction in public action

Public support is considered as sufficient in few categories for European New Space companies

- 42% of start-ups have mentioned to be either somewhat or completely satisfied regarding support with competition/incubators
- 36% of all respondents are either somewhat or completely satisfied regarding support with public funding

As such, many areas of public action still require improvement

- According to European space start-ups, areas of public support with the highest need of improvement (where they are somewhat or very dissatisfied) include adapted public procurement mechanisms (66%), regulatory and administrative burdens (55%) and understanding start-up needs (55%). Public demand for space-based services/ products as well as Entrepreneurship in the policy agenda also show a high level of dissatisfaction (50%)
- As would be expected, European space start-ups have their highest expectations for public support in areas where they have the lowest rate of satisfaction from current public action.

Finally, the results mirror that of "start-up expectations". While we can see that the overall public support to the start-up ecosystem is improving, there remains significant work, notably in terms of public demand to support European space start-ups.

6 TAKEAWAYS

ESPI Space Venture Europe 2021 statistics highlight an outstanding year for investment and entrepreneurship trends in the European space sector.

Investment trends	• Record investment in 2021 in Europe, with €611 million invested in European space start-ups, €73 million more than in 2020 (14%). Investment reaches €2 billion when including OneWeb in the perimeter. • Massive growth since 2014 in Europe, with annual investment growing from €50 million to €600 million in just 7 years - CAGR (2014-2021): 50% • Biggest investment round for start-up in 2021: Arqit (€81 million) to finance the initial deployment phase of its secure communication services. • Venture Capital accounts for the largest share of investment value, with 63% of investment originating from Venture-Capital. • Global investment into space ventures continuously increased from €5.2 billion in 2019 to €12.2 billion in 2021. • Venture Capital accounts for the largest share of financing worldwide with €7.5 billion (61%), while SPAC mergers accounted for the second largest share representing €3 billion (24%). • The U.S. is the region attracting most investments, experiencing growth of 72% over 3 years, from €3.2 billion in 2019 to €9 billion in 2021. • The world outside of the U.S., Europe, China and Japan saw the investment in space grow 1700% over 3 years, from €24 million in 2019 to €434 million in 2021.
Start-up profiles & priorities	• European start-ups are mostly microenterprises with between 1-5 employees (22%). • Most start-ups address B2B markets (88%), only 9% address B2G markets and 3% address B2C markets. • Most start-ups already generate revenue (85%), with 59% generating a revenue <€1 million and 26% >€1 million. • Start-ups seek first and foremost to establish their business in terms of products and markets. Top priorities for start-ups are "Marketing and customer acquisition", "Product development". • Overall increase in confidence and business situation: A larger share (76%) of start-ups met or exceeded their expectations in 2021. A larger share of start-ups (85%) expects an improvement of their business situation in 2022.
Investor's Perspective	• Investing in the European space sector is becoming easier, even though the market remains fragmented. • The U.S. ecosystem remains more favourable for investment due to differences in terms of public strategies, markets and business maturity • Investing in space remains attractive due to the sector's growth potential and requires a specific investment strategy. • Investors share different perspectives on risks associated to a potential valuation bubble.

7 European Start-up Stories

7.1 Unseenlabs

Unseenlabs was founded in 2015 by the two brothers Clement and Jonathan Galic. The disruptive project of the Galic brothers created a product that can detect radio frequency signal emitters around the world to deliver tangible and near real-time data. This technology offers the possibility to identify all the vessels including those who turn off their AIS (Automatic Identification System) transponders.

Their product is satellite-based rf technology: the new space-based radio frequency detection system, entirely developed in-house (both hardware and software) detects and characterizes the passive electromagnetic signature of any ship (cooperative or not). It distinguishes itself from high-resolution observation satellites because it guarantees the tracking of ships in difficult meteorological conditions and transmits precise data with respect to a much broader observation area: nearly 1 million km2 scanned at one time.

Competition on the SIGINT RF market

The only competitor of Unseenlabs which offers Signals Intelligence (SIGINT RF) technology with a fully operational service to date is the US company HawkEye 360. Its solution requires the use of three satellites - as opposed to just one for Unseenlabs - to geolocate transmitters. HawkEye 360 formed a long-term operational contract with a Governmental Satellite Communications Organization and recently won a contract with the National Geospatial-Intelligence Agency and has also been selected by the European Frontex Agency. According to a recent report by Quilty Analytics, other companies which plan to build commercial RF mapping networks over the next years (their services are not yet operational to date) are Aurora Insight, Horizon Technology and Kleos Space.

This mono satellite technology allowed the company to deliver data immediately after the first launch. Unseenlabs is the only European company to offer a fully operational service today, which is already used by the French Navy and by around 10 other customers around the world.

The coverage is continuously expanding with regular new launches and a constantly enriched service offering. In August, Unseenlabs launched its fourth maritime surveillance satellite on an Arianespace Vega rocket, instead of Rocket Lab as it did for its formers BRO spacecraft. With the successful launch of BRO-4 (Breizh Reconnaissance Orbiter-4), the French company now has the most advanced constellation in the field of RF signal interception from space: 7 satellites into orbit with full coverage of the globe and an optimal revisit time. The company will continue to deploy its constellation until it reaches between 20 and 25 satellites by 2025.

Unseenlabs also co-leads the new consortium “New Symphonie”, with Euroconsult. This collaboration with over 20 European space sector companies was established in response to a European Commission’s call for projects. It aims to shift from GOVSATCOM to an EU Space-based Global Secure Connectivity System that can deliver communication services for governmental and non-governmental users.

In 2021, Unseenlabs completed a €20 million Series B led by 360 Capital and involving other historical investors such as Definvest (BPIfrance and The French Ministry of the Armed Forces) and Breizh-up. The funds will enable the company to accelerate its commercial deployment through the hiring of new sales staff and the opening of new geographic hubs. After achieving a turnover of €3 million in 2020, Unseenlabs anticipates a turnover of €50 million in the short term.

7.2 Anywaves

Anywaves was officially launched in France in 2017 by Dr.Nicolas Capet, PhD engineer, expert in electromagnetism and microwaves, after a brief period of pre-incubation in the ESA Space Creativity centre. The company is developing miniature 3D printed ceramic antennas for satellite constellations.

The four commercial off-the-shelf products of Anywaves meet various needs of the satellite market: they propose the S-Band TT&C antenna for telemetry tracking and control, the X-Band antenna used for data downlink, the GNSS All-Bands antenna optimized to cover worldwide navigation systems, and the GNSS L1/E1 Band antenna used for satellite precise positioning.

Furthermore, the company chose adapted construction techniques such as 3D printing. This production method allows the company to produce antennas in small series, thus to fulfil the needs of the space industry. Moreover, it is a very flexible process, that makes it possible to create a broad range of products. The use of ceramic allows to withstand the spatial environment, which includes very large temperature ranges and resisting radiations that come from the Sun.

In a context where space missions can be increasingly implemented by smallsats rather than large satellites, having fitting miniature antennas is becoming necessary for the satellite constellations market. Companies like Anywaves, with a capability of rapid production, manage to meet a particular demand on the smallsats market.

Credit: Anywaves

In order to offer a complete and accessible portfolio of solutions geared towards international markets, Anywaves joined the New Space Factory, a group of French SMEs. In this group, Anywaves particularly teams up with MecanoID. This company helps to integrate the antennas and test their mechanical-thermal properties. The antennas are then installed on nanosatellites in clean rooms before the take-off. Anywaves was also one of the founding members of the Young European Enterprises Syndicate for space (YEESS), which included the creation of direct interfaces for young space enterprises with the European institutions.

Anywaves supplies a broad range of customers thanks to those generic antennas in S- and X- bands, that can work on a wide range of missions. Its customers range from Thales Alenia Space for Omnispace's global hybrid 5G network in 2020 or Airbus Defence and Space for the CO3D constellation this year to start-ups like Pixxel, an Indian company developing a constellation of imaging satellites. Furthermore, five Anywaves antennas already equip satellites in orbit, notably Eyesat and Angels. By 2024, Artic Weather Satellite will be equipped by Anywaves antennas, this project aims to demonstrate the usefulness of radiometric measurements in improving weather predictions globally and specifically in the Arctic region.

Anywaves has grown from a 2-persons start-up in 2017 to a 22-people manufacturer in 2021 and has already sold more than 150 products. The company raised €1.5 million in funding in 2019.

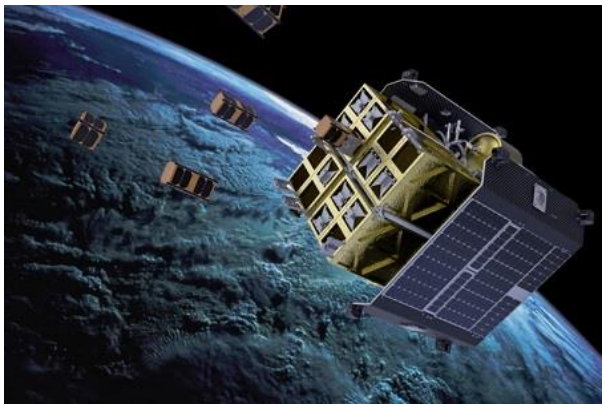
7.3 D-Orbit

D-Orbit was created in 2011 by Luca Rossettini and Renato Panesi in Italy. The company develops proprietary space logistics technology and transportation solutions, including launch and deployment services, avionics, mission control, and end-of-life solutions.

All the company's services are based on proprietary, patent technology. Among those:

- The ION Launch Service: D-Orbit loads a group of nanosatellites and carries them with their ION CubeSat Carrier, a space vehicle that can transport satellites in orbit and release them individually into distinct orbital slots. This reduces the time from launch to operations and the launch costs of satellite constellations.
- Their decommissioning devices such as D3. Installed on satellites before launch, D3 removes them from orbit at end-of-life or in case of a major failure. D3 is compliant with international space debris regulations, enabling operators of constellations to maintain their operational orbits free from uncontrolled satellites, and reducing collision risk.
- AURORA, an in-house proprietary cloud-based mission control software suit designed to control entire satellite constellations.

Together ION Launch Services and D3 characterize D-orbit as a first mover in decommissioning systems and solutions and precise deployment for CubeSats. With ION, the company already started to move small satellites in space. With that same technology, they aim to go to space and service other satellites, remove those that are there and eventually transport goods.



Credit: D-Orbit

Providing end-to-end services, D-orbit conducts missions from commissioning to decommissioning steps. D-Orbit succeeded this year in the deployment phase of the ION Pulse Mission and the ION Wild Mission. The latter led to deploying satellites of the Spanish Elecnor Deimos, the Bulgarian EnduroSat, and the Kuwaiti Orbital Space, which launched the country's first radio amateur satellite. D-Orbit also recently signed a contract with ESA for the development and in-orbit demonstration of a "Deorbit Kit," a self-contained suite of equipment that enables space vehicles of any size to perform propulsive decommissioning manoeuvres.

Since 2011, D-Orbit received a total funding of €23 million, including European debt financing of €15 million from the European Investment Bank in 2020. The other €8 million were funded through grants from EASME and the "Club degli Investitori" and through venture capital financing notably from TT Venture and Seraphim Capital. The company has now offices in Italy, Portugal, the UK, and the US. Its commitment to pursuing business models that are profitable, friendly for the environment, and socially beneficial, led D-Orbit to become the first certified B-Corp space company in the world.

7.4 Kinéis

Kinéis is a spin-off from French maritime and environmental monitoring company CLS (Collecte Localisation Satellites), which is managing the Argos network and aiming to upgrade it with a constellation of nanosatellites in LEO.

- The Argos system was created in 1978 by the French Space Agency (CNES), the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), originally as a scientific tool for collecting and relaying meteorological and oceanographic data around the world.
- In 1986, CNES created a subsidiary, CLS, to operate, maintain and commercialize the system. Other international space agencies also contribute such as EUMETSAT and ISRO.
- Since 2019, Kinéis, a subsidiary formed last year by French maritime company CLS, has taken over operation of the Argos hosted payload system and finalized manufacturing agreements for a constellation of 25 small satellites for IoT connectivity. Argos collects one-way data from maritime beacons, including humidity, temperature, and sea level thanks to 7 satellites and 20 ground stations. Kinéis will deploy a CubeSat constellation to replace Argos with a two-way connectivity system that can link devices in multiple industries.

Kinéis uses a radio frequency chip (7mm x 7mm) to provide satellite connectivity to any mobile. The goal is to create a large IoT constellation of nanosatellites at a lower altitude than Argos System, reducing the revisiting time to around 15 min and with a low consumption. The Kinéis IoT constellation will be placed in orbit in 2023. A prototype nanosatellite, Angels, was launched in 2019. 8 satellites of the current generation of Argos are already in orbit and allow any connected project leader (IoT) to test their prototypes.

Kinéis works closely with other space actors such as Thales Alenia Space for project management, HEMERIA for the development and manufacture of the platform and Syrlinks for the construction of the payload. The company recently chose Rocket Lab to launch and deploy its satellite constellation.

Regarding overseas business, The Federal Communications Commission (FCC) recently allowed Kinéis to offer satellite services in the U.S. market. Specifically, it grants Kinéis market access to certain MHz uplink bands, and a downlink band, conditioned on certain requirements including the outcome of future FCC deliberations, like a pending orbital debris proceeding. The company will open a subsidiary in Washington early next year.

Credit Kineis

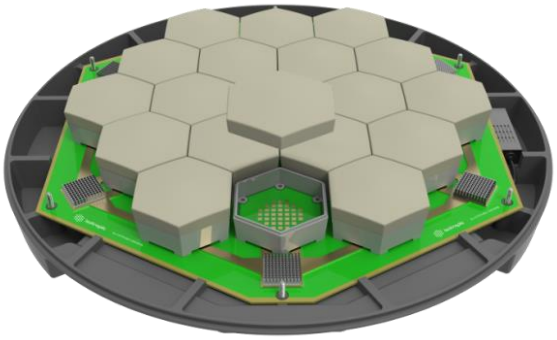
In 2020, Kinéis raised €100 million for the development, production and launch of a constellation of 25 nanosatellites, the installation of 20 ground stations and the development of new IT infrastructures for the renewal of the system. CLS and CNES invested in the start-up's 2020 funding round, which also included French export-import bank Bpifrance and industrial partners Thales Group, CubeSat builder Hemeria and software engineering firm Celad. The European Investment Bank and the French National Institute for Ocean Science (Ifremer) were also among the participants.

7.5 Isotropic Systems

Isotropic Systems Limited (ISL) was founded in 2013 by John Finney and is headquartered in London. The company is developing multi-band and electronically steerable antennas. ISL's antenna is a 'broadband' low-profile antenna with electronic beam steering and scalable to effective apertures. This antenna can connect to more than one satellite at a time: this technology is becoming attractive when more and more satellites are launched leading space companies to seek ground stations with more capabilities.

Until now, major technologies were dishes or electronically phased arrays, that could only connect to one satellite. Isotropic's patented radio frequency optics technology enables a high-performance multi-link ground antenna to simultaneously connect to multiple satellites in multiple orbits. The company's optical technology bends radio waves to mesh signals from several satellites. The antennas offer multi-beam support, which allows an increase in the capacity of communication systems, the preservation of the available frequency system and the reduction of interference. This allows the customer to create its own network, also increasing its data availability in case of a satellite failure.

The resilience of the system raises interest, particularly among defence forces such as the US Space Force, which manages the satellite communications for the US Armed Force. Indeed, the multi-beam antenna uses patented optical beamforming lens technologies that would allow them to arbitrage capacity from commercial and military satellite capacity over a single antenna to deliver data at the tactical edge. This would be the opportunity to merge MILSATCOM and COMSATCOM. The former, using close-to-the-Earth satellites, is more and more vulnerable to missiles, jamming and interference. Merging the two networks would allow more resilience in case of a satellite failure.



Credit: Isotropic Systems

In September 2020, SES and Isotropic announced they had been issued a two-phase contract by the Air Force Research Laboratory to evaluate the use of Isotropic's prototype multibeam antenna over the SES O3b medium Earth-orbit constellation. That contract is part of the Air Force's Defense Experimentation Using Commercial Space Internet (DEUCSI) program, designed to leverage commercial satellite broadband providers to connect its legacy systems.

In February, Satellite operator SES led a group of space investors, including Boeing HorizonX Global Ventures, the UK Space Agency, and deep-tech fund Promus, in a €33 million fundraising wave aimed at accelerating the commercial readiness of Isotropic Systems' antenna. Later in the year, Seraphim Space Investment Trust announced an investment of €32 million. The investment in Isotropic Systems, therefore, totalled €65 million in 2021. Isotropic Systems will use the funding to accelerate its production phase in time to support new constellations and satellites launching in GEO, HEO, MEO and LEO orbits from 2022 onwards. The company has already expanded its workforce by 40% over the last five months.

7.6 Rocket Factory Augsburg

Rocket Factory Augsburg (RFA) was established in 2018 as a corporate spinoff from OHB, via MT Aerospace Holding and became an independent joint-stock corporation in 2019, led by Stefan Brieschenk and Jörn Spurmann.

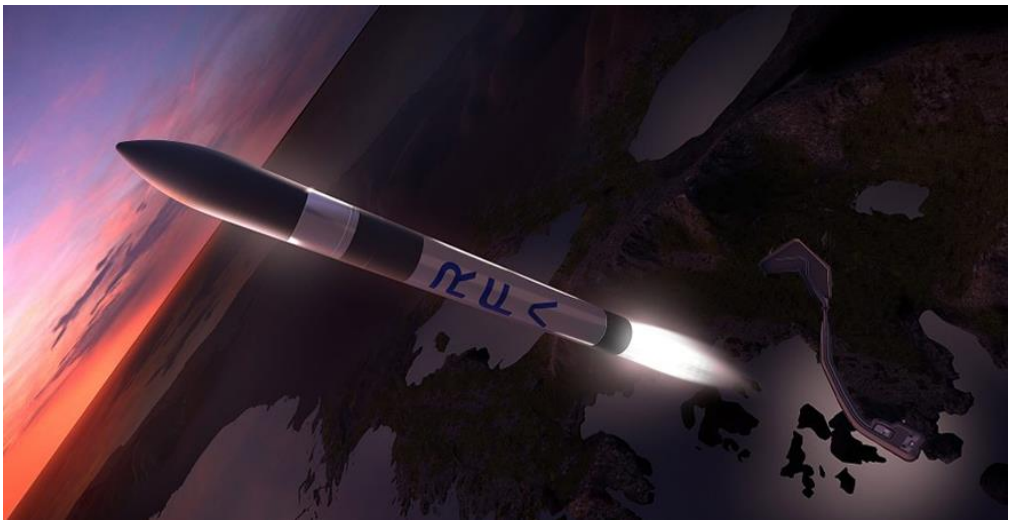
Rocket Factory Augsburg is developing the RFA One launcher, which will ensure delivery to the desired orbit for every payload onboard, in mission profiles from LEO to GTO. The RFA One launch vehicle features three stages:

- Stage 1 uses nine liquid fuel engines. Each engine is based on a simple gas generator cycle. The turbo pump has been reported to have already been tested and is designed for additive manufacturing.
- Stage 2 uses a single engine with the same fuel combination. The tanks of both stages are built from metal.
- Stage 3 is a kick stage using green propellants and a flight-proven engine.

RFA aims to offer a capacity of regular launches: micro-launching offers the possibility to respond to a precise need of the customer, launching as regularly as he desires and to reduce access time to space data. The other main objective of the company is to provide affordable services. The goal was to optimize the cost of the components, which was manageable with the help and the expertise of original partners such as OHB.

RFA emphasises the importance of European collaboration: Andøya Space Center, Norway, has been announced as the launch site and new offices were established in Matosinhos, Portugal. During the inauguration, a €9 million agreement was signed with AICEP, the Portuguese Trade & Investment Agency. The agreement targets the development and qualification of RFA ONE's launch system composite structures in close collaboration with Portugal's Centre of Engineering and Product Development in Matosinhos (CEiiA). This collaboration – Project Magellan – is actively supported by the Portuguese Space Agency, contributing to move Portugal up the added-value chain in the space sector.

The first operational flight is announced for the end of 2022, after the success of the launcher's test. Contracts were already signed including with OHB Cosmos and LuxSpace but also with Ultra Space Outpost to launch a demonstrator mission to the Moon, to initialize Plus Ultra's cislunar constellation "Harmony". RFA announced in February a financing round aiming to gather €25 million.



Credit: Rocket Factory Augsburg/Andøya Space

ANNEXES

Annex A – ESPI Space Investment Database

Dataset and sources

The assessment of investment statistics provided in this report is based on information collected by ESPI in a proprietary database. The ESPI Space Investment Database includes all deals from 2014-2021. The dataset includes publicly available data on announced operations and deals and information is collected by screening a high number of sources including investment firms', incubators' and accelerators' portfolios, articles and specialized news outlets or specialized sources such as CrunchBase. Furthermore, due diligence was made to appropriately filter all press and governmental releases as well as events. Cross-checking was systematically performed.

Perimeter and definitions

This study focuses on European space start-ups and aimed to collect data on investment received by these companies and to gather views of these companies on their business, the environment in which they evolve and their expectations from public actors. The following definitions and categories were applied to delineate the perimeter of the analysis.

European space start-ups

- Start-up: A start-up is defined in Europe as a company younger than 10 years, whose business tend to feature innovative concepts and models and who has not yet reached business maturity (defined according to the business stage: Public Offering, annual turnover or number of employees). For the purpose of this study and given the usually longer timeframe required in the space sector to reach business maturity (as compared to other industrial sectors), ESPI included companies founded after the year 2000. Business maturity (end of the start-up stage) is considered achieved if the company meets one of the following criteria (adapted from start-up and SME definitions by the European Commission):
    - Acquisition or Public Offering: the company has been acquired or listed on a stock market.
    - Turnover: the annual turnover of the company exceeds €50 million, or the annual balance sheet total exceeds €43 million.
    - Number of employees: the total number of employees exceeds 250.
- Space company: A company is considered a space company if the main business of the company (in revenue share) is part of the space value chain. For this definition, the study followed the space market segmentation provided by Seraphim's Spacetech Market Map 2019, which divides space activities into three segments:
    - Upstream: Build, Launch, Satellites;
    - Downstream: Downlink, Analyse, Store, Product;
    - Beyond Earth: Space Exploration, Space Resources, Space Logistics, Space Research.
- European company: A company was considered European when the headquarters of the business organization are based in Europe (EU Member States + ESA Member States), or if a majority of its business operations is conducted in Europe, a feature that implies, for instance, the eligibility for EU funds as those provided by the Horizon2020 program. Some exceptions exist for companies with multiple headquarters.

In a number of cases, the classification of a company as a European space start-up required an arbitration because of the business setup (e.g. multiple headquarters addressing different regional markets), the situation of the company (e.g. dormant company founded before 2000 but with a net business acceleration after 2000 and following a start-up behavior) or the nature of business (e.g. space is part of the products and services portfolio but not a core market).

For example, the study partially includes, or totally excludes, deals involving companies that reached business maturity during the period considered (2014-2018). This is for example the case of O3b Networks (today part of SES as SES Networks): the company is counted for a single investment in 2014 despite additional investment in 2016 and 2017. According to the definition adopted for this study, the company reached business maturity in 2015, because of annual revenues exceeding by far €50 million. Comparably, companies like GOMSpace and AAC Microtec were excluded after 2016, as they both started to be publicly traded, and that their business structure did not match anymore a start-up model. The British company Reaction Engines was included despite its age, as the company is still actively trying to develop the product for which it was founded, the SABRE engine.

New Space perimeter for global statistics

In order to provide comparable metrics with already established sources such as BryceTech and Seraphim capital, ESPI uses a broader "New Space" perimeter for global statistics that features a less stringent definition of "start-ups" and includes companies such as SpaceX or OneWeb which already reached maturity according to ESPI definition.

To ensure coherence with existing authoritative studies, ESPI selected the categories used in Bryce's Start-Up Space report series to classify sources and types of investment.

Investor categories

- Angel Investors: individuals or families (to include family offices) that have accumulated a high level of wealth and seek potentially high returns by investing in ventures during their early stages. Such investors may also operate with venture capital firms or other so-called angels. They will typically invest via straight equity, ranging in value from $50,000 to over $1,000,000. There is also a class of "super angels", who work in deals of $100 million or more (Jeff Bezos, as one example).
- Venture Capital Firms: VC firms represent groups of investors that invest in start-up, early stage, and growth companies with high growth potential, and accept a significant degree of risk. The trade of risk for potential high returns results in a high failure rate. Their investment form is equity, typically preferred stock, and comes in a series of rounds, traditionally Series A, B, C, etc.
- Banks: Banks are financial institutions that can support investment through a variety of instruments including, in particular but not only, loans and debt financing.
- Private Equity Firms: Private equity firms or groups are formed by investors to direct-ly invest in companies. They typically invest in established companies, rather than start-ups, through large transactions and often acquire an entire company or a group of related companies that can merge.
- Corporations: Corporations have different methods of engaging in investment. They frequently provide the funding necessary to bring space-based programs to initial operating capability, as well as to sustain on-going programs; they can also fund ventures, typically via straight equity, but also debt, and in the latter case with the option to convert to equity; and they also sometimes act via a corporate venture fund. Lastly, corporations may likewise acquire firms, including start-up space ventures, of which there have been several examples in recent years.
- Accelerators & Incubators: Although they are ultimately distinct types of actors, accelerators and incubators are similar in several core ways. Both aim to support start-ups, offer mentoring in

developing their business, and both offer means to at-tract investment. Broadly concerning their differences, "accelerators 'accelerate' growth of an existing company, while incubators 'incubate' disruptive ideas with the hope of building out a business model and company".

Investment categories

- Seed/Prize/Grant: Funding received by a start-up typically at an early stage of development. This category includes a variety of funding instruments that are usually obtained as the result of a selection process (application, competition) and involve limited obligations from the company.
- Acquisition: Situation whereby one company purchases most or all of another company's shares in order to take control. An acquisition occurs when a buying company obtains more than 50% ownership in a tar-get company.
- Debt Financing: Process of raising money by selling debt instruments to individuals and/or institutional investors (e.g. banks). In return for lending the money, the individuals or institutions become creditors and receive a promise that the principal and interest on the debt will be repaid.
- Private Equity: Investment consisting of capital that is not listed on a public ex-change. Private equity is composed of funds and investors that directly invest in private companies.
- Public Offering: Process of offering shares in a private corporation to the public. The first time, the operation is called an Initial Public Offering (IPO).
- Venture Capital: Funds invested by VC firms, usually with medium-term stakes, for high profit, high risk activities.

Space value chain segmentation

The space value chain can be divided into segments. ESPI selected the Seraphim SpaceTech Ecosystem Market Map (available at: https://seraphimcapital.co.uk/insight/news-insights/introducing-seraphim-spacetech-market-map) to organize start-ups business along the value chain.

The upstream part of the space value chain includes all business activities related to the development, production, deployment and operation of space systems. This includes:

- Build: development and manufacturing of space systems (incl. sub-systems, equipment, components and materials) and/or provision of related software and engineering services;
- Launch: development and manufacturing of launch systems and/or provision of launch services;
- Data: operation of space systems to lease or sell satellite capacity data.

The downstream part of the space value chain includes all business activities related to the exploitation of space systems' capabilities or data to provide space-enabled products and services to end-users:

- Downlink: development and manufacturing of the ground support infrastructure and services required to exploit a space system (e.g. relay systems, communications, ground terminals, cryptography);
- Store: provision of solutions for satellite data storage and processing:
- Analyse: provision of value-adding solutions for satellite capabilities and data exploitation (e.g. big data analytics, machine learning and artificial intelligence, algorithms);
- Product: provision of space-enabled products to end-users (e.g. mapping & 3D, data platforms, location and tracking, insight and monitoring).

Seraphim also include in a separate segment company whose business involve activities beyond Earth orbit including services and products for space exploration, space resources, space logistics or space research.

Annex B – ESPI Space Entrepreneurship Survey

About the survey

This analysis of the European entrepreneurial ecosystem is based on the results of the ESPI Space Entrepreneurship Survey 2021. The survey was issued to 300+ European space start-up and ESPI received more than 120 responses this year.

After careful review, ESPI filtered 74 individual responses from space start-ups located in 19 European countries.

This year, ESPI entrepreneurship survey consisted of 30+ questions addressing 2 main themes:

- *Space start-up ecosystem*: geographical distribution, business and markets, workforce, foundation.
- *Business situation and prospects*: self-assessment in 2021, priorities and prospects for 2022, perception of public support

Responses have been aggregated through multiple choice questions, scores and open comments of the respondents providing additional insights on their reply.

Survey respondents in 2021

ESPI is grateful to the many European space start-ups who took part to the survey and provided substantial information for this report.

The following table excludes the names of 11 start-ups who wished to remain anonymous.

Company	Headquarters	Core business
2AM , SIA	Latvia	Mostly Upstream
Accurision GmbH	Austria	Mostly Downstream
AIKO	Italy	Mostly Upstream
AST Advanced Space Technologies GmbH	Germany	Mostly Upstream
Atla.ai ApS	Denmark	Mostly Downstream
Atlantic Spaceport Consortium	Portugal	Mostly Upstream
Berlin Space Technologies GmbH	Germany	Mostly Upstream
Big Terra	Czech Republic	Mostly Downstream
Blue Dot Solutions	Poland	Mostly Downstream
ClearSpace SA	Switzerland	Mostly Upstream
Detektia	Spain	Mostly Downstream
Dynamic Genesis	Sweden	Mostly Downstream
Earth-i Ltd.	United Kingdom	Mostly Downstream
ENPULSION	Austria	Mostly Upstream
eoVision GmbH	Austria	Mostly Downstream

EOX IT Services GmbH	Austria	Mostly Downstream
Eptune Engineering	Portugal	Mostly Upstream
Exolaunch	Germany	Mostly Upstream
Gravitilab Aerospace Services	United Kingdom	Mostly Upstream
Hybrid Propulsion for Space	France	Mostly Upstream
iBOSS GmbH	Germany	Mostly Upstream
ICEYE	Finland	A mix of Upstream and Downstream
I-CONIC Vision AB	Sweden	Mostly Downstream
Infinite Orbits	France	Mostly Upstream
insar.sk Ltd	Slovakia	Mostly Downstream
KINEIS	France	Mostly Downstream
Latitudo 40	Italy	Mostly Downstream
Leaf Space	Italy	Mostly Downstream
Meandair B.V.	Netherlands	Mostly Downstream
MEEO	Italy	Mostly Downstream
MEOSS	France	Mostly Downstream
Miratlas	France	Mostly Upstream
Mission Space	Latvia	A mix of Upstream and Downstream
Oledcomm	France	A mix of Upstream and Downstream
Orbit Recycling	Germany	Mostly Upstream
Pangea Aerospace	Spain	Mostly Upstream
PASQ AB	Sweden	Mostly Upstream
PASQ space qualification	Sweden	Mostly Upstream
PLD Space	Spain	Mostly Upstream
Plus Ultra Space Outposts SL	Spain	Mostly Upstream
Porméthée	France	A mix of Upstream and Downstream
Progressive Systems Srl	Italy	Mostly Downstream
QuadSAT	Denmark	Mostly Upstream
S.A.B. Aerospace s.r.o.	Czech Republic	Mostly Upstream
Satellite Vu	United Kingdom	Mostly Downstream
scibit s.r.o.	Czech Republic	A mix of Upstream and Downstream
Skudo OÜ	Estonia	A mix of Upstream and Downstream
Space Analyses GmbH	Austria	A mix of Upstream and Downstream
Space Impulse	United Kingdom	A mix of Upstream and Downstream
SpaceAble	France	Mostly Downstream

Spacearth Technology SRL	Italy	Mostly Downstream
StatInf	France	A mix of Upstream and Downstream
Terrabotics	United Kingdom	Mostly Downstream
Unsinkable Robotics	Estonia	Mostly Downstream
Venture Orbital Systems	France	Mostly Upstream
vorteX.io	France	A mix of Upstream and Downstream
Wasat	Poland	Mostly Downstream
World from Space	Czech Republic	Mostly Downstream
XINETIS	France	Mostly Upstream
yuri	Germany	A mix of Upstream and Downstream
Zaitra s.r.o.	Czech Republic	A mix of Upstream and Downstream

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