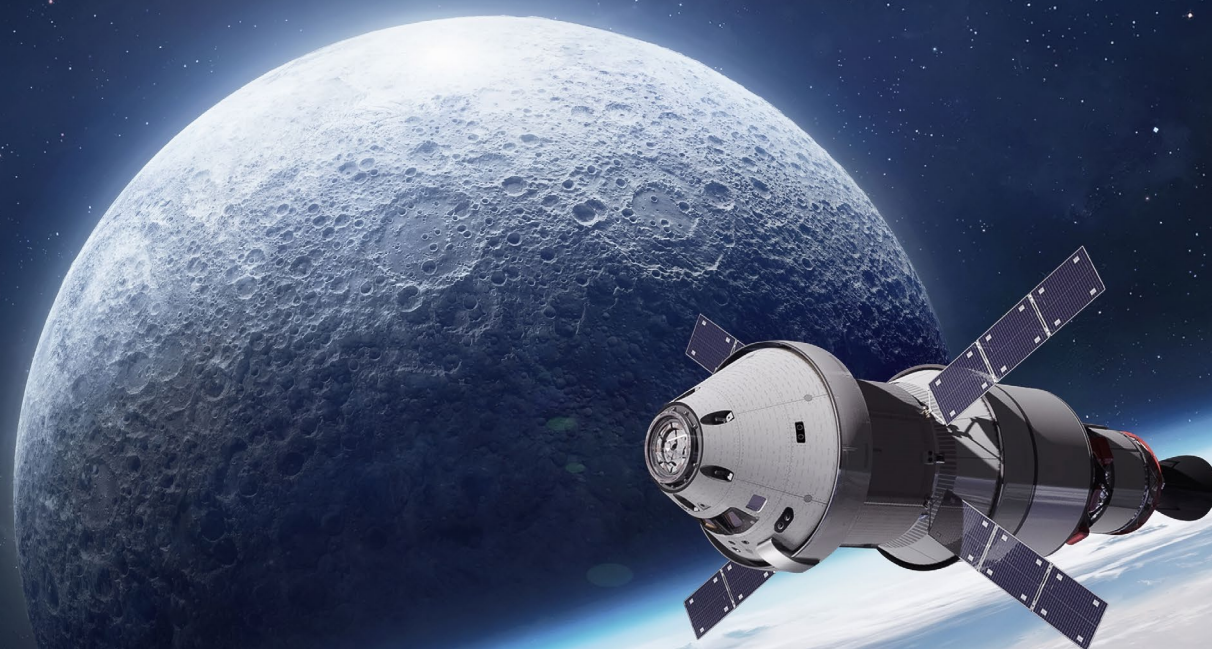




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The Nordic Space Technology Ecosystem – Country Reports

Mapping capabilities, gaps
and opportunities for stronger
Nordic collaboration



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The Nordic Space Technology Ecosystem – Country Reports

Mapping capabilities, gaps and opportunities for stronger Nordic collaboration

Report for Nordic Innovation

by Danish Technological University (DTI), RISE and Aalto University (AYO)

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Artist rendition. iStockphoto.

Introduction

This country report presents the space technology ecosystems of Denmark, Finland, Iceland, Norway and Sweden. Each chapter combines desk research, national strategy and policy material, available ecosystem mappings, patent analysis and interviews with national actors. The purpose is to identify the main structures, strengths, bottlenecks and opportunities that shape each national ecosystem and its role in a potential Nordic space agenda.

The chapters follow the same structure to provide for easy comparison. Each chapter begins with an overall profile of the national ecosystem and a short overview of the interviewees who were consulted. It then examines the strategic and institutional setting, including national policy priorities, public coordination as well as ESA and EU links, and the extent to which space is framed as science, industry, infrastructure, defence, climate capability or a broader enabler of societal resilience. The next sections look at the capability base of each country. This includes universities, research institutes, talent pipelines, RTOs, testbeds, ground infrastructure, launch or mission infrastructure, incubation environments and other enabling organisations. Particular attention is paid to how research and early-stage innovation are translated into higher-TRL development, commercialisation, public sector uptake and industrial scale-up.

Each chapter then maps the industrial and service landscape, covering upstream, midstream, downstream and space-enabled actors. Where data is available, the chapters include information on the number of companies or actors, employment, turnover, export orientation and value-chain distribution. The patent analysis is used as a supplementary indicator of technological specialisation and innovation activity. It is not treated as a complete measure of innovation, since many space-related technologies are not patented for commercial, strategic or security-related reasons.

The chapters also include examples or short cases where the material supports it. These cases illustrate how specific companies, missions, technologies or application areas reflect the wider national strengths and bottlenecks. They are used analytically rather than promotionally: The aim is to show how the ecosystem works in practice. Finally, each chapter synthesises the findings through points of agreement and disagreement across interviews, a SWOT analysis, an overall assessment and a discussion of Nordic cooperation from the country's perspective.

Taken together, the country chapters show that the Nordic space ecosystem is not one uniform system. It is a set of specialised national ecosystems with different strengths: research, launch and ground infrastructure, Earth observation, satellite communications, navigation, Arctic applications, testing, data services, defence relevance and downstream adoption. Therefore, the analytical task is to understand the individual country profiles and the complementarities between them. This is the basis for assessing where Nordic cooperation could add real value.



Artist view of The James Webb Space Telescope. ESA – D. Ducros.

1. Denmark

Denmark's space ecosystem is compact and specialised. This assessment is based on desk research, national strategy documents, available company and patent mappings as well as interviews with Danish actors from different parts of the ecosystem. The interviews cover public policy, ESA coordination, commercialisation support, business development, specialised space hardware, human-spaceflight-related technology and a new satellite-enabled Arctic robotics startup.

Interviews were conducted with the following individuals:

Figure 1. Danish interviewees

Interviewee	Job title	Organisation	Role in the ecosystem
Peter Mandix Sehestedt	Senior Adviser/ Chief Adviser, Space Strategy and Partnerships	Danish Agency for Higher Education and Science/ Ministry of Higher Education and Science	Public coordination, national strategy, ESA, regulation and policy
Sune Nordentoft Lauritsen	Managing Director/ Head of DTU Space Ventures	Space Ventures/ESA BIC Denmark/ESA Technology Broker	Commercialisation, startup and SME support as well as the bridge between space and business
Thomas Hofman-Bang	CEO	The Danish Industry Foundation	Business development, ecosystem support, scale-up and support for ESA BIC Denmark
Thomas A. E. Andersen	CEO/Managing Director	Danish Aerospace Company	Human spaceflight, astronaut equipment, extreme environments and dual-use

Interviewee	Job title	Organisation	Role in the ecosystem
Damir Ljubicic	Chief Executive Officer	Space Composite Structures DENMARK ApS	Specialised space hardware and composite structures for satellites and spacecraft
Nicoline L. Thomsen	CEO/Co-founder	Aaveq Robotics	Arctic robotics startup using satellite communication for unmanned maritime logistics

Together, the interviews present Denmark as a small but capable space nation. Denmark does not have the domestic market, sovereign launch infrastructure or large prime contractors found in larger space economies. Its position instead rests on strong research environments, internationally relevant niches, ESA participation, specialised companies and a growing support infrastructure for startups and commercialisation.

There is broad agreement on this basic picture. Peter Mandix Sehestedt describes Denmark as a specialised and capable ecosystem, but not one dominated by large primes or system integrators. Sune Nordentoft Lauritsen similarly argues that Denmark should not try to cover the full space value chain. Instead, Denmark should compete through selected niches where research, engineering and application capabilities can become globally relevant.

The Aaveq Robotics interview adds an important angle. It shows how Danish space relevance can emerge indirectly, through companies that do not primarily identify as space firms. Aaveq is a robotics and maritime logistics startup, but its Arctic business model may depend on satellite communication for remote operation in Greenlandic fjords. This makes it a downstream or space-enabled case rather than a traditional space company.

1.1 Strategic framing and public coordination

Denmark's new national strategy for space research and innovation marks a shift in how space is understood in Danish policy. Space is framed not only as a scientific field, but also as a strategic domain linked to climate action, security, defence, preparedness and business development. This positions space as a cross-cutting capability for both societal resilience and economic competitiveness. Peter Mandix Sehestedt describes the strategy as a major elevation of space within Danish policy and as a 'game changer'. In his view, space has been placed among a small number of prioritised research and innovation areas, supported by increased funding, stronger Danish participation in ESA and a new national space programme under Innovation Fund Denmark.

The strategy also gives national missions an important role as instruments for capability-building. Missions are not only scientific projects; they are expected to connect universities, public authorities and companies as well as to help Denmark build technological depth in a small national ecosystem. This is particularly important because Denmark cannot compete primarily through scale. Instead, it must concentrate resources around selected strengths and organise collaboration so that a limited number of actors can function as a more coordinated national system.

The Ministry of Higher Education and Science as well as the Danish Agency for Higher Education and Science form the central public coordination layer. They coordinate Danish ESA interests, regulate satellite launches by Danish operators or from Danish territory and contribute to cross-government coordination. In a small ecosystem, this role is unusually important because a small number of missions, programmes and institutional choices must carry much of the system-building effort.

The Danish space office was established to gather responsibilities that had previously been spread across government, and its role includes coordinating Danish interests in ESA, regulating and approving satellite launches by Danish operators or from Danish territory and contributing to cross-government coordination.

In a small ecosystem, this coordinating role is especially important. A limited number of national missions, programmes and policy instruments must do a large amount of system-building work. Therefore, the Danish strategy is not only a research policy document, but also an attempt to connect space more directly to national priorities in security, defence, preparedness, climate, nature, biodiversity and commercial development. It also places Denmark's international cooperation primarily within European frameworks, especially ESA, EU space programmes, Horizon Europe, EUSPA and EUMETSAT.

ESA is central in almost all interviewee accounts, but its role is interpreted differently. From the ministry perspective, ESA is the main institutional arena through which Denmark can build capabilities and influence priorities as a member state. Peter Mandix Sehestedt is clear in holding that the Danish strategy is largely about strengthening participation in ESA while also creating complementary national instruments. Sune Nordentoft Lauritsen takes a more commercialisation-oriented view: ESA is essential because it builds technical capability, legitimacy and experience, but it is not the end market. For firms to scale, they must use ESA-enabled capabilities in broader commercial markets.

Space Denmark complements the formal policy layer by functioning as a sector platform and outward-facing gateway. Its value lies in helping firms, researchers and institutions find each other and in making the Danish ecosystem easier for foreign partners to understand. For a small country with many specialised actors, this brokerage function is strategically useful.

1.2 Universities and talent as the core capability base

The university layer is one of the foundations of the Danish space ecosystem. The national strategy describes Danish space activity as organised around three main university hubs: DTU, Aarhus University and Aalborg University, with a fourth hub being prepared at the University of Southern Denmark. This indicates that Denmark's knowledge base is not concentrated in a single institution but rather distributed across a small number of specialised environments.

The interviews reinforce this picture. Peter Mandix Sehestedt highlights strong university environments and notes that universities use space to attract students and talent. He points to DTU's dedicated education in the field, Aarhus University's growing interest and the DISCO student satellite initiative involving several universities. He also singles out Aalborg as an example of how education, talent and company development can reinforce one another.

DTU Space remains one of Denmark's most central research and engineering actors. It provides capabilities in space systems engineering, high-precision instrumentation, satellite navigation, mission participation and specialist education. Sune Nordentoft Lauritsen points, in particular, to DTU's advanced optical camera technology, which he says has flown on more than 100 satellite missions, and to DTU's internationally strong position in satellite navigation.

Aarhus University is important especially in the scientific and mission-oriented parts of the ecosystem. Through Aarhus Space Centre and participation in national mission activities, it contributes to both research excellence and the interface between scientific missions and industry.

Aalborg University adds a different capability profile: practical spacecraft engineering, small-satellite experience, student satellite programmes and a long tradition of using space as an engineering education platform. This makes Aalborg particularly important for hands-on talent development and small-satellite heritage.

University of Southern Denmark contributes more clearly to the actor map. Aaveq Robotics began as a student project in the robotics engineering environment in Odense, and Nicoline L. Thomsen herself is a drone engineer from SDU. The case shows that space-enabled innovation may also emerge from adjacent fields such as robotics, autonomy and maritime technology, not only from traditional space departments.

The interviewees broadly agree that the research base is strong. The disagreement lies in how it should be converted into industrial growth. Policy and commercialisation actors see universities as an essential source of talent, technologies and startups. Damir Ljubicic from Space Composite Structures is more critical of a public space system that he sees as too university-centred. He does not reject universities, but he does argue that company

incentives differ from academic incentives: companies need deadlines, customers, turnover and the next contract, not just research collaboration.

1.3 RTOs as enabling and bridging actors

Research and technology organisations such as Danish Technological Institute, FORCE Technology and Alexandra Institute should be understood as enabling and bridging actors in the Danish space ecosystem rather than core space actors. Their role is not primarily to build satellites or operate missions, but rather to help firms move from research and prototypes to tested, validated and industry-ready solutions.

This role is important because several interviewees point to the same bottleneck: Denmark is strong in research and early innovation, but weaker in the transition to higher-TRL development, qualification and commercial maturation. Peter Mandix Sehestedt describes this as a remaining 'valley of death' between research and broader commercial uptake.

The most direct contribution from RTO institutes lies in testing, validation and qualification. Danish Aerospace Company specifically mentions its relationship with Danish Technological Institute, especially around vibration testing and technical facilities. Space Composite Structures also highlights the importance of testing, verification and manufacturing experience in space-grade composite structures. Its work combines design, manufacturing, testing, integration and verification, which illustrates the kind of applied capability where external test and technology environments can be relevant.

RTO institutes can help small and specialised space firms overcome barriers which they cannot easily handle alone: environmental testing, materials testing, calibration, metrology, documentation, certification support, production optimisation and demonstration. This is particularly relevant for hardware firms, where moving towards TRL 6–7 can be expensive and risky. They can also connect space to adjacent markets such as defence, maritime activities, climate monitoring, critical infrastructure, energy, agriculture and digital services. In that sense, they strengthen some of the weakest links in the Danish ecosystem: maturation, industrialisation, cross-sector application and SME access to specialised infrastructure.

1.4 Funding, incubation and commercialisation support

The Danish funding and incubation layer is relatively well-defined, but it is still developing. ESA BIC Denmark, Space Ventures, the ESA Technology Broker, Innovation Fund Denmark, EIFO and The Danish Industry Foundation all play different roles.

Space Ventures presents itself as a practical bridge between space and Danish business development. Its mission is to commercialise space for the benefit of Denmark, with one

track for startups through ESA BIC Denmark and another for established firms through the ESA Technology Broker. The purpose is not only to support research, but also to help Danish companies turn space-related capabilities into viable businesses.

The Danish Industry Foundation plays a different role. Thomas Hofman-Bang describes the foundation as an actor 'at a distance': It is not a core space institution, but rather a catalytic supporter of initiatives that can strengthen business development, innovation and competitiveness. Its support for ESA BIC Denmark reflects this role. In his assessment, Denmark has meaningful space-related research and some industrial competence, but the sector remains small and underdeveloped in business terms. The central challenge to overcome is the gap between technological promise and company growth.

Innovation Fund Denmark is much broader than space, but it is important because it can fund research-based innovation and capability-building, including space technology calls and national programme activities. EIFO, likewise, is not a dedicated space fund, but it is relevant as a state-backed finance and export actor that can support company growth, exports and investment in strategic technologies.

The Aaveq interview adds a more granular view of how startup support works in practice. Aaveq has not grown through one single programme. It has done so through a chain of connected nodes: SDU Startup Station, BlueTech Startup Hub in Svendborg, ErhvervsFyn, Odense Robotics, ESA BIC Denmark, UArctic, ESANI in Greenland, Business Angel Network Greenland and personal mentors. Nicoline Thomsen's assessment of the Danish startup ecosystem is notably positive: She says the team has been surprised by how much help is available, especially for startups emerging from a university environment.

At the same time, Aaveq illustrates the classic hardware-startup gap. The company has been successful in obtaining soft funding because it sits at the intersection of technology, environment and health. However, it is now entering a more demanding phase where the need is no longer small grants but rather larger financing, commercial validation, operational testing and patient capital.

The interviewees agree that early-stage support has improved. However, they disagree somewhat on what is most urgent regarding the next steps. Sune Nordentoft Lauritsen emphasises the shortage of mature private investors and large pools of capital for hard-tech scaling. Thomas Hofman-Bang frames the same issue as a structural scale-up challenge: Denmark is good at generating knowledge and early entrepreneurial activity, but weaker at building larger and lasting companies. He stresses that deep-tech and hardware-oriented firms are notoriously difficult to scale because they require significant capital and long development timelines. Industrial actors place more emphasis on customers and contracts: capital matters, but companies also need real missions, industrial deadlines and procurement that creates learning through delivery.

1.5 Danish space industry and services

The latest mapping of space-related companies from 2017 identified around 200 Danish companies using an OECD methodology. The sector employed 2,378 full-time equivalents and generated a total turnover of DKK 6.2 billion, of which 53 per cent came from exports. The Danish space industry is diverse and highly specialised. For around one third of firms, space-related activities account for 75–100 per cent of turnover, while for just over 40 per cent, they represent less than 10 per cent. Companies with a high space-related turnover share are generally smaller, reflecting the presence of many niche firms with narrow product portfolios.

The sector is dominated by downstream activities, with 145 downstream firms compared with 62 upstream firms, and only 15 companies are active in both segments. However, several firms note that the upstream/downstream distinction does not always capture their actual business models. Around 80 per cent of Danish space firms are micro or small enterprises, while larger firms often operate in adjacent defence, security and aerospace markets. The industry is relatively young, with an average founding year of 1999. Downstream firms tend to be younger, reflecting the expansion of satellite data applications across business domains.

The leading company examples illustrate Denmark's profile. Terma is one of the clearest examples of an established Danish space company with advanced systems capabilities and long-standing international relevance. GomSpace represents Danish strength in small satellites and mission systems. Space Inventor is a newer example of a firm working on small-satellite platforms and missions. Danish Aerospace Company represents a very different niche: human spaceflight, astronaut health, exercise equipment and operational systems for extreme environments.

The interview with Danish Aerospace Company shows how specialised some Danish positions are. DAC has developed medical and exercise equipment for astronauts since 1988, supplied exercise bicycles for Space Shuttle missions and has had equipment on the International Space Station since 2000. The company's core is not satellites, launch systems or passive components, but rather systems that monitor and maintain human performance in space and other demanding environments. Andersen repeatedly defines DAC's relevance through the phrase 'human in the loop'.

The same interview also shows how Danish space niches may expand into adjacent dual-use markets. DAC increasingly applies its capabilities to defence, emergency preparedness and extreme environments on Earth. Andersen's view is that the Danish ecosystem is less central to DAC in traditional human spaceflight, where the company's market is international, but it becomes more relevant when the company moves into defence and dual-use applications.

Space Composite Structures represents another specialised industrial profile. The company designs, manufactures and tests composite structures for satellites and spacecraft. Damir Ljubicic stresses that the firm is not only an engineering consultancy: It manufactures hardware. Its strengths lie in combining engineering, manufacturing, testing and agility for low-volume, high-requirement space structures. At the same time, Damir is more sceptical than other interviewees about whether Denmark has a true industrial space ecosystem yet. In his view, Denmark has capable individual firms, but it lacks a prime contractor structure, domestic missions and a supply chain built around Danish space projects.

The Aaveq case expands the industrial picture further. Aaveq is not a classical space firm, but it is a space-enabled company. Its unmanned vessels may depend on satellite communication for remote operation in areas where 4G coverage is poor or blocked by terrain. Through ESA BIC Denmark, Aaveq has tested OneWeb and Starlink connectivity in Greenlandic fjords. This shows how space infrastructure can become part of a broader service model in robotics, maritime logistics and Arctic waste management.

CASE · AVEC ROBOTICS

Aaveq Robotics uses satellite data in a maritime garbage truck in the Arctic

Aaveq Robotics is a Danish robotics startup developing unmanned surface vessels for maritime logistics in Greenland and the wider Arctic. The company began as a student project at the University of Southern Denmark, initially exploring whether unmanned boats could be used for oil spill response in Arctic waters. A formative stay in Qaqortoq changed the company's direction. After a local waste dump caught fire and municipal actors pointed to waste as a more urgent problem, Aaveq shifted towards maritime waste collection for small settlements.

The company's first application is a small 'maritime garbage truck': an unmanned or remotely operated boat that can collect everyday waste from remote settlements and transport it to central handling points. This is relevant because many Greenlandic settlements are not connected by roads, labour is scarce and conventional vessels can be costly or impractical for frequent small-scale collection.

Aaveq is relevant to the space ecosystem because satellite communication may become a key enabler of its service model. The company received support from ESA BIC Denmark to test whether satellite communication could provide sufficient bandwidth, latency and reliability for remote operation in Greenlandic fjords. The team has tested OneWeb and Starlink equipment in Greenland, and

Nicoline Thomsen's first impression was that satellite communication looked more feasible than expected, especially because of Starlink's network.

The case illustrates three broader points about the Danish ecosystem. First, space-enabled innovation can emerge from adjacent sectors, such as robotics, maritime services and environmental infrastructure. Second, Danish startup support works through connected nodes rather than one central system. Third, Arctic and North Atlantic use cases can create demanding test environments where satellite-enabled solutions become practically necessary rather than technologically optional.

Aaveq also nuances the Nordic cooperation agenda. Nicoline Thomsen does not see Norway as the most obvious first market, even though it is Arctic, because Norway has roads and stronger internal infrastructure in many areas. The key problem is not the cold climate alone, but also the combination of labour shortages, no roads between settlements and dependence on maritime logistics. This makes Greenland, Alaska and northern Canada more relevant early markets.

1.6 Innovation landscape and patents

Denmark's patent sample is smaller than those of Finland and Sweden, but it shows a coherent and recognisable profile. One important strand is small satellites and satellite-enabled services. GomSpace appears with patents linked to LEO satellites and air-traffic communication, illustrating Denmark's role in applying small-satellite capabilities to practical infrastructure challenges. Satcom-related patents point towards telecommunications applications, including management of satellite-link resources.

CASE · QUADSAT

Airborne simulation of satellite orbital behaviour for antenna testing

Quadsat's airborne satellite orbital simulator is one of the most inventive Danish entries in the sample. Rather than building a satellite itself, the company appears to simulate satellite movement using unmanned aerial systems in order

to test and evaluate ground terminal antennas. This is an appealing innovation because it reduces the distance between laboratory testing and real operational conditions. Satellite communication systems are often difficult and expensive to validate in realistic settings, especially before launch or deployment. Therefore, an airborne simulator may offer a more flexible and lower-cost way to test performance, identify weaknesses and improve products earlier in the development process. The wider significance is that future space innovation will depend not only on satellites in orbit but also on better testing, calibration and validation tools on Earth.

Quadsat represents a distinctively Danish form of space-sector innovation: highly specialised, application-oriented and positioned in the enabling layers of the value chain. The company's role in the sample suggests strength in test infrastructure and measurement rather than in spacecraft manufacturing itself.

Another theme is enabling technologies around the space sector rather than full spacecraft platforms. Quadsat's airborne satellite orbital simulator is a strong example: It supports the testing and validation of satellite communication systems from the ground or near-ground environment. This suggests a Danish strength in specialised tools, test equipment and enabling services around the satellite value chain. Danish Aerospace Company adds a human-spaceflight dimension through astronaut exercise equipment, while Terma contributes systems-oriented capabilities relevant to safety and distributed control in satellite technology.

Therefore, the patent evidence does not point to a broad Danish patent base across all space domains. Instead, it points to focused niches where space intersects with applied engineering, system integration, testing, human-spaceflight support, communication services and small-satellite applications. This matches the interview-based picture: Denmark's strength is not scale but rather specialised and practical capabilities.

1.7 Overall assessment for Nordic cooperation seen from Denmark

Denmark appears as a small but capable space nation with a clearer strategic direction than before. Its strengths lie in specialised research environments, technical niches, ESA experience, selected globally relevant firms and a growing understanding that space is a strategic capability for security, resilience, climate action and business development.

The main weakness is scale. Denmark has research quality, strong individual firms and an improving startup pipeline, but it lacks the industrial depth, large customers, domestic

procurement volume and scale-up capital needed to turn more capabilities into larger companies and integrated value chains. Therefore, several actors suggest that the next phase should focus less on general ecosystem support and more on capability-building through missions, demonstration, qualification, procurement and commercial market access.

A recurring message is that Danish space policy must bridge two logics. One is the research and ESA logic, which has built knowledge, credibility and international participation. The other is the industrial and commercial logic, where firms need customers, deadlines, certification, production experience, investment and repeated delivery. The Danish ecosystem will become stronger if these two logics are connected more directly.

The Aaveq Robotics case shows that this should not only be understood as a traditional space-industry challenge. Space-enabled innovation may come from companies working in robotics, maritime logistics, environmental services and Arctic infrastructure, where satellite communication or space-based data becomes a necessary enabling layer. This widens the relevant ecosystem and strengthens the argument for a broader definition of space technology.

Figure 2. SWOT for Danish Space Ecosystem

Strengths	Weaknesses
Strong research and knowledge base at DTU, Aarhus University, Aalborg University and emerging environments at SDU.	Small and fragmented industrial ecosystem with limited domestic prime contractor capacity.
Specialised industrial niches in small satellites, instrumentation, star trackers, satellite electronics, composite structures, human-spaceflight equipment, testing and selected downstream applications.	Weak transition from research and startup formation to scale-up, higher TRL, qualification and commercial maturation.
Clearer political recognition of space as relevant to security, defence, preparedness, climate, green transition and business development.	Limited domestic demand, rather few national missions and insufficient recurring procurement opportunities.
Strong ESA connection, giving Danish actors legitimacy, technical learning, networks and access to programmes.	Capital and working-capital constraints, especially for deep-tech and hardware firms with long development cycles.
Collaborative culture, short distances and trust between universities, companies and public actors.	Shortage of specialised aerospace, composite, component-level and project management competences.
Opportunities	Threats
Use national or Nordic missions as instruments for industrial capability-building.	Denmark may remain a subcontractor ecosystem if companies do not gain access to larger missions and work packages.

Opportunities	Threats
Expand downstream and space-enabled services in climate, maritime activities, agriculture, logistics, infrastructure, defence and public sector services.	Larger countries and US new space actors may move faster and capture value before Danish companies can scale.
Build dual-use and defence applications around North Atlantic monitoring, Arctic surveillance, emergency preparedness and extreme environments.	ESA dependency may reinforce slow, documentation-heavy processes that do not always fit commercial new space markets.
Strengthen commercialisation through ESA BIC Denmark, Space Ventures, the ESA Technology Broker, Innovation Fund Denmark, EIFO and The Danish Industry Foundation.	Political momentum may weaken if the strategy is not followed by funding continuity, missions and implementation.
Use Nordic cooperation to create critical mass, shared test infrastructure, stronger ESA positioning and more international visibility.	Nordic cooperation may remain symbolic if it is not connected to missions, funding, procurement and industrial work packages.

From a Danish perspective, Nordic cooperation is attractive when it helps compensate for Denmark's limited scale. The most obvious opportunity is to create mission-driven initiatives that Denmark could not organise alone. Joint Nordic missions or constellations in areas such as Arctic weather, maritime monitoring, environmental observation, secure communications, defence preparedness or North Atlantic surveillance could create real demand for Nordic suppliers and help firms mature their technologies through concrete deliveries.

A second opportunity is coordinated Nordic engagement in ESA. Denmark has limited weight as a small member state, but a more aligned Nordic position around selected technologies, missions or application areas could create greater visibility and influence. This would be especially relevant if Nordic countries use ESA as a practical cooperation framework rather than trying to build a separate Nordic system from scratch.

A third opportunity lies in shared test, demonstration and qualification infrastructure. Small Danish firms face high costs when moving technologies to higher TRL levels. A Nordic test and validation network could make existing facilities more visible and accessible, reduce duplication and help firms qualify products faster.

A fourth opportunity concerns dual-use, defence and Arctic applications. Danish actors see growing relevance in the overlap between space, defence, preparedness, maritime awareness, extreme environments and critical infrastructure. Nordic cooperation could be particularly useful where shared geography and security interests create common needs, especially in the Arctic and North Atlantic.

The main limitation is that Nordic cooperation is not currently the primary organising framework for Danish space policy. ESA, the EU, Horizon Europe, EUSPA and EUMETSAT remain more operationally important because they provide established

programmes, funding and infrastructure. The Nordic level is relevant, but not yet strongly institutionalised in Danish strategy. Another limitation is that national actors often know their own ecosystems better than those of neighbouring countries. Therefore, a mapping exercise is valuable because it can reveal where complementary strengths actually exist.

Therefore, the Danish view of Nordic cooperation is pragmatic rather than symbolic. The interviewed actors are generally positive, but they do not see Nordic collaboration as valuable, simply because it is Nordic. It becomes valuable when it creates critical mass, real missions, stronger ESA positioning, access to complementary capabilities, test and demonstration opportunities, defence- and Arctic-relevant solutions as well as clearer routes to market.



Artist rendition of fictitious space station orbiting earth. iStockphoto.

2. Finland

Finland's space technology combines a strong new space profile, advanced telecommunications capability, globally visible Earth observation companies, deep research expertise and a growing policy interest in resilience, defence and security of supply. Compared with Sweden and Norway, Finland does not have the same scale of traditional space infrastructure, launch activity or long-established state-owned space operators. Instead, its profile is shaped by startups, research institutes, university-based commercialisation, digital capabilities and a small number of internationally visible growth companies.

Therefore, the Finnish ecosystem is best understood as a relatively young but increasingly mature space economy. It is not built around one dominant prime contractor or a single national infrastructure asset. Rather, it has developed through a combination of public strategy, ESA participation, Business Finland instruments, Aalto University's role in new space development, applied research organisations as well as firms, such as ICEYE, Nokia, ReOrbit, Kuva Space, Aurora Propulsion Technologies, and emerging PNT actors such as SharpNav. In the wider Nordic ecosystem, Finland appears particularly strong in the digital and operational layer of space systems: satellite communications, non-terrestrial networks, Earth observation, SAR, positioning, data services and space-enabled resilience.

This chapter is based on desk research, national strategy and policy material, ecosystem mapping, patent data and interviews with Finnish and Nordic actors. The interviews were used to test and nuance the desk-based mapping and to understand how actors assess Finland's strengths, bottlenecks, commercialisation conditions and potential for Nordic cooperation.

Interviews were conducted with the following individuals:

Figure 3. Finnish interviewees

Interviewee	Job title	Organisation	Role in the ecosystem
Tero Vihavainen	Senior Adviser on Space Policy	Ministry of Economic Affairs and Employment	National space policy, public coordination, ESA/EU interface and industrial policy
Kaisa Ahonen	Project Manager ESA BIC Finland	Aalto Startup Center/ESA BIC Finland	Startup incubation, early-stage support, commercialisation and ESA-linked entrepreneurship
Mikko Punjala	Founder and Chairman of the Board	SharpNav Oy	Startup developing resilient LEO-PNT capabilities
Renske Martijnse-Hartikka	Senior Project Manager	Forum Virium Helsinki/Space4Cities	City innovation, downstream applications, Copernicus data and public sector demand
Tapio Tourula	Chief Preparedness Specialist	National Emergency Supply Agency	Security of supply, resilience, PNT, remote sensing and satellite communications
Jarkko Koskinen	Deputy Director General	Finnish Geospatial Research Institute (FGI)	Research in geodesy, GNSS, Earth observation, SST and applied space data
Jyri Heilimo	Representative	Finnish Meteorological Institute (FMI)	Meteorology, remote sensing, space weather, ground station operations and satellite data
James Francis	Fellow Researcher	European Space Policy Institute	Nordic and European space policy perspective
Tima Latvala	Director, Space Business Area	GoFore	Private company
Heidi Kuusiniemi	Professor, Wireless Systems	Tampere University	Research on wireless systems
Tiina Nurmi	Chief Adviser	Business Finland	Business ecosystem perspective

Taken together, the interviews suggest a Finnish ecosystem with strong momentum, high innovation capacity and a clear set of internationally relevant niches. Interviewees broadly agree that Finland has a strong basis in telecommunications, Earth observation, SAR, GNSS/PNT, space data, security of supply and startup-driven innovation. They also point to recurring bottlenecks: scale-up capital, access to anchor customers, limited domestic

market size, gaps between ESA and non-ESA activities as well as the need to connect technical capability more strongly to end-user demand.

2.1 Strategic framing and public coordination

Finland has developed a relatively clear strategic framing of space as both an industrial opportunity and an enabling infrastructure for society. The policy perspective is not limited to satellites and scientific missions. It links space to innovation, digitalisation, public administration, national resilience, security of supply, defence, Arctic conditions and the use of satellite data. In the conducted ministry interview, Tero Vihavainen describes the Finnish ecosystem as highly functional and the result of more than a decade of long-term development, with ecosystem building forming part of both the 2018 space strategy and the updated 2025 strategy. From this perspective, public administration should primarily act as an enabler, helping the sector grow without becoming overly directive.

The Ministry of Economic Affairs and Employment is the central public coordination actor. Its role is to coordinate national space policy across branches of government and to support growth of the space sector from an industrial policy perspective. The Finnish Space Committee links ministries and relevant public actors, while international coordination takes place through ESA, the EU Space Programme, EUSPA, the European Commission, the EU Council, UN COPUOS, bilateral partnerships and Nordic cooperation. This gives Finland a multi-layered governance structure in which national policy, ESA participation, EU programmes and commercialisation instruments are all relevant.

A notable feature of the Finnish framing is the emphasis on space as a societal dependency. Vihavainen points to the growing importance of satellite data in public administration, critical infrastructure and wider societal functions. Tapio Tourula from the National Emergency Supply Agency makes a similar point from a security-of-supply perspective: PNT, remote sensing and satellite communications are increasingly important to the continuity of critical societal functions, especially in exceptional circumstances. This means that space is no longer treated only as a research or high-tech industry. It is also becoming part of Finland's preparedness and resilience architecture.

ESA remains highly important, but interviewees do not present it as the only relevant framework. For Vihavainen, ESA activities are important for expertise-building and international networks, while EU programmes such as CASSINI and the EIC, Business Finland instruments, Space Finland communication activities, accelerators and Research to Business funding are also important. Kaisa Ahonen similarly describes ESA BIC and ESA Phi-Lab as central for startup support, credibility and international connectivity, but also notes that significant innovation occurs outside ESA frameworks, including ICEYE, ReOrbit and EUSPA-related activities.

There is some disagreement about how well the system is connected. Policy actors tend to emphasise long-term strategic development and the value of open, discussion-oriented cooperation. Startup and commercialisation actors recognise these strengths but are more likely to point to the gaps between different parts of the ecosystem. Ahonen sees the connection between ESA and non-ESA activities as relatively weak, with no complete overview linking the ecosystem. Punnala describes Finland as small and well connected but also argues that the collaboration between companies remains limited and that broader new space ecosystem initiatives beyond ESA-related activities are needed.

2.2 Research, universities and talent as the capability base

Research and education are central to Finland's space ecosystem. Aalto University has a particularly visible role, both through satellite development and through its position in commercialisation infrastructure such as ESA BIC Finland and ESA Phi-Lab Finland. Several interviewees point to Aalto as the main active institution in satellite development and as one of the foundations of Finland's new space ecosystem. Punnala highlights Aalto University's space engineering education and commercialisation pathways as a key strength, while Ahonen describes Aalto and collaborative research networks as important capability-building environments.

The research base extends beyond Aalto. Tampere University, the National Land Survey of Finland, VTT Technical Research Centre of Finland, the Finnish Geospatial Research Institute (FGI) and the Finnish Meteorological Institute (FMI) are all relevant to the Finnish ecosystem.

Finland is particularly strong in space geodesy, satellite navigation, remote sensing and space surveillance and tracking. FGI works with GNSS, Earth observation, gravity measurements, triangulation, satellite tracking, space debris and near-Earth objects, and it collaborates with ESA, NASA, JAXA, the Finnish Government, the Defence Forces, NATO, universities, CSC and VTT. It also provides data and services to more than 150 end-user organisations in sectors such as forestry, mining and agriculture. This illustrates how Finnish research institutes can act not only as scientific actors, but also as providers of operationally relevant infrastructure and data services.

FMI is active in weather-related remote sensing, atmospheric and land-surface remote sensing, ionospheric research, Earth magnetic-field research, space weather, satellite instrumentation and ground station activity, especially at Sodankylä. Its work connects to EUMETSAT, Copernicus, Destination Earth, ECMWF, ESA, NASA and NOAA. The interview also describes the Finnish ecosystem as being in a 'boom' phase, with new space activity raising awareness across the whole field.

The interviewees agree that Finland has strong technical talent, but they differ on whether the research base is already sufficiently broad. Ahonen is cautious, suggesting that the research base is still developing and not yet strong enough overall, with Aalto standing out more clearly than the wider institutional landscape. Vihavainen adds that Finnish academia can still be too disciplinary, with too little multidisciplinary space-related research. This suggests that Finland's research base may be strong in specific technical domains, but that broader interdisciplinary capacity—combining engineering, data, regulation, business, policy and end-user understanding—still needs development.

Talent needs are also changing. The issue is no longer only whether Finland can produce engineers and scientists. Punnala points to gaps in commercialisation, regulation, systems integration and business scaling. James Francis makes a similar point at the Nordic level, arguing that space education remains highly technical and that more attention needs to be paid to space law, business, policy, data utilisation and societal applications. Therefore, the Finnish ecosystem has a strong technical foundation, but its next phase requires broader competences that can connect technology development to markets, regulation, procurement and public sector use.

2.3 RTOs, testbeds and enabling infrastructure

Finland's enabling infrastructure is distributed across research institutes, digital infrastructure, ground stations, test environments, innovation platforms and public sector use cases. Unlike Norway and Sweden, Finland is not primarily defined by major launch or polar ground-station infrastructure. Its enabling layer is more closely associated with data, telecommunications, geospatial research, weather and space-weather services, satellite development, city testbeds and digital public sector applications.

VTT Technical Research Centre of Finland is one of the central applied research actors, particularly where space overlaps with telecommunications, electronics, sensing, materials, digital technologies and industrial applications. Several interviewees identify VTT as part of the Finnish capability base, especially in relation to research translation and applied technology development. In a Finnish context, RTOs and applied research environments should be seen as bridging actors: They are not necessarily the most visible commercial space companies, but they help connect research, industry, public needs and technology maturation.

FGI and FMI are also enabling infrastructure actors, not only research organisations. FGI provides expertise and data in geodesy, GNSS, Earth observation and SST, while FMI contributes remote sensing, meteorology, space weather, calibration and validation as well as ground-station-related capabilities. These institutions matter because the value of space technology depends on trusted data, operational continuity, calibration, validation and the ability to translate satellite observations into useful services.

Sodankylä appears as an important northern data and ground-station environment. Its relevance lies not only in infrastructure, but also in Finland's northern geography and long-standing remote sensing competence. Compared with Norway's Svalbard and Sweden's Kiruna/Esrang environments, Finland's Arctic infrastructure may be less dominant in the Nordic space landscape, but it remains important for national capability, calibration, validation and northern-condition applications.

Living labs and city-based test environments are another important part of the Finnish enabling layer. Renske Martijnse-Hartikka's interview highlights Forum Virium Helsinki's work with Space4Cities, Regions4Climate and PCP Wise, using Copernicus Earth observation data for city planning and climate resilience. Her point is that cities are often overlooked actors in the space ecosystem, even though they can act as end users, co-developers and procurers of space-enabled solutions. Living lab environments can help test applications beyond traditional calibration and validation sites and improve the alignment between technical developers and real public sector needs.

Several interviewees point to infrastructure gaps. Ahonen mentions the need for more specialised laboratory infrastructure for startups. Punnala notes that companies often need to fund demonstrations themselves and that national and Nordic pilot opportunities are limited. Martijnse-Hartikka adds that access to Earth observation data remains difficult for non-technical users and that EO processing can be resource- and energy-intensive. These observations suggest that Finland has strong enabling institutions, but still lacks a fully integrated test, demonstration and validation pathway for turning space technologies and data products into deployable services.

2.4 Funding, incubation and commercialisation support

Finland has a relatively well-developed early-stage support structure for space entrepreneurship. ESA BIC Finland, operated through Aalto Startup Center, supports startups under five years old with funding, business development, technology access and ESA-linked credibility. Ahonen describes ESA BIC Finland as active across upstream, downstream and technology transfer, with hub locations and collaborators including the University of Vaasa, Turku, Tampere, Helsinki and Espoo. This gives the Finnish startup environment a visible entry point into the European space ecosystem.

ESA Phi-Lab Finland, Business Finland, Research to Business funding, EUSPA CASSINI, EIC instruments, venture capital and EU project funding are also part of the commercialisation landscape. Vihavainen describes Finnish space innovation as financed through Research to Business funding, early-stage funding programmes, Business Finland instruments and venture capital for startup and growth phases.

The main weakness is not startup formation but rather scale-up. This is one of the strongest areas of agreement across the interviews. Ahonen points to a gap between

early-stage startup support and larger-scale investment, with too few investors who understand space technologies. The scale-up stage is the main financing bottleneck, especially for funding rounds above €10 million. Punnala argues that early-stage support is more available than later-stage development funding close to deployment and TRL9.

Customer access is the second major commercialisation challenge. Space technologies often require long development timelines, significant upfront investment, regulatory clearance, technical validation and patient capital. Ahonen notes that startups can remain too technology-focused and insufficiently attentive to market needs, customer value and value-chain positioning. Punnala emphasises the importance of securing a first reference customer. Tourula adds that public sector procurement is often not agile enough to act as an early buyer of new services, especially where legal obligations, framework agreements and security considerations limit experimentation.

There is also a difference between support for technology development and support for market creation. Finland appears relatively strong at helping new actors form and access early development funding. It is less clear that the system consistently helps them move into procurement, commercial validation, export markets and larger institutional customers. This is especially important because the domestic Finnish market is small. Finnish firms must internationalise quickly, but the first reference customer, demonstration environment and export pathway can be difficult to secure.

2.5 Finish Space industry and services

Finland's national space strategy identifies around 200 companies operating in the space sector. A Business Finland/Space Finland survey provides a narrower view: Among the 30 responding companies, space-related turnover in 2022 was estimated at EUR 150 million, exports at EUR 100 million and employment at 808 people. A broader group of 70 Finnish space-related enterprises reported EUR 4.33 billion in total turnover and 12,794 employees, but these figures include the companies' wider business activities, not only space.

The Finnish space industry is characterised by a strong new space profile, several internationally visible growth companies, deep telecommunications capabilities and a broad group of small firms and research-linked ventures. The ecosystem does not have a large national prime contractor comparable to those found in larger European space nations. Ahonen sees this absence as both a weakness and a strength: It limits industrial anchoring, but it also encourages agility and startup-driven development.

Finland's most visible commercial strength is Earth observation. ICEYE is the clearest example and one of the strongest Nordic space companies overall. Its SAR satellite constellation, satellite operations and data services give Finland a globally recognised position in commercial Earth observation. Kuva Space adds another EO-related profile, particularly around hyperspectral imaging and small satellites. These companies make

Finland more than a downstream user of space data; they position the country as a producer of satellite infrastructure, data and operational services.

The second major industrial strength is telecommunications and non-terrestrial networks. Nokia remains a crucial actor, even though space is only one part of its wider business. In the patent analysis, Nokia is one of the strongest Finnish actors, with patents linked to satellite switching, assistance information, timing, handover and communication protocols for non-terrestrial networks. This points to a Finnish role in integrating satellites into future mobile networks rather than treating satellites as isolated infrastructure. Finland's wider telecommunications heritage, including radio technology, antennas, SATCOM, GOVSATCOM and network intelligence, is repeatedly highlighted by interviewees as a national strength.

A third area is positioning, navigation and timing (PNT). SharpNav represents a new entrepreneurial effort in resilient LEO-PNT, while FGI and related research environments provide the knowledge base for GNSS, geodesy and navigation. Punjala argues that Finland has strengths in PNT and GNSS that are not always fully visible within the wider ecosystem, and that resilient PNT could become an important field for national and Nordic cooperation.

A fourth area is spacecraft subsystems and specialised enabling technologies. ReOrbit, Aurora Propulsion Technologies and other specialised companies indicate capabilities in satellite platforms, propulsion, mission architecture and enabling subsystems. Aurora's propulsion-related patent points to compact propulsion solutions for small spacecraft, which are increasingly relevant as constellations grow and requirements for manoeuvring, orbit correction and debris mitigation become more important.

The downstream and space-enabled layer is growing but uneven. Forum Virium Helsinki's work shows how space data can support cities, climate resilience and planning. NESA's perspective shows how space services are becoming relevant for security of supply, preparedness and critical societal functions. However, Martijnse-Hartikka argues that Finland is still more hardware- and data-production-oriented than end-user-service-oriented, with too little emphasis on accessible services for non-technical users. This is an important observation: Finland has strong upstream and midstream capability, but the next wave of value may depend on stronger downstream integration into cities, public agencies, industry and critical infrastructure.

2.6 Innovation landscape and patents

The patent sample indicates that Finland is one of the two strongest Nordic countries in space-related patenting, alongside Sweden. In the wider Nordic patent analysis, Sweden and Finland account for the largest shares, each at around 45 per cent of the identified space-related patent sample. Finland's portfolio is led by Nokia and ICEYE, which

together point to strengths in non-terrestrial networks, satellite communications, Earth observation, constellation management and spacecraft subsystems.

The patent data should be read as an indicator of technological orientation, not as a complete measure of innovation. Some firms do not patent because they prefer secrecy, speed, software-based advantage or trade secrets. Defence, dual-use and security-sensitive technologies may also be underrepresented. Nevertheless, the Finnish patent pattern is analytically useful because it points to a coherent profile: digital infrastructure, communications, satellite data, operations and selected spacecraft technologies.

Nokia's patents point towards the integration of satellites into mainstream telecommunications. Several patent families concern satellite switching, assistance functions, timing, handover and store-and-forward communication. The broader significance is that Finnish innovation is not only about building satellites, but also about making satellite connectivity work as part of everyday digital infrastructure. This could become particularly important for remote regions, maritime connectivity, emergency communications, defence resilience and connectivity during terrestrial network failure.

ICEYE's patents point to another type of innovation: modular SAR satellite architecture, constellation operations and motion analysis from radar data. The significance lies in both satellite manufacturing and operational intelligence. As Earth observation shifts from occasional image acquisition to constellation-based monitoring, value is increasingly created through tasking, prioritisation, interpretation and delivery of actionable information. Therefore, ICEYE's patent profile places Finland in both the upstream and downstream parts of the value chain.

The patent sample also suggests smaller but important Finnish niches in propulsion, small-satellite systems and enabling technologies. Aurora Propulsion Technologies illustrates how specialised startups can contribute critical subsystems for small spacecraft. Taken together, the Finnish patent landscape supports the wider interview finding: Finland's strength is not scale across every part of the space value chain, but rather depth in specific areas where digital, telecommunications, satellite operations and data capabilities intersect.

CASE · SHARPNNAV

Resilient LEO-PNT for a more robust positioning infrastructure

SharpNav is a Finnish startup founded by Mikko Punnala in 2024. The company is developing a private LEO-PNT constellation with the ambition of providing centimetre-level positioning accuracy. Its focus is satellite-based positioning, navigation and timing, which is a field that is becoming increasingly important as societies depend more heavily on GNSS and as concerns grow about jamming, spoofing, resilience and strategic autonomy.

The company has several Finnish strengths all at once. It draws on Finland's GNSS and geospatial research base, collaboration with Tampere University, Aalto University and FGI as well as a wider national capability in telecommunications, radio technology, AI, autonomous systems and defence-related technologies. It also reflects the Finnish new space pattern: a technically specialised startup emerging from a strong knowledge environment and seeking to build a globally relevant service in a field where public sector resilience needs and commercial demand may grow together.

SarpNav is relevant because PNT is increasingly seen as critical infrastructure. Many digital, transport, logistics, energy, finance, defence and emergency systems depend on accurate timing and positioning. Traditional GNSS systems are powerful, but they are also vulnerable to interference and disruption. A resilient LEO-PNT constellation could add redundancy, accuracy and robustness, especially in northern and Arctic conditions where reliability is strategically important.

The case also illustrates several Finnish bottlenecks. Punnala points to fragmented funding pathways from early-stage concepts to operational deployment, limited late-stage development funding, the need for anchor customers and the small size of the domestic market. A company developing space infrastructure cannot solely rely on small grants or early venture funding. It needs demonstrations, regulatory support, spectrum and export processes, international partnerships as well as customers willing to validate and adopt the solution.

Therefore, SharpNav shows both the promise and the challenge of the Finnish ecosystem. The promise is a high-knowledge, globally relevant niche that combines space, security, resilience and digital infrastructure. The challenge is that such companies need more than technical expertise. They need patient capital, institutional customers, internationalisation support, regulatory capacity and demonstration opportunities. In that sense, SharpNav is not only a

company case; it is a test of whether Finland can turn new space expertise into strategic infrastructure businesses.

The case also has Nordic relevance. Punjala identifies resilient PNT as a strong area for Nordic collaboration, alongside weather services and imaging. A Nordic approach could be relevant because the countries share northern geography, critical infrastructure needs, security concerns and small domestic markets. Joint pilots, test environments or public sector demand aggregation could help firms like SharpNav move faster from technology development to operational validation.

2.7 Overall assessment for Nordic cooperation seen from Finland

Finland's main role in the Nordic space ecosystem is as a new space, data, telecommunications and operational-intelligence actor. It is not the Nordic country which is the most defined by launch infrastructure, ground-station scale or traditional aerospace primes. Instead, it contributes strong capabilities in SAR, Earth observation, satellite communications, non-terrestrial networks, GNSS/PNT, space data, startup commercialisation and resilience-oriented applications.

Its strongest capabilities are found in the combination of research, digital infrastructure and entrepreneurship. Finland has internationally visible firms, strong telecommunications heritage, advanced geospatial and meteorological research as well as a policy environment increasingly aware of space as critical infrastructure. The patent sample reinforces this assessment by showing a concentration of Finnish innovation around Nokia and ICEYE, with additional specialised activity in propulsion, small satellites and enabling systems.

The main bottleneck is scale. Finland can produce ideas, startups and technical breakthroughs, but interviewees consistently point to difficulties in moving from early development to larger commercial and operational scale. This includes access to patient capital, late-stage technology funding, anchor customers, procurement pathways, demonstration environments and international market entry.

For the ecosystem to develop further, Finland needs to strengthen the bridge between research, startups, public sector demand and scale-up finance. This does not necessarily require creating a large traditional prime contractor. It may instead require stronger mission-oriented procurement, better use of cities and public authorities as early

customers, stronger links between ESA and non-ESA frameworks, more space-aware investors and Nordic or European mechanisms for larger demonstrations.

Finland's strengths complement the other Nordic countries well. Sweden brings broad engineering depth, Esrange, hardware and industrial capabilities. Norway brings Arctic infrastructure, satellite operations, maritime monitoring and ground-segment strength. Denmark brings specialised engineering, small satellites, testing and application niches. Finland adds digital systems, SAR, EO operations, telecom integration and new space entrepreneurship. Together, these capabilities could support a more complete Nordic value chain than any one country could build alone.

Figure 4. SWOT for the Finnish Space Ecosystem

Strengths	Weaknesses
Strong new space profile. Finland has visible growth companies, startup activity and internationally recognised actors such as ICEYE, ReOrbit, Kuva Space and emerging PNT firms.	Limited scale-up capital. Several interviewees identify a gap between early-stage support and larger funding rounds, especially above €10 million.
Deep telecommunications and digital capability. Nokia, radio technology, SATCOM, GOVSATCOM and non-terrestrial networks give Finland a strong position in future connectivity.	Lack of large national primes. The ecosystem is agile, but it lacks large anchor companies that are primarily dedicated to space across the full value chain.
Strong EO, SAR and geospatial expertise. Finland is particularly visible in SAR, remote sensing, GNSS, geodesy and satellite data applications.	Fragmentation between developers and users. End-user needs, especially in cities and public sector applications, are not always well connected to technical development.
Strong public and research base. Aalto, VTT, FGI, FMI, Business Finland, ESA BIC and ESA Phi-Lab provide an important knowledge and support structure.	Small domestic market. Finnish firms need to internationalise quickly and often lack anchor customers for validation and growth.
Growing security and resilience relevance. Space is increasingly linked to security of supply, defence, PNT resilience, remote sensing and critical infrastructure.	Skills gaps beyond STEM. Interviewees point to needs in regulation, commercialisation, systems integration, policy, business and international scaling.
Opportunities	Threats
Resilient PNT and secure communications. Finland can build on telecommunications, GNSS and security-of-supply needs to develop strategic space-enabled infrastructure.	International competition. Larger European countries, US new space actors and better-capitalised firms may outpace Finnish companies.
Arctic and northern applications. Snow, ice, forests, climate resilience, remote connectivity and northern monitoring create strong Nordic and international use cases.	Ownership and strategic control may move abroad. Small companies may become internationally owned as they scale, potentially weakening national anchoring.
Downstream public sector markets. Cities, preparedness agencies and critical infrastructure users can become stronger demand-side actors for space services.	Public procurement may remain too rigid. If public actors cannot test or buy emerging services, companies may lack domestic validation opportunities.

Opportunities	Threats
Nordic cooperation on PNT, EO, weather and resilience. Shared geography and small markets make joint pilots, missions and funding instruments attractive.	ESA/EU and national frameworks may remain poorly connected. Fragmentation between funding systems and ecosystem forums could reduce the impact.
Joint Nordic scale-up mechanisms. A Nordic fund or shared demonstration infrastructure could address the capital and TRL maturation gaps.	Space may remain too technology-driven. Without stronger market orientation, startups risk developing impressive technology without clear customers.

From a Finnish perspective, Nordic cooperation is attractive because it can help overcome scale limitations. The Finnish ecosystem is strong in selected niches, but its domestic market, capital base and demonstration opportunities are limited. Nordic cooperation could create larger reference markets, shared pilots, common test environments and a stronger international profile.

The most promising area is resilience-related space infrastructure. Tourula sees strong opportunities in security of supply, critical infrastructure resilience and continuity of space-based services. Punnala highlights resilient PNT, weather services and imaging. Vihavainen points to security of supply and coordinated engagement towards the EU and ESA. These observations suggest that Finland would benefit from a Nordic agenda built around practical shared needs rather than broad symbolic cooperation.

A second opportunity is Earth observation and climate services for northern conditions. Finland's strengths in SAR, remote sensing, snow, forests, ice and environmental data could combine with Norway's Arctic and maritime orientation, Sweden's data and infrastructure capabilities as well as Denmark's application and testing niches. Martijnse-Hartikka highlights winter technology and Arctic know-how as areas where Nordic collaboration could strengthen global competitiveness.

A third opportunity is shared test, demonstration and validation infrastructure. Finnish startups and growth companies often need pilots and reference customers. A Nordic test and demonstration network could support PNT, EO, satellite communications, city applications, Arctic use cases and dual-use resilience services. This would be particularly valuable if it involved real public sector users rather than only research projects.

A fourth opportunity is coordinated ESA and EU positioning. Finland already uses ESA, EUSPA, Horizon Europe, CASSINI and Business Finland instruments. A Nordic approach could help align priorities around selected technologies, missions or application areas, especially where Nordic countries share needs in Arctic monitoring, secure communications, PNT resilience and environmental data. However, the interviewees also make it clear that ESA and EU frameworks are already operationally important, and Nordic cooperation would need to add something practical rather than duplicate the existing mechanisms.

A fifth opportunity is startup and scale-up support. Ahonen suggests a joint Nordic fund dedicated to space activities. Such a mechanism could address one of the ecosystem's clearest weaknesses: the gap between early-stage support and larger-scale investment. A Nordic fund would not solve all commercialisation barriers, but it could create a stronger regional investment story and help companies access capital, networks and customers across borders.

The limitations are also clear. First, Nordic cooperation lacks a strong common funding or procurement mechanism. Without money, missions or customers, cooperation risks becoming dialogue rather than capability-building. Second, the national priorities differ. Finland may prioritise PNT resilience, telecommunications and security of supply, while Norway may focus on the ground segment and maritime monitoring, Sweden on infrastructure and industrial systems as well as Denmark on specialised applications and ESA participation. Third, small companies have limited capacity to participate in broad Nordic processes unless they lead to concrete opportunities.

A further limitation is visibility. Several actors note that cross-border knowledge remains incomplete. Finnish actors may know national networks well but lack systematic understanding of complementary capabilities in Denmark, Sweden, Norway and Iceland. Therefore, mapping can create value, but only if it leads to practical matchmaking, shared pilots and a clearer division of roles.

The Finnish view of Nordic cooperation can be summarised as pragmatic and opportunity-driven. Finland does not need Nordic cooperation as a substitute for ESA, EU or national instruments. It needs Nordic cooperation where shared northern conditions, small markets and complementary capabilities make joint action more effective than national action. Therefore, the strongest Finnish agenda would focus on resilient PNT, Earth observation, weather and climate services, secure communications, Arctic and northern applications, shared demonstration infrastructure and scale-up finance.



Artist rendition of Gaia. ESA – D. Ducros.

3. Iceland

Iceland is the smallest and most institutionally emergent space ecosystem in the Nordic region. It should not be assessed against the same criteria as Denmark, Finland, Norway or Sweden, where the ecosystem is supported by larger industrial bases, more mature public structures and, in most cases, ESA membership. Iceland's profile is different. Its space relevance lies less in spacecraft manufacturing, launch systems or a large domestic company base, and more in analogue environments, Arctic and North Atlantic geography, research support, Earth observation use, data infrastructure and international mission facilitation.

The analysis is based on desk research, ecosystem mapping, patent data and two interviews. The interviews were conducted with Daniel Robert Leeb from the Iceland Space Agency/IRISS and Marco Pizzolato from Copernicus Iceland/the Natural Science Institute of Iceland. Together, they suggest an ecosystem that is small but strategically relevant: Iceland does not yet have a broad space industry, but it has assets that are internationally valuable if they are organised through stronger institutions, clearer national coordination and practical international partnerships.

Interviews were conducted with the following individuals:

Figure 5. Icelandic interviewees

Interviewee	Job title	Organisation	Role in the ecosystem
Daniel Robert Leeb	CEO/Executive Mission Director; Managing Director	Iceland Space Agency/IRISS	Space research coordination, international partnerships, analogue environments, mission support and institution-building
Marco Pizzolato	Copernicus Iceland representative/specialist at the Natural Science Institute of Iceland	Natural Science Institute of Iceland/Copernicus Iceland	Earth observation, Copernicus coordination, geospatial infrastructure and downstream public sector data use

3.1 Strategic framing and public coordination

Iceland's space ecosystem is still in formation. A central point from the Iceland Space Agency/IRISS interview is that space has only recently gained a clearer institutional home in Icelandic public administration. Daniel Robert Leeb describes this as a key historical bottleneck: space did not previously have an obvious ministry or policy owner, which made coordination and follow-up difficult. The current institutional development around IRISS, hosted under the University of Iceland and supported by the ministry responsible for higher education, science and innovation, is significant because it gives Iceland a more formal research and innovation anchor.

It is important to clarify that the Iceland Space Agency should not be read as a national public agency equivalent to the Swedish National Space Agency or the Norwegian Space Agency. The reviewed material and interview input describe it as a privately organised connector and facilitator, linking Icelandic institutions, foreign agencies, universities and private actors. IRISS appears as the more formal academic and institutional platform, which is intended to serve as a research and innovation hub and point of contact for international cooperation.

This gives Iceland a hybrid coordination structure. ISA/IRISS works with analogue research, international facilitation and strategic positioning, and Copernicus-related activities are coordinated through the Natural Science Institute of Iceland, which now also carries national mapping responsibilities. Marco Pizzolato describes this as a practical, distributed model: Iceland is connected to Copernicus through national representation, public agencies, research institutions, National Collaboration Programmes and operational users rather than through a single comprehensive national space strategy.

3.2 Research, universities and talent as the capability base

Iceland's research base is not broad in the sense of covering the full space value chain. Its strength lies in specific intersections: geology, volcanology, geodesy, remote sensing, environmental monitoring, analogue fieldwork, Arctic and sub-Arctic conditions and operational logistics. The University of Iceland is central because it provides the academic platform for much of the institutional development, including IRISS. The ecosystem mapping also highlights the University of Iceland and partner institutions as foundational because they help turn Iceland's geographic and scientific strengths into a more coherent research capability. The most important institutions mentioned in interviews include the Natural Science Institute of Iceland, the Agricultural University of Iceland, the Environmental and Energy Agency of Iceland, the University of Iceland, the Icelandic Ocean Cluster, the Icelandic Met Office, the Marine Research Institute, the Icelandic Coast Guard and the National Land and Forest Institute.

The strongest scientific niche is Iceland's terrestrial analogue relevance. Daniel Robert Leeb describes Iceland as having highly diverse Moon and Mars analogue environments in relatively close proximity, combined with accessibility, infrastructure and field logistics. This gives Iceland a credible role in astronaut training, robotic testing, mobility trials, in-situ resource utilisation, communications, energy systems and human-robot teaming. The point is not that Iceland can compete with larger countries in all parts of the space value chain. Rather, it can offer field environments that are difficult to replicate elsewhere and that are directly relevant to lunar and planetary exploration.

The second research strength is Earth observation and geospatial data use. Marco Pizzolato presents Copernicus as highly relevant because Iceland must monitor large, dynamic and difficult-to-access areas. Volcanic systems, glaciers, dust storms, marine zones, fisheries, land cover, afforestation and climate impacts all create demand for remote sensing. In this sense, the needs of Iceland's research and public sector create a strong downstream use case for space-based data even if the country does not itself have a large space manufacturing sector.

3.3 RTOs, testbeds and enabling infrastructure

Iceland's enabling infrastructure is primarily geographic, data-oriented and field-based. The most distinctive infrastructure is the natural terrain itself: volcanic landscapes, glacial areas, lava fields, remote highlands and coastal environments. These environments make Iceland relevant for analogue missions, planetary field science, astronaut training and equipment testing for extreme conditions.

MÁNI is presented in the interview material as a long-term platform for Moon and Mars analogue activities, while GameGardur/the space park is described as part of a future ground-segment and data-processing agenda. Daniel Robert Leeb points to these two areas as key priorities for Iceland's space future: analogue research and ground-segment/data infrastructure.

The Natural Science Institute of Iceland plays a different enabling role. It maintains national spatial data infrastructure, geospatial datasets and Copernicus representation. This makes it an important downstream infrastructure actor rather than a traditional space technology organisation. The Copernicus-related work also shows the importance of in-situ validation. Dust and air-quality sensors, marine measurements, land-cover data and future high-resolution imagery are necessary because satellite products often need to be tested against Icelandic conditions before users trust them.

3.4 Funding, incubation and commercialisation support

Compared with the other Nordic countries, Iceland has a much less visible space-specific funding and incubation system. As Iceland is not an ESA member, there is no Icelandic ESA BIC, and there are no dedicated space fund or large national space innovation programme comparable to those found in Denmark, Sweden, Finland or Norway either. This is one of the clearest signs that the Icelandic ecosystem is still emerging.

The interviews suggest that the main bottleneck is not only funding volume, but also strategic understanding and coordination. Daniel Robert Leeb argues that Iceland has international relevance, but that domestic public funding and awareness of the value of space remain below what is needed to capture more national value. Marco Pizzolato similarly points to limited expert time, small public budgets, awareness, trust, validation needs and resolution limits as barriers to wider Copernicus uptake.

Commercialisation is most visible in downstream and space-enabled applications, especially marine and environmental data. The Blue North project and Copernicus Marine activities are examples of how space data may support fisheries, coastal monitoring, marine data literacy and innovation. Marco Pizzolato highlights Green Fish as an example of a startup using Copernicus Marine data to predict fish locations, improve fuel efficiency and reduce bycatch risks. This suggests that Iceland's commercial potential is likely to be strongest where space data supports existing sectors such as fisheries, marine industries, environmental monitoring and public safety.

3.5 Space industry and services

Iceland does not currently appear to have a broad industrial space sector. The ecosystem mapping did not identify a bench of large space manufacturers, dedicated space investors or major upstream companies comparable to those found elsewhere in the Nordics. Daniel Robert Leeb states that there are very few purely space-focused Icelandic firms beyond ISA/IRISS-related activity.

This does not mean that Iceland is irrelevant to space. Rather, its role is service-based, research-based and location-based. Iceland can support international actors through analogue field campaigns, logistics, testing, training, research coordination, data use and possibly ground-segment infrastructure. The domestic user base is also important: public authorities, research institutes, environmental agencies, the Icelandic Met Office, the Marine Research Institute, the Icelandic Coast Guard, the Icelandic Ocean Cluster and sectoral actors in fisheries, forestry and environmental monitoring all form part of the wider space-enabled ecosystem.

Therefore, in value-chain terms, Iceland is weighted towards downstream applications and enabling infrastructure rather than upstream production. Its most plausible role is

not to build satellites, but rather to help test technologies, validate data, support missions and apply space-based information to national and Arctic-relevant challenges.

3.6 Innovation landscape and patents

The patent analysis confirms Iceland's limited industrial footprint in the space technology sample. Only one Icelandic patent family was identified, related to satellite beamforming and attributed to individual inventors rather than a large space company. This is too small a sample to support strong conclusions, but it suggests that Iceland does not currently have a broad patent-active space technology base.

The beamforming example is still relevant because it falls within satellite communications, a strategically important area of the future space economy. However, compared with Finland's large patent base in non-terrestrial networks and Earth observation or Sweden's engineering depth in spacecraft subsystems and satellite communications, Iceland's patent footprint is marginal. Therefore, the more meaningful innovation evidence is found outside patents: in analogue environments, Copernicus uptake, field validation, marine applications and institutional innovation around IRISS and MÁNI.

CASE · MÁNI

Iceland as a platform for lunar and Martian analogue research

MÁNI illustrates Iceland's most distinctive space niche. Rather than trying to build a full industrial space value chain, it positions Iceland as a platform for lunar and Martian analogue research, testing, training and technology development. This plays directly to Iceland's geographic strengths: volcanic landscapes, lava fields, glacial environments, remote terrain and operational conditions that can resemble aspects of planetary exploration environments.

The relevance of MÁNI is both scientific and practical. Analogue environments can support astronaut training, rover and robotic testing, mobility experiments, communication systems, energy systems, crew operations, life-support concepts, ISRU-related testing and human-robot teaming. These are areas where realistic terrain and field operations matter because they cannot be fully reproduced in laboratories.

The case also shows how Iceland can contribute internationally without needing to replicate larger countries' upstream capabilities. It can provide terrain, logistics, field expertise, research coordination and mission support.

For the Nordic region, MÁNI could become a practical cooperation platform. Danish instruments, Finnish data systems, Swedish robotics or communication technologies as well as Norwegian Arctic operations experience could be tested in Icelandic analogue environments. This would make Iceland a contributor to Nordic space capability through field validation and operational realism.

3.7 Overall assessment for Nordic cooperation seen from Iceland

Iceland's role in the Nordic space ecosystem is highly specialised. It is not a broad industrial space nation, but it can be a valuable platform for analogue research, mission support, Earth observation validation, Arctic and North Atlantic monitoring, and data-driven public sector applications.

Its strongest capabilities are tied to geography, field conditions and use cases: Moon and Mars analogue environments, volcanic and glacial terrain, marine and fisheries monitoring, dust and air-quality validation, climate and land-cover observation as well as potential ground-segment/data-processing roles.

The main bottlenecks are institutional maturity, funding, expert capacity, public awareness and commercial scale. Iceland needs stronger coordination and more deliberate mechanisms for converting international interest into domestic capability, research value and business opportunities.

Iceland complements the other Nordic countries precisely because it is different. It can offer testing environments, validation conditions and Arctic/North Atlantic use cases that strengthen technologies developed elsewhere in the region.

Figure 6. SWOT analysis of the Iceland space ecosystem

Strengths	Weaknesses
Unique analogue environments for Moon and Mars research, astronaut training and field testing.	Very small domestic space industry and only a few clearly space-focused companies.
Strong relevance for Earth observation because of the volcanic, glacial, marine and Arctic conditions.	Limited space-specific funding, incubation and commercialisation infrastructure.
Emerging institutional anchors through IRISS, the University of Iceland and Copernicus coordination.	Public coordination is still developing, with no fully mature national space strategy framework.

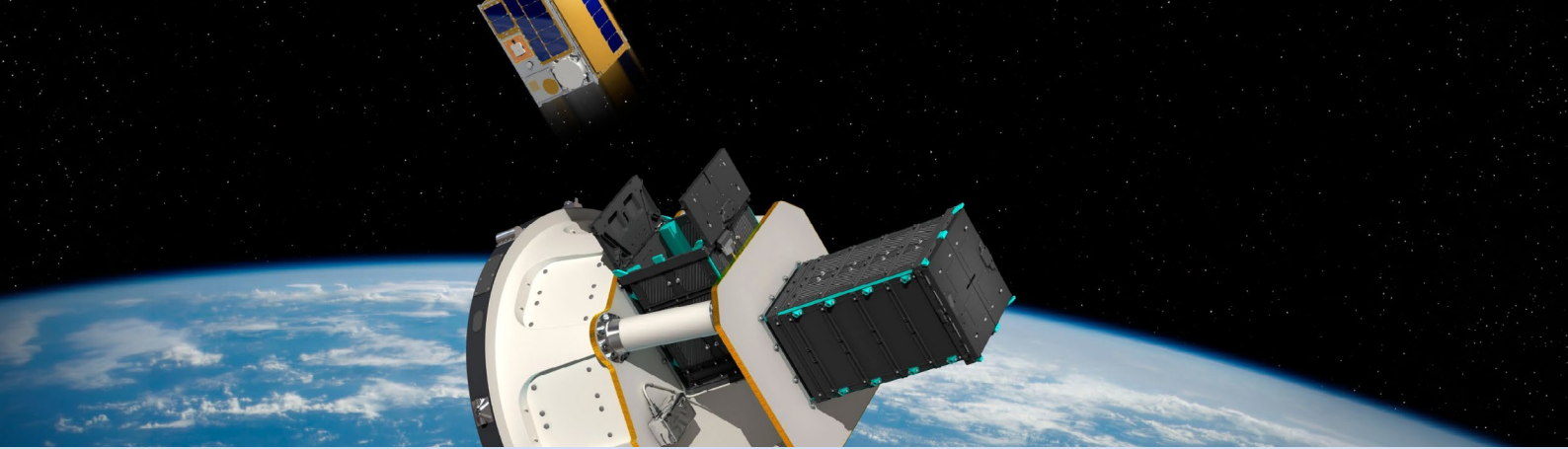
Strengths	Weaknesses
Strategic North Atlantic location, with potential for ground segment, data resilience and polar-orbit relevance.	Limited expert capacity and small public sector budgets restrict uptake and development.
Strong international appeal for research, training and mission support.	Risk that foreign actors use Icelandic assets without sufficient domestic value capture.
Opportunities	Threats
Develop Iceland as a Nordic analogue testing and field-validation platform.	Ecosystem may remain project-based and peripheral without continuity in funding and institutions.
Build ground-segment, data-processing and resilience roles linked to Arctic and North Atlantic needs.	Weak coordination could cause Iceland to miss opportunities despite international interest.
Expand Copernicus-based services in fisheries, marine monitoring, climate, volcanoes, dust and land cover.	Limited domestic scale may make it difficult to sustain commercial firms.
Use Nordic cooperation to share tools, validation infrastructure and public sector applications.	Nordic cooperation may remain rhetorical if not tied to funding, missions and users.
Contribute to Nordic and Arctic governance on orbital debris, mega-constellations and responsible space use.	Larger countries may dominate agendas unless Iceland's niche role is clearly defined.

From Iceland's perspective, Nordic cooperation is the most valuable where it helps turn niche assets into practical capability. The most promising areas are analogue testing, Arctic and North Atlantic Earth observation, ground segment, data resilience, space weather, marine applications, Copernicus-based public sector services and shared validation infrastructure.

Iceland could contribute terrain, field logistics, data-validation environments, North Atlantic positioning and demanding operational use cases. It would need complementary technology, funding, missions, industrial partners, data platforms and stronger routes to market from other Nordic countries.

The limitations are clear. ESA and EU frameworks may be more operationally important for many activities than a Nordic framework. Iceland is not an ESA member state in the same way as Denmark, Finland, Norway and Sweden, and the domestic ecosystem has fewer dedicated space companies. There is also no common Nordic funding or procurement mechanism that can automatically turn cooperation into projects.

Therefore, the Icelandic view of Nordic cooperation is pragmatic. Iceland should not try to resemble the larger Nordic ecosystems. Iceland should act where Iceland is genuinely strong: analogue environments, Arctic-relevant data, validation, North Atlantic infrastructure and mission support. If cooperation is built around those assets, Iceland can become a small but strategically valuable part of a more integrated Nordic space ecosystem.



Artist's view of the release of Celeste IOD-1 & 2 satellites. ESA – D. Ducros.

4. Norway

Norway's space technology ecosystem is one of the most strategically positioned and infrastructure-heavy in the Nordic region. Where some Nordic countries are primarily characterised by research excellence, specialist manufacturing niches or new space entrepreneurship, Norway stands out for the degree to which space is linked to geography, public-purpose infrastructure, Arctic operations, maritime surveillance, defence, communications and national resilience. Therefore, space in Norway is not only a research or industry domain. It is also an operational extension of the state, of critical infrastructure and of Norway's strategic position in the High North.

This chapter is based on desk research, ecosystem mapping, patent analysis and interviews with Norwegian actors representing public coordination, industry organisation, launch and test infrastructure, incubation, downstream innovation and upstream startup activity.

Interviews were conducted with the following individuals:

Figure 7. Norwegian interviewees

Interviewee	Job title	Organisation	Role in the ecosystem
Mari Eldholm/ Pernille Sofie Hauge	Senior advisers	Norwegian Space Agency/ NOSA	Public coordination, ESA/EU, policy, grants and industry development
Gunnar Heløe	Director	NIFRO	Industry representation, political dialogue and ecosystem development
Ketil Olsen	CEO	Andøya Space	Launch, testing, defence, education and strategic infrastructure

Interviewee	Job title	Organisation	Role in the ecosystem
Jo Bjørnstad	Managing Director	ESA BIC Norway	Startup incubation and commercialisation
Torgeir Solberg	Business Developer	Arctic Phi-Lab Norway	Arctic Earth observation, downstream innovation and ESA Phi-Lab support
Martin Grande	Co-founder & CEO	Tycho Space	Upstream startup, edge computing and satellite payloads

Taken together, the interviews describe Norway as a small but unusually complete space nation. It does not have the industrial scale of larger European countries, but it has assets that many larger countries lack: a polar launch site, global ground-segment capacity, state-backed satellite infrastructure, strong maritime and Arctic demand as well as major public-industrial actors such as Kongsberg, KSAT, Nammo, Space Norway and Andøya Space. NOSA describes an ecosystem of around 130 actors, including large firms, SMEs, startups, telecom actors, research institutions and universities. NIFRO likewise describes Norway as broad, export-oriented and shaped by a 'heavy public footprint', with strong public ownership and public demand in several parts of the ecosystem.

4.1 Strategic framing and public coordination

Norway's space policy is strongly shaped by usefulness. Space is treated as a means to serve national interests in communications, maritime awareness, emergency preparedness, defence, sovereignty, environmental monitoring and Arctic presence. This gives the Norwegian ecosystem a more utility-oriented character than in countries where space is framed mainly through science or technology policy.

The Norwegian Space Agency is the central public authority and the main gateway into the national space system. It works under the Ministry of Trade, Industry and Fisheries, which gives the Norwegian space effort a relatively strong industrial and business orientation. NOSA advises government and industry, manages national space-related instruments, coordinates ESA and EU participation as well as contributes to industrial development. The placement under a business ministry is analytically important. It signals that Norwegian space activity is closely connected to industrial capability, exports and strategic infrastructure rather than only to research and education.

The conducted interviews confirm this framing. NOSA sees its role as both policy-oriented and ecosystem-building, and points to a broader and more diverse Norwegian ecosystem than in earlier years. NIFRO also emphasises that Norway's space ecosystem is export-oriented and public-purpose driven. The domestic market is too small to sustain growth

alone, but Norwegian geography creates strong national demand in areas such as polar communications, maritime monitoring and Arctic surveillance.

ESA remains central. For NIFRO, ESA has historically been one of the most important mechanisms through which Norwegian companies have built competence, won contracts and entered international value chains. ESA is not only a funding mechanism; it is also a quality stamp, a learning arena and a gateway to European industrial networks. Andøya Space similarly describes ESA as a key 'premise supplier' for European space development, while stressing that ESA must be complemented by national investment, commercial initiative and political willingness to take strategic risk.

At the same time, Norway's position outside the EU is a recurring concern. NIFRO stresses that Norway's non-EU status can leave Norwegian industry on the sidelines as EU space ambitions grow and ESA and EU activities become more closely intertwined. This does not weaken Norway's ESA membership, but it does create uncertainty around access to EU-driven programmes, industrial roles and future strategic initiatives. For Norway, maintaining access to European space programmes is not just a technical matter. It is a strategic industrial priority.

The Norwegian governance model also shapes Nordic cooperation. Because Norway organises space under a business ministry, while Denmark, Sweden and Finland are more closely tied to research or education ministries, it is not always obvious where Nordic space issues should be coordinated politically. NIFRO sees this as a practical barrier to stronger Nordic cooperation: The institutional geography differs between countries, even when the strategic interests overlap.

4.2 Research, universities and talent as the capability base

Norway has a strong but distributed research and talent base. The most visible university and research environments include NTNU, the University of Oslo, the University of Tromsø, the University of Bergen, the University of Stavanger, SINTEF and the Norwegian Defence Research Establishment. These actors contribute to space systems engineering, small satellites, Earth observation, solar physics, auroral research, climate monitoring, sensors, remote sensing and defence-related space competence.

NTNU is especially important in small satellites, remote sensing and practical mission experience. NTNU's Small Satellite Lab has become a central node for research, education and student-driven space activity. Its HYPSON missions show that the university is not only teaching space systems, but also developing and operating satellites in practice. This gives Norway a hands-on engineering pipeline that can support both public missions and startup formation.

The University of Oslo contributes with scientific depth, space sensors and systems expertise as well as education in space systems. The University of Tromsø is important in auroral research, Arctic Earth observation and northern-space science. The University of Bergen contributes to climate-related research and Earth-system understanding, while the University of Stavanger adds space science and related competences. In combination, these environments give Norway a research base that is closely aligned with national needs in polar operations, climate monitoring, maritime activity and security.

The interviews point to a broad understanding of talent. NIFRO warns against defining space competence too narrowly. Engineers are essential, but future space capability also requires law, regulation, defence, communication, business, policy and international cooperation. This is especially relevant as space becomes more closely linked to defence, the new Norwegian space law and the coming EU Space Act. In NIFRO's view, Norway also needs interdisciplinary capacity, not just more technical specialists.

Tycho Space adds a more startup-oriented perspective. From Martin Grande's point of view, the university layer and student organisations are among the most important parts of the ecosystem because they are where interest is sparked and practical learning happens. However, he also argues that too much intellectual property and practical knowledge disappears when student projects are not better connected to commercialisation pathways. For him, Norway has talent and infrastructure, but it lacks a clear roadmap from a funded first project to commercial deployment.

There is broad agreement that Norway has strong talent, but there is disagreement on where the main weakness lies. Policy and industry-representation actors emphasise the breadth of competence and the importance of connecting education, public programmes and industry. Tycho Space stresses the lack of a smooth funding and commercialisation path for young companies and university spinouts. Andøya Space highlights another dimension: Recruitment is also affected by geography. Andøya's northern location is a strategic asset, but it must still compete with urban labour markets for engineers and specialists.

4.3 RTOs, testbeds and enabling infrastructure

Norway's most distinctive ecosystem layer is infrastructure. Andøya Space, KSAT, Svalbard ground-segment facilities, Space Norway's communications infrastructure and defence-related test environments make Norway unusually strong in the operational and enabling layers of the space value chain.

Andøya Space is one of the most important single actors in the Nordic space ecosystem. It has a history going back to 1962 and has launched close to 1,300 rockets, mainly scientific sounding rockets. Ketil Olsen describes Andøya Space as a multi-role infrastructure actor rather than a narrow launch provider. It has four main 'legs': scientific suborbital rocket launches, defence testing, education and the newer orbital spaceport.

Public material similarly describes Andøya Space as active in sounding rockets, Arctic launch sites, full-scale defence testing, ground-based scientific instrumentation, drone services, education and small-satellite launch infrastructure.

The geographic logic is central. Andøya's northern position gives access to polar and sun-synchronous orbits, open sea areas and relatively limited air and maritime traffic. Olsen argues that this gives Norway a strategic advantage because launches can take place northwards between Svalbard and Greenland without crossing other nations. By contrast, the Swedish orbital launches from Esrange face more complex overflight issues because launch trajectories may cross Norway.

KSAT gives Norway another globally significant infrastructure position. Its ground-station network and Svalbard operations enable frequent satellite data downlink from polar orbits. NIFRO explains the Svalbard advantage in operational terms: Satellites in polar orbits pass frequently, making it possible to download data almost on every pass. This turns geography into a global service capability and places Norway in a different category from countries whose space ecosystems are mainly built around manufacturing or research.

Space Norway is also central because it links satellite communications to national needs in the High North. Its role illustrates a key Norwegian pattern: Space infrastructure is not only commercial, but also public-purpose and strategic. Communications, surveillance and resilience in the Arctic are treated as national capabilities.

The interviews suggest that Norway's enabling infrastructure is strong, but not always sufficiently visible or accessible to smaller firms. ESA BIC Norway points to the need for a clearer overview of test, demonstration and validation facilities. Arctic Phi-Lab Norway similarly notes that specialised capabilities exist, but they are not systematically mapped or promoted across the ecosystem. This matters because startups and SMEs often need access to test and demonstration environments before they can approach customers or investors.

4.4 Funding, incubation and commercialisation support

Norway has several support mechanisms for space-related innovation, including NOSA instruments, Innovation Norway, the Research Council of Norway, ESA programmes, ESA BIC Norway and Arctic Phi-Lab Norway. These actors support different stages of the value chain, from research and early technology development to startup incubation, downstream application development and commercialisation.

ESA BIC Norway plays an important role in supporting early-stage space-related companies. Its portfolio is particularly relevant for downstream and space-enabled firms using satellite data, GNSS, AIS, geospatial AI, sensor fusion and satellite communications

in areas such as maritime operations, aquaculture, forestry, climate, infrastructure and security. This confirms that much of the startup activity in Norway is not classical upstream manufacturing, but rather space-enabled business development in sectors where Norway already has strong end-user markets.

Arctic Phi-Lab Norway adds another layer by focusing on Arctic Earth observation and downstream innovation. Its relevance lies especially in connecting satellite data, AI, geospatial analytics and Arctic use cases. In a Norwegian context, this is strategically important because many of the most valuable applications are problem-driven: maritime monitoring, ice, climate, infrastructure, emergency preparedness, security and public administration in northern and remote areas.

The interviews nevertheless point to a persistent funding gap. NOSA argues that many firms need customers and contracts more than additional R&D grants because a real customer helps validate a product and attract investors. Tycho Space is more explicit from an upstream startup perspective: Norway has talent and infrastructure, but no smooth path from TRL 4 to TRL 9, especially for space hardware. Hardware development is capital-intensive, the agency cannot fund it fast enough, and companies must often pursue many small programmes in parallel, losing momentum in a patchwork of low-value funding.

This points to one of the main structural weaknesses in the Norwegian ecosystem. Early-stage support exists, and strategic infrastructure is strong, but the transition to commercial deployment remains difficult. Downstream firms may find viable markets earlier because they can build on data and software. Upstream startups face a harder path because hardware requires testing, qualification, capital expenditure and long customer cycles. Tycho Space argues that upstream startups risk falling into a 'valley of death' unless they are lucky, self-funded or able to secure unusually strong partners.

Investors are also seen as insufficiently connected to the space sector. Tycho Space notes that Norwegian venture capital has a limited understanding of space business models, especially where defence, hardware and long development cycles are involved. This creates a gap between technical opportunity and commercial finance. NIFRO's broader view is similar but less startup-specific: The domestic market is small, and larger actors must internationalise. Public procurement and industrial policy are important if Norway wants to convert geopolitical momentum into industrial capability.

4.5 Norwegian Space industry and services

A recent NOSA mapping identifies around 130–140 space-related actors in Norway, with NOSA's published figures referring to 138 actors, approximately 2,700 jobs and NOK 11.7 billion in annual economic activity. The sector is concentrated, however, with telecom as the dominant segment and five actors accounting for most of this activity.

Norway's industrial base is both strategically important and unusual in a Nordic context. It is shaped by public ownership, export orientation, infrastructure services and dual-use demand. Major actors include Kongsberg Defence & Aerospace, KSAT, Nammo, Andøya Space, Space Norway, ESA BIC Norway companies, SMEs, startups, universities and research institutions. NIFRO represents this broad industrial landscape and acts as a forum for political dialogue, awareness-building and networking.

Kongsberg Defence & Aerospace is one of the most important industrial actors. It represents Norway's ability to connect defence, surveillance, maritime monitoring and space systems. It is involved in satellites, payloads, mission integration and defence-related applications, and is often seen as one of the key anchor companies in the Norwegian space economy. Nammo contributes propulsion and rocket-related capabilities. KSAT represents operational ground segment and satellite services. Space Norway links national communications needs with satellite infrastructure. Andøya Space contributes launch, testing, education and defence-related infrastructure.

This gives Norway a relatively complete value chain for a small country. Andøya Space emphasises that Norway now has many of the elements normally associated with larger space powers: satellite capabilities, ground segment, infrastructure, defence relevance, scientific launch activity and now a spaceport. The missing element, according to Olsen, is a commercially available Norwegian launch vehicle. Norway has rocket-motor capability and some rocket-development activity, but not yet a full commercial rocket for operational launch services.

Tycho Space offers a similar but more startup-oriented interpretation. Grande argues that Norway 'owns much of the value chain', including a launch site, KSAT's ground-station network, sensor builders, payload builders, integrators, mission primes and data-product companies. He sees maritime and coastline surveillance as a particularly promising niche because Norway has the need, the universities, the sensor concepts and the geographic driver.

At the same time, the ecosystem is not fully balanced. NIFRO notes that even Norway's larger firms are often not large enough to act as prime contractors in major international programmes. They frequently need to partner with actors in Germany, France or other larger European space nations. This reinforces Norway's export orientation and dependence on international value chains.

The industry is also shaped by classification and defence sensitivity. Defence and security applications are growing, but intelligence-related work is often nationally controlled and not fully visible to the open innovation ecosystem. NIFRO points out that this may limit broader industry participation, particularly for SMEs. Tycho Space similarly sees defence-related markets as difficult to enter because they are closed, relationship-based and require years of credibility before new firms are 'let into the room'.

4.6 Innovation landscape and patents

Norway's patent footprint in the Nordic space patent sample is smaller than those of Finland and Sweden. The identified Norwegian patents are primarily concentrated on sensing, measurement and scientific instrumentation rather than broad patenting across satellite platforms, communications or launch systems. This could make Norway look less innovation-intensive if patents are read in isolation.

However, the interviews and ecosystem mapping suggest that patent data understate Norway's role. Much of Norway's space capability is not primarily expressed through patents. It is expressed through infrastructure, operations, public-purpose systems, ground-segment services, defence-related capabilities, satellite communications, maritime applications and Arctic monitoring. These areas may involve innovation, but not always in ways that appear strongly in patent databases.

Therefore, the patent sample should be treated as an indicator and not as a full measure of Norwegian innovation. It suggests that Norway is less patent-heavy than Finland or Sweden, but not necessarily less strategically important. Norway's role is visible in assets and operational systems: Andøya, Svalbard, KSAT, Space Norway, maritime surveillance needs, Arctic data services and state-backed infrastructure. In Nordic comparison, Norway's innovation profile is more infrastructure- and service-oriented than patent-led.

This also matters for Nordic cooperation. Finland and Sweden appear stronger in patent-active digital, telecom and hardware innovation, while Norway contributes operational geography, infrastructure, ground segment and Arctic use cases. Denmark adds specialised engineering, testing and downstream niches. The Nordic opportunity is not that all countries should patent or build the same technologies, but that these different capability profiles can be combined.

CASE · ANDØYA SPACE

Launch infrastructure as strategic capability

Andøya Space illustrates Norway's distinctive role in the Nordic ecosystem. It is not merely a company, and not merely a launch provider. It is a national infrastructure node that connects science, defence, education, testing, launch, Arctic geography and European autonomy.

The organisation's roots go back to 1962, when activity at Andøya began in collaboration with NASA, the Danish Meteorological Institute and the Norwegian Defence Research Establishment to study how aurora affected military communication in the High North. Since then, Andøya has launched

close to 1,300 rockets, mainly for scientific sounding rocket missions. This long operational heritage gives Norway practical experience in launch safety, payload integration, atmospheric research and international mission support.

Today, Andøya Space has four main business areas: scientific suborbital launches, defence testing, education and orbital launch through Andøya Spaceport. Its defence range supports full-scale testing and operational training, while its education activities help build future talent. The spaceport adds a new dimension by positioning Norway in the emerging European market for small-satellite launches.

Olsen's strategic argument is that Andøya Spaceport is not only a commercial infrastructure project. It is part of Europe's need for sovereign access to space and for responsive launch capacity. He describes space as 'invisible infrastructure' on which modern societies depend. Communications, navigation, electricity systems, financial transactions, emergency services and defence all rely on satellites. If satellites are lost or disabled, the ability to launch replacement capacity quickly becomes a strategic capability.

The case also illustrates the tension in Nordic cooperation. Andøya and Esrange in Sweden are both important northern launch infrastructures, and there may be both complementarity and a rivalry between them. From a Nordic perspective, the strategic challenge is to avoid duplicative national competition where coordination could create stronger regional capability.

4.7 Overall assessment of Nordic cooperation seen from Norway

Norway's space ecosystem is best understood as a strategic infrastructure and operations ecosystem. Its main strengths are not primarily patent volume or the number of startups, but rather the combination of Arctic geography, launch and test infrastructure, ground-segment capacity, public-purpose satellite services, maritime and defence demand as well as strong anchor companies.

This makes Norway one of the most important Nordic countries for space-based resilience, Arctic operations, maritime surveillance, satellite communications and European strategic autonomy. It is also one of the few Nordic countries with launch-related infrastructure that can shape the regional space agenda.

The main bottlenecks are scale, funding continuity, EU access, market access for SMEs and the transition from demonstration to deployment. Norway has strong public infrastructure and major actors, but startups and smaller firms still struggle to move from research or early prototypes into commercial markets. Therefore, the challenge is to connect infrastructure, public demand, ESA participation, private capital and industrial delivery more effectively.

Norway's role in a Nordic ecosystem is complementary. It can contribute launch infrastructure, ground segment, Arctic test environments, maritime use cases, operational data services and public-purpose demand. Finland can contribute new space, communications and Earth observation capabilities. Sweden can contribute launch-related experience, telecom and advanced space hardware. Denmark can contribute specialised engineering, testing, downstream services and Arctic responsibilities through Greenland and the Faroe Islands. Therefore, Norway's strongest contribution is not to replicate others, but rather to anchor Nordic cooperation in real operational needs in the High North.

Figure 8. SWOT for the Norwegian space ecosystem

Strengths	Weaknesses
Strong Arctic geography, polar access, Svalbard ground stations and launch infrastructure.	Small domestic market and strong dependence on export from an early stage.
Public-industrial anchors such as Kongsberg, KSAT, Nammo, Space Norway and Andøya Space.	Funding gap between early support, demonstration and operational deployment, especially for hardware.
Operational strengths in maritime surveillance, satellite communications, Arctic monitoring and ground segment.	Norway's non-EU status creates uncertainty as EU and ESA programmes become more intertwined.
Strong ESA participation, ESA BIC Norway and emerging Phi-Lab capacity.	Test and demonstration infrastructure is strong, but not always sufficiently visible or accessible to SMEs.
Research and talent base at NTNU, UiO, Tromsø, SINTEF, FFI and student space environments.	Defence and dual-use markets can be closed, classified and difficult for startups to enter.
Opportunities	Threats
Arctic and maritime monitoring, secure communications, preparedness and critical infrastructure protection.	EU space programmes may become harder to access for non-EU Norway.
Andøya Spaceport as part of European autonomous and responsive launch capacity.	Rivalry with Sweden around launch infrastructure could weaken Nordic cooperation.
Nordic test, demonstration and first-customer mechanisms for SMEs and startups.	Startups may be acquired or fail before value creation scales in Norway.
Spin-in from offshore, ocean, autonomy, defence and harsh-environment industries.	US and larger European new space actors may move faster and dominate markets.
Joint Nordic positioning in ESA, Arctic applications, defence and maritime services.	Nordic cooperation may remain symbolic if it is not tied to funding, procurement and missions.

From Norway's perspective, Nordic cooperation is valuable when it solves concrete problems and creates scale that national markets cannot provide alone. The strongest opportunities lie in Arctic and maritime applications: surveillance, search and rescue, environmental monitoring, ice and weather services, secure communications, fisheries, offshore infrastructure, critical infrastructure protection and defence preparedness.

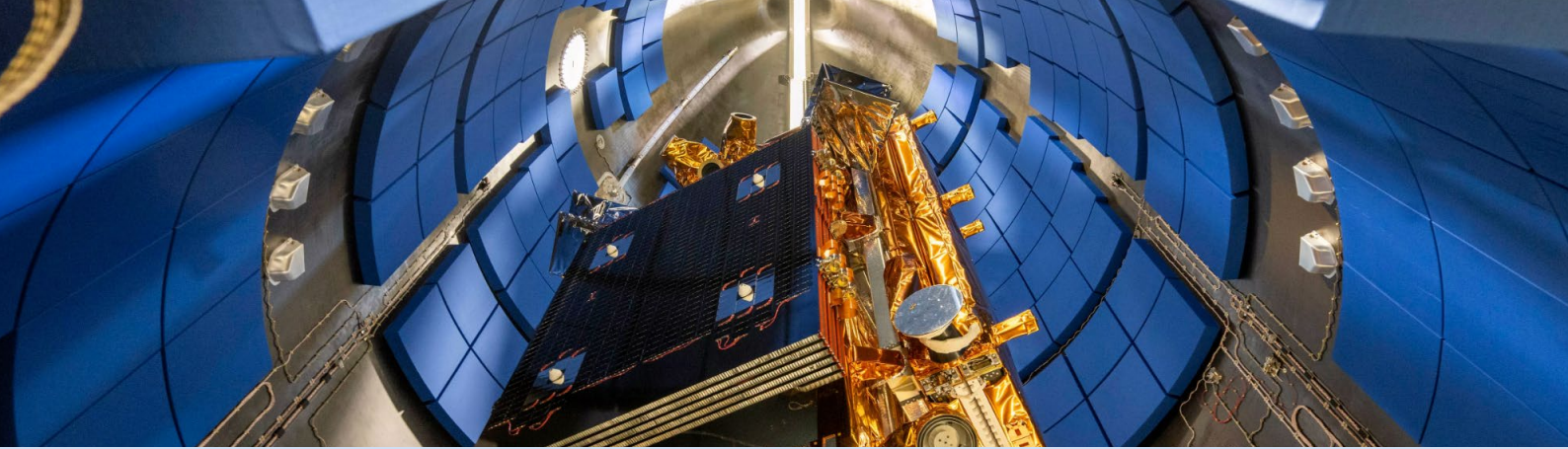
A second opportunity is coordinated Nordic positioning in ESA. NIFRO suggests that Nordic countries could coordinate more systematically before ESA meetings or programme decisions, especially where their capabilities are complementary. This could help smaller countries gain visibility and influence in areas such as Arctic monitoring, ground segment, launch, test infrastructure and dual-use services.

A third opportunity is shared test, demonstration and infrastructure mapping. Norway has strong facilities, but they are not always visible to firms outside established networks. A Nordic map of launch-related, environmental, ground-segment, validation, data and operational test infrastructure could help SMEs find facilities faster and reduce duplication.

A fourth opportunity is joint mission development. Nordic missions around maritime surveillance, coastline monitoring, environmental monitoring, secure Arctic communications or border awareness could create the first customers and industrial work packages. Tycho Space explicitly argues that Nordic collaboration could help access customers, partners, talent and funding, if it includes SMEs, research organisations and large companies rather than only incumbents.

The limitations are equally clear. Nordic space cooperation is not yet strongly institutionalised. National funding schemes are designed to create national jobs and national industrial return. Defence and intelligence-related space activities are often classified and nationally controlled. Space is placed under different ministries in different countries. There may be a rivalry between Norwegian and Swedish launch ambitions if cooperation is not handled strategically.

Therefore, the Norwegian view is pragmatic. Nordic cooperation should not be built around general declarations alone. It should start with shared problems where Nordic geography and capability overlap: the High North, maritime surveillance, secure communications, Earth observation, defence preparedness, test infrastructure and European strategic autonomy. If these priorities are translated into missions, procurement, testbeds and joint ESA positioning, Norway could become one of the anchors of a stronger Nordic space ecosystem.



Copernicus Sentinel- 1D Encapsulation. ESA – M. Pédoussaut.

5. Sweden

Sweden combines a national space agency, major research environments, internationally visible space infrastructure, established industrial actors, a defence and aerospace base as well as a growing layer of startups and downstream service companies. Compared with Denmark, Sweden has a larger industrial base and stronger space infrastructure. Compared with Finland, it appears less cohesive as a new space ecosystem, but stronger in traditional engineering, launch-related infrastructure, subsystems and defence-adjacent capabilities. Compared with Norway, it has a broader industrial and research base, while Norway is more clearly shaped by Arctic operations, ground-segment services and national space operators.

The Swedish ecosystem is best understood as broad but fragmented. Agency capacity, research, infrastructure and industry are all present, but the conducted interviews point to a weak integration between research and commercialisation, between public funding and market demand as well as between startups and large incumbents. This creates a recurring tension: Sweden has many of the ingredients of a strong space ecosystem, but not always the coordination, procurement mechanisms or scale-up pathways needed to turn those ingredients into fast-growing commercial capabilities.

The analysis below is based on desk research, national strategy and ecosystem mapping material, patent analysis and interviews with Swedish actors. The interviews were used to test and nuance the mapping, especially on commercialisation, public sector demand, downstream applications, defence relevance, scale-up finance and the scope for Nordic cooperation.

Interviews were conducted with the following individuals:

Figure 9. Swedish interviewees

Interviewee	Job title	Organisation	Role in the ecosystem
Ernesto Gutierrez	Innovation Management	Swedish National Space Agency/Rymdstyrelsen	Public funding, national coordination, downstream innovation and space-data use
Karin Holmqvist	Head of Space Strategy & Innovation	Saab	Defence industry, system integration, dual-use space strategy and innovation
Markus Skogsmo	CEO and co-founder	PandionAI	Startup using AI, Earth observation and multi-sensor data for operational decision support
Emil Vinterhav	CEO	PASQ/Vinterstellar	Environmental testing, AIT, mission analysis and flight dynamics software
Ulf Palmnäs	Founder	Rymdkapital/Expansion Aerospace Ventures	Space investment, startup advisory and commercialisation finance
Arun Thirumalesh Madanaguli	Researcher, Entrepreneurship & Innovation research group	Luleå University of Technology	Ecosystem research, downstream commercialisation, SMEs and northern Sweden

Taken together, the interviews present Sweden as a country with strong technical capabilities and research environments as well as significant infrastructure, but also with a fragmented innovation system. The strongest shared message is that Sweden is not lacking ideas or competence; it is lacking stronger demand mechanisms, better scale-up finance, more active public procurement, clearer industrial direction and tighter links between space technology and end users.

5.1 Strategic framing and public coordination

Swedish space policy has historically been strongly connected to research, ESA participation and scientific capability. The Swedish National Space Agency, under the Ministry of Education since 2011 and before that under the Ministry of Enterprise and Innovation, is the central national actor and acts as funder, coordinator and expert authority. Its work includes support for research, technology development, downstream use of satellite data, ESA participation and national innovation initiatives. In the

downstream domain, the agency's role is especially to fund, coordinate and enable innovation and the use of space data for societal benefit, including Earth observation, navigation and telecommunications.

The Swedish strategy frames space as a contributor to knowledge, innovation, competitiveness and societal services. This provides a broad policy basis, but the interviews suggest that implementation is not always sufficiently industrial or market oriented. Several interviewees argue that space remains too strongly positioned as a research domain and not enough as an industrial, commercial, defence or critical-infrastructure domain. PandionAI notes that the Swedish National Space Agency sits under the Ministry of Education, which shapes how space is positioned nationally and may limit its ability to act on industrial and security-policy mandates.

This view is echoed from a defence-industry perspective. Saab argues that Sweden has strong individual capabilities, but that space is still too often understood as something specialised and research-led rather than as a driver of economic growth, defence capability and system integration. For Saab, the main issue is not whether Sweden has technology, but whether the country can integrate technologies into complete operational capabilities, especially for total defence.

The Swedish National Space Agency interview gives a more enabling and application-oriented view. It emphasises the agency's role in funding downstream innovation, supporting infrastructures such as Digital Earth Sweden as well as encouraging the use of satellite data across climate, environment, agriculture, transport, urban planning, security and logistics. From this perspective, Sweden's public coordination role is already moving towards the wider societal use of space data. However, the same interview also recognises fragmentation, weak coordination, unclear value chains and insufficient integration between technology developers and users.

Therefore, a clear difference in emphasis exists. Public coordination actors highlight the existing programmes, ESA links and growing downstream use. Commercial and industrial interviewees place more weight on missing strategic steering, weak procurement, limited anchor customers and insufficient industrial policy. This does not mean that these views are incompatible. Rather, it shows that Sweden's strategic framing is broad, but that the ecosystem still lacks a sufficiently strong mechanism for converting research, infrastructure and public funding into commercial and operational scale.

5.2 Research, universities and talent as the capability base

Sweden has a strong research and education base in space-related fields. The important actors include KTH, Chalmers, Luleå University of Technology, the Swedish Institute of Space Physics, RISE and SLU as well as specialised research groups linked to satellite

technology, space physics, atmospheric science, remote sensing, data processing and AI. The Swedish National Space Agency interview describes the research base as very strong in satellite technology, remote sensing and data science.

The Swedish Institute of Space Physics is one of the country's most important science actors, especially in space physics and atmospheric research. Northern Sweden is also central because of the relationship between research environments, Esrange, Kiruna, LTU and space infrastructure. LTU is often presented as a 'space university', and the Kiruna campus close to Esrange gives the region a distinctive profile in space education, research and ecosystem development. The LTU interview stresses that Sweden has strong research output and a strong talent pipeline, but it also warns that effectiveness is the central problem: Research and talent do not automatically translate into scalable companies or sustained regional capability.

This talent issue appears in several interviews. Sweden trains capable engineers and researchers, but retention is difficult. LTU points to a mismatch between the ambition to build northern Sweden as a space region and the difficulty of keeping graduates in the region; many leave for ESA, France, the US or other international opportunities. PandionAI similarly notes that talent in Earth observation is scarce, partly because the domain is narrow and the Swedish pipeline is limited.

Interviewees also point to missing competences beyond science and engineering. Sweden has strong technical talent, but weaker capabilities in entrepreneurship, venture building, commercialisation, system-level business development, user-centred design and change management. This is a recurring Nordic pattern: The research base is strong, but the translation into industrial growth is weaker. From the Swedish National Space Agency perspective, the link between research and commercialisation is still insufficient because incentives and structures for translation from research to application are not strong enough.

The research base itself should be treated as a sufficient strength. Research-oriented and agency perspectives see it as a core asset. Startup and investor-oriented voices argue that strong research is not enough if there are no anchor customers, limited commercialisation pathways and weak scale-up finance. The LTU interview puts this sharply: The ecosystem produces technology reasonably well, but not always in response to demand, which means many initiatives fail at the scaling phase.

5.3 RTOs, testbeds and enabling infrastructure

Sweden's enabling infrastructure is one of its clearest strengths. Esrange Space Center, operated by the Swedish Space Corporation, gives Sweden a distinctive position in the Nordic and European space landscape. Esrange has long been important for sounding rockets, stratospheric balloons, testing and research campaigns, and it is being developed

for orbital launch. Together with SSC's wider ground-station and mission-support activities, this gives Sweden a space-infrastructure profile that few small countries can match. The ecosystem mapping describes Sweden, together with Norway, as one of the Nordic countries combining a national agency, Esrange, industrial primes, science institutions and an ESA BIC pathway.

From a defence and systems perspective, Saab identifies Sweden's strengths in rocket engine testing, ground station networks, satellite communications including terminals, 6G, electronic warfare sensors, edge computing, suborbital launch services, stratospheric ballooning and future orbital launch services. This points to a Swedish infrastructure and capability profile that is particularly relevant to dual-use and defence applications.

Testing and qualification are also part of the Swedish ecosystem. PASQ provides environmental testing as a service, including thermal, radiation, EMC and RF testing. Its customer base includes Japanese satellite and system integrators, which use PASQ because of availability and lower administrative overhead compared with some domestic alternatives. This is an important example of a smaller Swedish firm filling a practical gap in the space value chain, helping companies move hardware towards validation and qualification without requiring them to own test infrastructure themselves.

Digital and downstream infrastructure is also important. The Swedish National Space Agency interview highlights Digital Earth Sweden and other data-oriented initiatives as mechanisms for making satellite data more usable across public sector and commercial applications. These infrastructures matter because much of the future value of space technology depends not only on satellites, but rather on processing, integrating and applying data in real decision-making environments.

However, infrastructure is not the same as ecosystem integration. Several interviewees argue that Sweden has many assets but weak mechanisms for connecting them. PandionAI notes that Swedish actors remain dependent on international partners for some validation steps, and that downstream actors are not sufficiently connected to established industrial end users in sectors such as energy, forestry, defence and civil security. LTU similarly argues that actors may be connected in formal ecosystem terms, but that the connectivity is not always effective because incentives are misaligned.

5.4 Funding, incubation and commercialisation support

Sweden has several public and semi-public funding and support mechanisms for space-related innovation. The Swedish National Space Agency, ESA programmes, ESA BIC Sweden, ESA Phi-Lab Sweden, Vinnova, the Swedish Energy Agency, regional incubators, THINGS, Space West, Arctic Business, LTU Business and other innovation actors all form part of the support landscape. In early technology development and research, Sweden is relatively well supplied with public funding and European pathways.

The problem identified across interviews is the transition from publicly funded technology development to commercial growth. PandionAI describes the largest gap as the bridge between grant-funded technical development and commercial scaling: funding is reasonably available for early R&D, and capital exists for companies with proven revenue, but the intermediate stage remains difficult. Rymdkapital gives a similar assessment, identifying a gap between seed and Series A, a lack of private risk capital, weak accelerators and the absence of early risk-willing customers.

The investor perspective is especially critical of the Swedish market formation problem. Rymdkapital argues that Sweden lacks several functions found in more mature ecosystems, including accelerators, venture capital and early customers willing to take technological risk. In this view, agencies are dominant funders, but they are weak as strategic market shapers, while investors are only beginning to engage with space.

Saab also emphasises the absence of an anchor-customer model. From its perspective, the key missing mechanism is one where government invests early and commits as a future customer. This would reduce risk, force performance and help unlock private capital. Without such demand, companies struggle to attract venture capital, loans or strategic investment.

There is broad agreement that public procurement is a bottleneck. Public sector buyers are often cautious and procurement processes are slow and rigid. SMEs may lack the resources to navigate them. PandionAI notes that public end users often do not have established pathways for integrating new suppliers. Saab describes procurement as slow, rigid and resource intensive. LTU adds that publicly funded projects sometimes make it difficult for SMEs to build proprietary technology that can be reused across use cases.

Overall, Sweden's funding system supports research and early innovation better than scale-up and demand creation. Therefore, the next stage of ecosystem development depends less on creating more ideas and more on building stronger commercial pathways: anchor customers, demonstration programmes, procurement models, investor literacy and links to large industrial users.

5.5 Space industry and services

Sweden has one of the largest space-related industrial bases in the Nordic region. The latest Swedish mapping, based mainly on 2023 data, contacted 124 known space-related companies and included register-based data for 103 private limited companies. In 2023, Swedish companies with space activities had a total turnover of about SEK 18 billion and employed around 4,600 people. The space-specific part of their activity was smaller but still significant: just over SEK 4.8 billion in space-related turnover and around 1,650 space-specific full-time equivalents. Reported R&D investment was just over SEK 650 million.

The Swedish industrial base includes established actors such as SSC, Saab, GKN Aerospace, Beyond Gravity Sweden, OHB Sweden, AAC Clyde Space, Ovzon, Unibap and other specialised suppliers. It also includes a growing downstream and software layer, with companies working on AI, Earth observation, edge computing, data integration, maritime awareness, forestry, energy infrastructure and other space-enabled applications. PandionAI describes the established industry as including Saab, GKN Aerospace, Beyond Gravity, SSC and OHB Sweden, while newer companies in downstream and edge computing are helping push the field forward.

The industry is diversified. Many companies do not operate only in space; rather, space is just one business area alongside defence, communications, sensing, aerospace or advanced engineering. This can be a strength because Sweden has strong adjacent sectors. However, it can also make the space ecosystem harder to coordinate because many firms do not primarily depend on domestic space policy.

Sweden's upstream and midstream strengths include subsystems, satellite structures, launch interfaces, propulsion heritage, satellite communication terminals, ground networks, data handling and space infrastructure. The downstream layer is newer and less visible but increasingly important. PandionAI argues that the downstream and applications side receives less visibility than upstream activity, even though this is where many newer companies, commercial opportunities and connections to established industries are located.

Therefore, the industrial picture is mixed. Sweden has more breadth than the other Nordic countries, but interviewees repeatedly describe the system as fragmented. Large companies are important, but they may move too slowly and are not always active in supporting startups. Startups are innovative, but they face weak market access and limited scale-up finance. Public agencies fund development, but they do not always act as strategic customers. Universities and RTOs provide knowledge, but commercial translation is uneven.

5.6 Innovation landscape and patents

The patent analysis shows that Sweden has one of the strongest and most space-oriented patent profiles in the Nordic region. Together with Finland, Sweden accounts for the largest share of identified Nordic space-related patent families. However, the Swedish pattern differs from Finland's pattern: where Finland's profile is led by digital infrastructure, satellite operations and Earth observation, Sweden's patent portfolio points more strongly towards engineering depth, spacecraft subsystems, launch interfaces and satellite communications.

One major Swedish theme is spacecraft and launcher mechanics. Beyond Gravity Sweden appears with a concentration of patents on spacecraft separation devices,

payload dispensers, clamp-band systems, hold-down release mechanisms and structural components. These are mission-critical technologies. They may be invisible to end users, but they are central to whether satellites can be safely carried and released. This gives Sweden a strong position in specialised upstream hardware and launch-related systems.

A second major theme is satellite communications. Ovzon, ReQutech and RUAG Space/Beyond Gravity contribute patents on terminals, antenna and filter structures, beam handling, communication handover, repeater architectures and interference management. Ericsson adds another layer through patents related to non-terrestrial networks, timing adaptation, satellite assistance information, feeder-link switching, beam switching, edge computing and GNSS-related functions. This suggests a Swedish strength at the interface between satellite infrastructure and advanced telecom systems.

A third theme concerns spacecraft control, propulsion and navigation. OHB Sweden and ECAPS point towards spacecraft control and propulsion capabilities, while Saab contributes navigation-related inventions relevant where satellite signals are weak or unavailable. Taken together, the Swedish patent pattern indicates a mature engineering base with strong relevance to future Nordic cooperation on mission-critical subsystems, secure communications, defence applications and non-terrestrial networks.

As with all patent analysis, the results should be interpreted cautiously. Patents are an indicator of technological orientation, not a complete record of innovation. Some companies do not patent for secrecy, commercial speed or security reasons, and defence or dual-use technologies may be underrepresented. Still, the Swedish sample is analytically clear: Sweden is one of the Nordic region's strongest hardware, systems and satellite communications innovation environments.

CASE · PANDIONAI

Turning satellite data into operational alerts

PandionAI is a Stockholm-based AI analytics and intelligence company working in the Earth observation industry. The company was founded based on the view that satellite data is rarely operationally useful on its own. End users do not primarily need imagery; they need timely information, alerts and decision support. This places PandionAI in the downstream and midstream layer of the space value chain, where the main task is to translate complex satellite and sensor data into actionable intelligence.

The company develops and operates AlertSat, a source-agnostic platform that combines multiple satellite data sources with AI for automated monitoring,

anomaly detection and alert generation. Its activities span energy infrastructure, maritime domain awareness, wildfire detection and precision forestry. These domains are highly relevant to Sweden because they connect space technology to established national strengths in energy, forestry, civil security, defence, maritime operations and environmental management.

PandionAI also coordinates ALERT-IOD, an ESA Phi-Lab-funded in-orbit demonstration project validating AI-based detection onboard satellite. The project illustrates how ESA can support technical validation and credibility, while the commercial path depends on national and international end users outside the ESA framework. This duality is important: ESA can help prove the technology, but revenue depends on whether public and industrial users adopt the service.

The case illustrates several wider Swedish strengths. It builds on AI, software competence, Earth observation, data fusion and Sweden's ability to integrate technology into operational workflows. It also reflects the emerging importance of edge computing and onboard processing, where satellites do not only collect data but help filter, analyse and prioritise information before it reaches the ground.

At the same time, PandionAI illustrates the main Swedish bottlenecks. The company is grant-funded and has active pilot discussions, but like many downstream firms, it faces the difficult transition from validation to commercial revenue. Early paying customers are hard to secure, public sector procurement is cautious and industrial customers often require evidence that small companies cannot easily finance alone.

The case also has Nordic relevance. PandionAI has been in dialogue with a Norwegian space hardware company on potential software-hardware collaboration and has supported a Danish AIS data infrastructure initiative. This suggests that downstream AI companies can connect Nordic capabilities across borders: Swedish analytics, Norwegian space hardware or maritime infrastructure, Danish data initiatives, Finnish EO or communications capabilities as well as Arctic use cases.

5.7 Overall assessment for Nordic cooperation seen from Sweden

Sweden’s main role in the Nordic space ecosystem is as a broad infrastructure, engineering, research and systems-capability actor. It is the Nordic country with perhaps the most complete set of institutional ingredients: a national agency, Espace, SSC, strong research environments, established industrial firms, ESA pathways, downstream initiatives and defence-relevant capabilities.

Its strongest capabilities lie in spacecraft subsystems, launch interfaces, satellite communications, advanced engineering, space science, data handling, AI, ground networks and emerging dual-use integration. The patent sample reinforces this picture by showing Swedish depth in mission-critical hardware, satellite communication equipment, telecom integration and navigation-related technologies.

The main bottleneck is not a lack of capability but rather weak system integration. Sweden has many assets, but the interviewees repeatedly point to fragmentation, insufficient market pull, weak public procurement, limited scale-up capital, slow adoption by public and industrial users as well as inadequate links between startups and large companies. In short, Sweden is strong in the components of an ecosystem, but less strong in converting them into coherent growth pathways.

For Sweden’s ecosystem to develop further, the next phase needs to be more demand-driven. This means stronger anchor-customer models, clearer public sector use cases, more flexible procurement, better commercialisation support, more space-literate investors and stronger collaboration between large incumbents and startups. It also means treating space not only as research, but also as infrastructure, defence capability, a digital service layer and an industrial opportunity.

Sweden complements the other Nordic countries well. Its infrastructure and engineering depth can support Danish specialised technologies, Finnish digital and Earth Observation capabilities, Norwegian Arctic and ground-segment strengths as well as Icelandic research and analogue-environment roles. If these complementarities are organised around concrete missions, demonstrations and markets, Sweden could become a central platform for Nordic space collaboration.

Figure 10. SWOT for the Swedish space ecosystem

Strengths	Weaknesses
Broad institutional base. Sweden combines a national space agency, Espace, SSC, industrial actors, universities, research institutes and ESA-linked support structures.	Fragmented ecosystem. Interviewees consistently point to weak coordination, unclear value chains and insufficient integration between research, industry, users and investors.

Strenghts	Weaknesses
Strong research and engineering capability. Sweden has strong space science, remote sensing, aerospace, defence, data handling, AI and subsystem competences.	Weak commercialisation pathway. Research and early technology development do not translate systematically into scalable companies or domestic market uptake.
Space infrastructure. Esrangle, ground networks, sounding rockets, balloons, testing environments and future orbital launch give Sweden a distinctive Nordic role.	Limited anchor customers. Public procurement is slow and cautious, and Sweden lacks a clear model where government acts as early customer and risk-sharing buyer.
Strong industrial and defence-adjacent base. Saab, SSC, Beyond Gravity, OHB Sweden, GKN, Ovzon and others provide industrial depth and international credibility.	Scale-up finance gap. Private risk capital is limited, especially between grant-funded validation and commercial revenue.
Strong patent profile. Swedish patents show depth in launch interfaces, spacecraft subsystems, satellite communications, telecom integration and navigation-related technologies.	Downstream under-visibility. Applications and space-enabled services receive less visibility than upstream infrastructure, despite strong commercial potential.
Opportunities	Threats
Nordic launch, testing and demonstration hub. Sweden can use Esrangle and related infrastructure to support Nordic missions, testbeds and validation.	Talent and company drain. Entrepreneurs and graduates may relocate abroad to find capital, customers or clearer growth pathways.
Defence and total defence integration. Sweden can build on defence, sensors, communications, EW, edge computing and system integration.	ESA dependency without spillover. ESA funding may support technology development without creating domestic commercial scale.
Downstream AI and EO services. Sweden has strong opportunities where AI intersects with forestry, energy, maritime, climate, security and public services.	International competition. Larger countries and faster new space ecosystems may capture markets before Swedish firms can scale.
Public procurement as market shaper. More strategic public demand could help startups validate technology and attract private investment.	Fragmentation persists. Without stronger coordination, Sweden may remain strong in parts but weak in integrated capabilities.
Coordinated Nordic programmes. Shared Arctic, climate, security and communications needs could create larger markets and stronger ESA/EU positioning.	Infrastructure ambitions outpace governance and funding. Launch and dual-use ambitions require long-term investment, regulation and customers.

From a Swedish perspective, Nordic cooperation is attractive because it can help solve scale, market and capability gaps. Sweden has strong infrastructure and technical capability, but it does not have a large domestic market for most space technologies. Nordic cooperation could create larger reference markets, shared public sector demand and more visible value chains.

The first opportunity is the joint use of test, launch and demonstration infrastructure. Esrangle, Swedish testing capabilities and related northern environments could support Nordic missions, suborbital campaigns, validation activities and dual-use demonstrations.

This would be the most valuable if linked to concrete industrial work packages and public sector users, not just research collaboration.

The second opportunity is downstream applications in shared Nordic sectors. Climate monitoring, forestry, energy infrastructure, maritime domain awareness, Arctic and North Atlantic operations, emergency preparedness and civil security are all areas where Swedish AI, software and data-integration capabilities could combine with Finnish EO, Norwegian maritime and Arctic infrastructure as well as Danish specialised data and testing niches.

The third opportunity is defence and dual-use cooperation. Saab's perspective points to total defence as a possible area where Sweden could become internationally competitive through smart integration of the full value chain. Nordic cooperation could add value where countries share security concerns but have complementary capabilities in sensors, communications, maritime monitoring, Arctic operations, ground infrastructure and decision-support systems.

The fourth opportunity is coordinated public demand. Several Swedish interviewees argue that the missing factor is not only funding but also customers. A Nordic mechanism for pilot procurement, pre-commercial procurement or shared public sector challenge programmes could help firms validate technologies and build exportable references. This would be especially relevant for downstream applications and dual-use services.

The fifth opportunity is finance and acceleration. Rymdkapital and other interviewees point to the weak investment capacity in Sweden. A Nordic space accelerator, co-investment facility or scale-up mechanism could help address the gap between early grants and commercial growth. LTU suggests a UK Space Catapult-style cross-country platform that maps capabilities, hosts demand-side actors and helps recombine competences across countries.

The limitations are significant. ESA and EU frameworks remain more operationally important than Nordic cooperation for many actors. National priorities differ, and there is no common Nordic funding or procurement authority. Many Swedish companies are small and cannot spend time on broad cooperation unless it leads to customers, investment or technical opportunities. There is also limited cross-border visibility: Actors often know their national ecosystems better than complementary capabilities in neighbouring countries.

Therefore, the Swedish view of Nordic cooperation is pragmatic. It should not be built as another discussion platform. It should focus on concrete missions, shared infrastructure, public sector demand, demonstration projects, procurement mechanisms, scale-up finance and international positioning. Sweden can contribute infrastructure, engineering, research, defence and AI capability. In return, it needs complementary Nordic markets, partners, customers and coordinated demand. If Nordic cooperation can provide that, it could help Sweden move from a broad but fragmented ecosystem towards a more integrated regional space capability.



The Horsehead Nebula in Orion. iStockphoto.

Methodological appendix

Appendix A: Literature

- Aalto University. (2025). Keys to growth: How a student satellite became Finland's new success story. Aalto University. www.aalto.fi/en/news/keys-to-growth-how-a-student-satellite-became-finlands-new-success-story
- Andøya Space. (n.d.). Andøya Space. Andøya Space. www.andoyaspace.no
- Arctic Business. (2024). Arctic Business is the new operator of ESA BIC Sweden. Arctic Business. www.abi.se/2024/04/04/arctic-business-is-the-new-operator-of-esa-bic-sweden
- Artemis Iceland Workgroup. (n.d.). Artemis Iceland Workgroup. IRIS. www.iriss.is/artemis-iceland-workgroup
- Business Finland. (2025a). Taking the road, up to the skies. www.businessfinland.fi/globalassets/finnish-customers/about-us/results-and-impact/taking_the_road-evaluation-report-8-2025.pdf
- Business Finland. (2025b). Business Finland grants funding to ICEYE.
- Danish Ministry of Higher Education and Science. (2024). Strategy for Space Research and Innovation. www.ufsn.dk/media/brvab5uc/strategy-for-space-research-and-innovation.pdf
- ESA BIC Denmark. (n.d.). ESA BIC Denmark. www.spaceventures.dk/esabic
- European Space Agency. (n.d.). Member States & Cooperating States. ESA. www.esa.int/About_Us/Corporate_news/Member_States_Cooperating_States
- Finnish Government, Ministry of Economic Affairs and Employment, and Finnish Space Committee. (2025). Space Strategy 2030. julkaisut.valtioneuvosto.fi/handle/10024/166266
- GomSpace. (n.d.). GomSpace. www.gomspace.com

Government Offices of Sweden. (2025). The role of space in a new security situation: Sweden's defence and security strategy for space. www.government.se/information-material/2025/02/the-role-of-space-in-a-new-security-situation--swedens-defence-and-security-strategy-for-space

Iceland Space Agency. (n.d.). Iceland Space Agency. www.icelandspaceagency.is

ICEYE. (n.d.). ICEYE. www.iceye.com

IRISS. (2025). IRISS – Iceland Research Institute for Space Science. www.iriss.is

Kongsberg Defence & Aerospace. (n.d.). Space and surveillance/satellites. Kongsberg Defence & Aerospace. www.kongsberg.com/kda/what-we-do/defence-and-security/space-and-surveillance

KSAT. (n.d.). KSAT. www.ksat.no

Kuva Space. (n.d.). Kuva Space. www.kuvaspace.com

Leeb, D. R. (2024). A framework analysis on the space sector in Iceland. New Space. www.liebertpub.com/doi/10.1089/space.2024.0007

Ministry of Economic Affairs and Employment of Finland. (2025). Space Strategy 2030. www.tem.fi/en/the-national-strategy-for-finlands-space-activities

Ministry of Higher Education and Science. (2024). Strategy for space research and innovation: National priorities for Danish space research, innovation and technology development 2025–2035. Ministry of Higher Education and Science. www.ufm.dk/english/publications/2024/november/strategy-for-space-research-and-innovation

Norwegian Government. (2020). The Government's strategy for Norwegian space activities.

Norwegian Space Agency. (n.d.). Norwegian Space Agency. www.romsenter.no/en

Norwegian Space Agency. (n.d.). Space activities are important for Norway.

OHB Sweden. (n.d.). OHB Sweden. www.ohb-sweden.se

Space Denmark. (n.d.). Space Denmark. www.spacedenmark.dk

Space Finland. (n.d.). Space Finland. www.spacefinland.fi

Space Inventor. (n.d.). Space Inventor. www.spaceinventor.com

Space Norway. (n.d.). Space Norway. www.spacenorway.no

SpaceFinland. (2025). Finnish Space Strategy 2030 julkaisut.valtioneuvosto.fi/server/api/core/bitstreams/aec5a820-12d1-421e-9a78-499e9070e9ce/content

SpaceFinland. (2024). Space sector well taken into account in the Government decision on the objectives of security of supply. www.valtioneuvosto.fi/en/-/60305973/space-sector-well-taken-into-account-in-the-government-decision-on-the-objectives-of-security-of-supply

SSC. (2025). Annual and Sustainability Report 2024. Swedish Space Corporation. www.sscspace.com/wp-content/uploads/2025/07/SSC-Annual-and-Sustainability-Report-2024_EN.pdf

Swedish National Space Agency. (2019). The Strategy of the Swedish National Space Agency. www.rymdstyrelsen.se/contentassets/3d8de30dbebb406c8f375c267ed04fe8/rymdstrategi-eng_web.pdf

Terma. (n.d.). Space. Terma. www.terma.com

University of Iceland. (2023). Memorandum of Understanding committing to collaboration in space research. english.hi.is/news/memorandum-understanding-committing-collaboration-space-research

VTT. (2026). Reliable connections via space – VTT strengthens satellite communications excellence. www.vttresearch.com/en/news-and-ideas/reliable-connections-space-vtt-strengthens-satellite-communications-excellence

Appendix B: List of main abbreviations

Abbreviation	Expansion	Explanation
AI	Artificial Intelligence	Used in satellite data processing, onboard analytics, sensor fusion and space-enabled services.
AIS	Automatic Identification System	Maritime vessel identification and tracking system, relevant for satellite-supported maritime monitoring.
AIT	Assembly, Integration and Testing	Key phase in satellite and spacecraft development before launch.
CASSINI	EU CASSINI Space Entrepreneurship Initiative	EU initiative supporting space startups, investment and commercialisation.
COPUOS	Committee on the Peaceful Uses of Outer Space	UN committee concerned with international cooperation and governance in outer space.
EO	Earth Observation	Satellite-based observation of Earth, including land, sea, ice, atmosphere, forests, climate and infrastructure.
ESA	European Space Agency	Central European space organisation for missions, technology development, funding and international cooperation.
ESA BIC	European Space Agency Business Incubation Centre	ESA-linked incubator supporting space-related startups with funding, business support and technical networks.
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites	European organisation operating meteorological satellite systems and related data services.
EUSPA	European Union Agency for the Space Programme	EU agency supporting the EU space programme, including market uptake and services related to Galileo and EGNOS.
GEO	Geostationary Earth Orbit	Orbit where a satellite appears fixed relative to Earth; relevant for communications and weather satellites.
GNSS	Global Navigation Satellite System	Satellite navigation systems used for positioning, navigation and timing, such as GPS and Galileo.

Abbreviation	Expansion	Explanation
GOVSATCOM	Governmental Satellite Communications	Secure satellite communication services for government, defence, emergency and public sector users.
HAPS/HALE	High-Altitude Platform Stations/ High-Altitude Long-Endurance platforms	Near-space platforms used for observation, communication or surveillance.
HYP SO	HYPerspectral Smallsat for Ocean Observation	Norwegian small-satellite mission line using hyperspectral imaging for ocean observation.
IOD	In-Orbit Demonstration	Demonstration and validation of technology after launch into space.
IRISS	Iceland Research Institute of Space Science	Icelandic research and innovation platform for space science and space-related collaboration.
ISA	Iceland Space Agency	Icelandic space-related connector and facilitator mentioned in the Iceland chapter.
ISRU	In-Situ Resource Utilisation	Use of local resources in space exploration, for example on the Moon or Mars.
JAXA	Japan Aerospace Exploration Agency	Japanese space agency and international research collaborator.
KSAT	Kongsberg Satellite Services	Norwegian ground-station and satellite-services company, central to Norway's space infrastructure.
LEO	Low Earth Orbit	Orbit close to Earth, widely used for Earth observation, communications constellations and new space systems.
LEO-PNT	Low Earth Orbit-based Positioning, Navigation and Timing	Emerging approach to resilient navigation and timing services using LEO satellites.
NASA	National Aeronautics and Space Administration	US space agency and international space actor.
NOSA	Norwegian Space Agency	Norwegian public space agency responsible for national space policy, ESA coordination and industry support.
PNT	Positioning, Navigation and Timing	Satellite-enabled services providing location, navigation and precise timing for infrastructure, transport and defence.
SAR	Synthetic Aperture Radar	Radar-based Earth observation technology that can monitor Earth regardless of cloud cover or daylight.
SATCOM	Satellite Communications	Communication services delivered via satellites, including maritime, Arctic, government and emergency communications.

Abbreviation	Expansion	Explanation
SSA	Space Situational Awareness	Monitoring of satellites, debris, orbital risks, space weather and the wider space environment.
SST	Space Surveillance and Tracking	Tracking of satellites, space debris and other objects in orbit.
TRL	Technology Readiness Level	Scale used to assess technology maturity from early research to operational deployment.

Appendix C: Tech mining of patent methodology

We have identified patent active and pending patents from Nordic actors via the global patent database Patsnap using search strings inspired by WIPO.^[1]

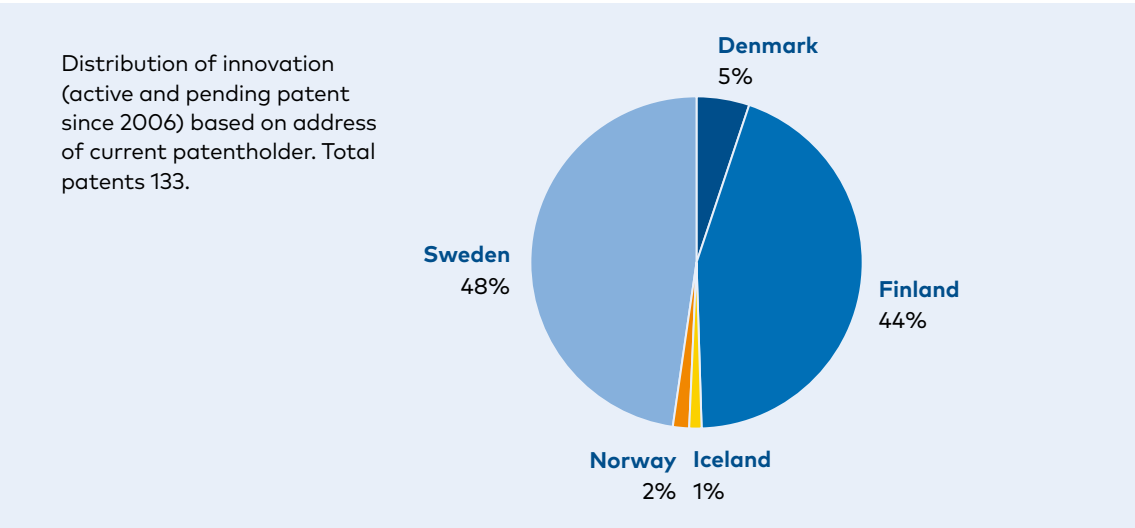
The search was designed to find currently active and pending patents in the Nordic countries that are directly or explicitly related to space and satellite technologies, including spacecraft, satellites, space stations, probes, astronaut/cosmonaut systems and space vehicles. It also captures enabling technologies for space use when the patent text clearly links them to space, such as space propulsion, satellite power systems, solar and energy components, navigation and positioning, antennas, communications payloads, remote sensing, Earth observation and non-terrestrial networks. In addition, the search includes patents on orbital satellite systems such as LEO, GEO and other Earth-orbit concepts as well as near-space platforms like HAPS/HALE pseudo-satellites, stratospheric platforms, aerostats and high-altitude communication systems. At the same time, the query tries to exclude clearly non-space uses, such as generic air-to-ground traffic or work-platform technologies, unless they are explicitly framed as non-terrestrial or high-altitude communication solutions.

A total of 1,380 patents were identified in the first raw search, and the search result was then cleaned using AI to qualitatively evaluate the patents from their title, abstract and patent-codes to reduce the 'noise' of the search results. This reduced the number to 673 patents that have a medium to very clear relation to space, of which 133^[2] have a very clear relation to space.

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1. www.wipo.int/web-publications/wipo-technology-trends-technical-annex-the-future-of-transportation-in-space/en/introduction-to-space-transportation.html
 2. The numbers reported are patent families. An innovation can be patented in several countries, but in counting patents, they are usually grouped even if there are more patents behind.

Many companies take out patents to secure their intellectual property for a period and thus patents are a great and continuously updated indicator for innovation and market interest for a region. It is an indicator and not a complete registration of innovation/technology since some companies prefer not to take out a patent for secrecy reasons and technologies with military or dual-use potential may not be patented. Therefore, in the global search for patents on space technologies there are relatively few patents from, for example, Tesla. Companies in Sweden and Finland have most of the patents (about 45% each), and Denmark has 5%, Norway 2% and only one company with an address in Iceland that has patented a technology which is for satellite beam forming (Figure 1).

Figure 1. Patents in Nordic countries with relation to space.



Appendix D: Interview overview

Additional interviews were and are being conducted (or scheduled) following the drafting of the above definition and preliminary recommendations. The table below gives an overview as of 1 June 2026:

Name	Position	Organisation/programme	Category	Country
Thomas A. E. Andersen	CEO	Danish Aerospace Company	Company	Denmark
Damir Ljubcic	CEO	Space Composite Structures DENMARK ApS	Company	Denmark

Name	Position	Organisation/programme	Category	Country
Thomas Hofman-Bang	CEO	The Danish Industry Foundation	Foundation	Denmark
Peter Mandix Sehestedt	Senior Adviser in the Division for Space	Ministry of Higher Education and Science	Policy	Denmark
Sune Nordentoft Lauritsen	Head of Space ventures (DTU)	Space Ventures DK	Hubs	Denmark
Tero Vihavainen	Secretary General	Finnish Space Committee	Policy	Finland
Jyri Heilimo	Head of Group	Finnish Meteorological Institute	Research	Finland
Jarkko Koskinen	Deputy Director General	Finnish Geospatial Research Institute	Research	Finland
Tapio Tourula	Chief Preparedness Specialist	National Emergency Supply Agency	Policy	Finland
Timo Latvala	Director, Space Business Area	Gofore	Company	Finland
Kaisa Ahonen	Project manager	ESA BIC Finland	Hubs	Finland
Renske Martijnse-Hartikka	Senior Project Manager	Forum Virium Helsinki	NGO/city innovation company	Finland
Mikko Punnala	Founder and Chairman of the board	SharpNav Oy	Startup	Finland
Heidi Kuusiniemi	Professor, Wireless Systems	Tampere University	Research	Finland
Tapio Tourula	Chief Preparedness Specialist	National Emergency Supply Agency	Public Authority	Finland
Tiina Nurmi	Chief Adviser	Business Finland	Hubs	Finland
James Francis	Research Fellow	European Space Policy Institute	Research	Nordics (based in Switzerland)
Marco Pizzolato	Natural Science specialist	Copernicus in Iceland	Research	Iceland
Daniel Robert Leeb	CEO	Iceland Space Agency	Policy	Iceland

Name	Position	Organisation/programme	Category	Country
Ketil Olsen	CEO and President of Andøya Space	Andøya Space AS	Company	Norway
Jo Bjørnstad	Managing Director ESA BIC NO	ESA BIC Norway	Hubs	Norway
Gunnar Helsøe	CEO	Norwegian Industrial Forum for Space Activities (NIFRO)	Cluster	Norway
Torgeir Solberg	Business Developer	ESA Phi-lab Norway	Funding	Norway
Pernille Sofie Hauge	Senior Adviser, innovation	Space Agency Norway	Policy	Norway
Charlotte Lahnborg Alme	Associate	Norwegian Space Cluster	Cluster	Norway
Ernesto Gutierrez	Head of Innovation and Societal Benefit	Swedish Space Agency	Policy	Sweden
Ulf Palmnäs	CEO	Rymdkapital	Venture capital	Sweden
Karin Holmqvist	Head of Space Strategy & Development	SAAB	Company	Sweden
Marcus Skogsmo	CEO	PandionAI	Company	Sweden

