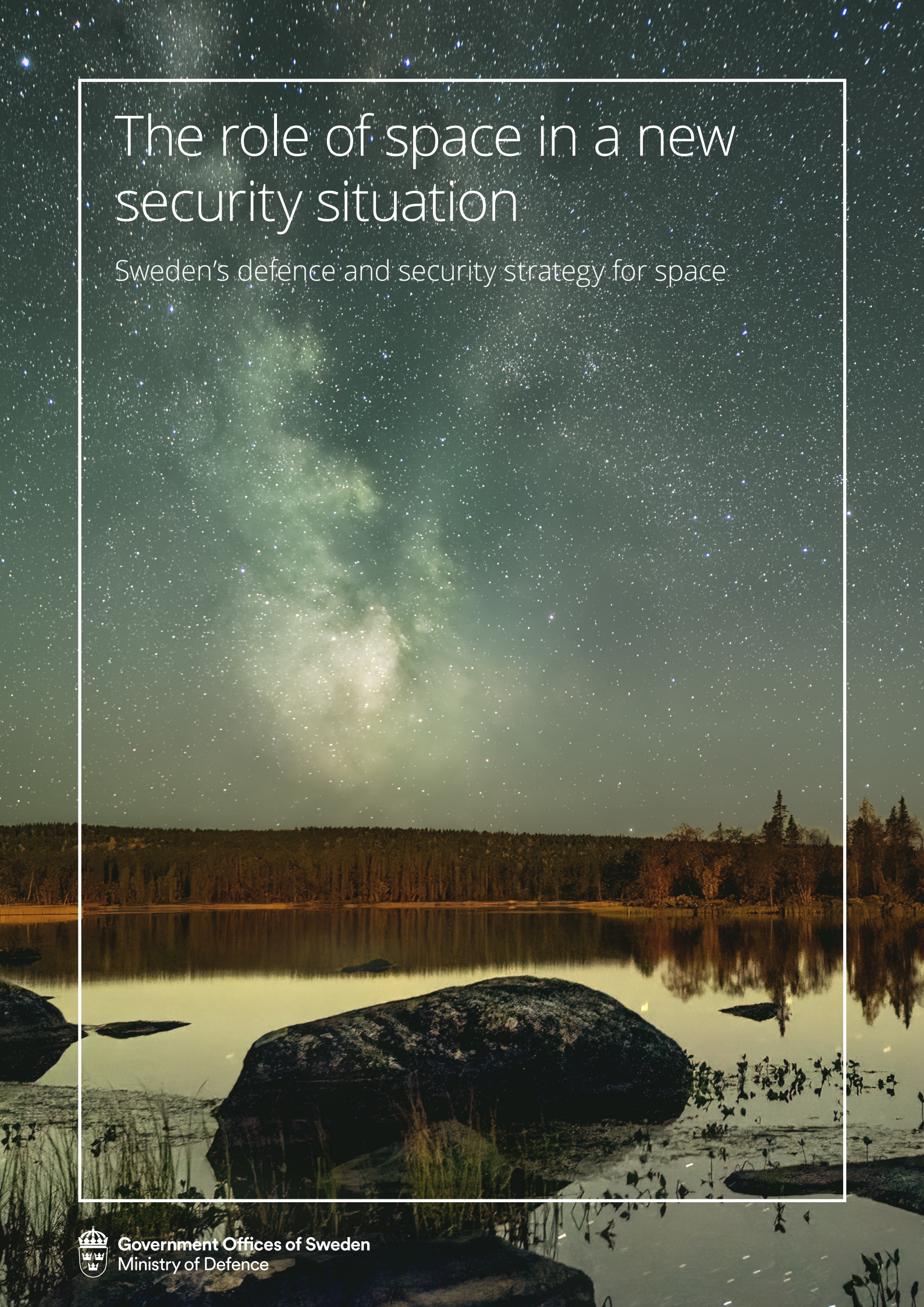
The role of space in a new security situation

Sweden's defence and security strategy for space



Government Offices of Sweden
Ministry of Defence

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Glossary

CER – Critical Entities Resilience

Counterspace capabilities are capabilities that are used to mislead, degrade, deny, disrupt or destroy an adversary's access to space infrastructure and/or space services. The effect can be reversible (for example jamming of signals) or non-reversible (for example attack with ballistic robots).

COPUOS – United Nations Committee for the Peaceful Uses of Outer Space

DIANA – Defence Innovation Accelerator for the North Atlantic

EDA – European Defence Agency

EDF – European Defence Fund

EU – European Union

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

GNSS – Global Navigation Satellite Systems

HCOC – Hague Code of Conduct

ITU – International Telecommunication Union

MTCR – Missile Technology Control Regime

NATO – North Atlantic Treaty Organization

NIF – NATO Innovation Fund

NIS2 – Network and Information Security 2

NORDEFCO – Nordic Defence Cooperation

PESCO – Permanent Structured Cooperation

SatCen – European Union Satellite Centre

SDA – Space Domain Awareness is a timely and actionable awareness of all events, actions, intentions and actors in the space domain. SDA encompasses SST, space weather, the electronic warfare environment and space intelligence in order to understand events in a multi-domain context.

Space capability is the ability to use space infrastructure to support operations in other domains. It includes doctrine, organisation, personnel and materiel.

Space data is produced and/or transmitted via space infrastructure and used to provide space services.

Space debris is a result of human activities in space and is made up of debris from objects placed in space, such as satellites, rocket stages, etc.

The **space domain** includes the physical environment in the form of the orbits around the Earth and the area between the Earth and the Moon. It also includes the space infrastructure and the space sector. The space domain is based on the following segments: the launch segment, the space segment, the link segment, the ground segment and the user segment.

Space infrastructure includes space-based systems (satellites), data links, launch infrastructure and ground-based systems (ground stations, operations centres, etc.).

Space intelligence is processed information, obtained via all intelligence channels and provides a basis for assessment of the space domain and its actors. It may include technical intelligence on space operations and space systems, intelligence from open sources and strategic environmental analysis of the development of the space domain including actors and technology.

Space services are provided by space systems to users for various operations and activities, for example navigation.

SSA – Space Situational Awareness is an operator-specific overview of the space environment and space flight as well as the most important space risks. These risks include collisions between space objects, fragmentation of space objects, re-entry into the atmosphere, space weather and near-Earth objects. SSA is based on SST, space weather and near-Earth objects.

SSC – Swedish Space Corporation

SST – Space surveillance and tracking of space objects is done through a network of ground- and space-based sensors.

UN – United Nations

Ministerial foreword

Pål Jonson
Minister for Defence

Space is a strategic domain – its use is of great importance to our societies and, not least, to our defence. With space systems we can today observe, communicate and navigate at any time, almost anywhere on Earth. Space is also an operational domain. The use of space contributes to Sweden's total defence and security by enhancing the effect of our existing defence capabilities and ensuring important societal functions.

We will secure our defence and security interests in and through space by establishing ourselves as a significant and responsible space actor in defence and security. Our geostrategic location and collective national capacity in the space sector constitute the starting points to achieve our strategic objectives.

Sweden will safeguard freedom of action in and through space. Space is an arena for cooperation, but is also characterised by competition and contention, along with the fact that the Earth orbits constitute a finite resource. We will have the ability to anticipate and manage challenges connected to space. In concrete terms, this means taking various technical, political, diplomatic and military measures when necessary. It also entails awareness of yourself and the opponent, which is why situational awareness in the space domain is central.

Sweden will create a portfolio consisting of space capabilities, services and capacity to support our total defence and crisis preparedness. By making strategic choices between ownership, collaboration with others and commercial access, we increase our strategic independence and become a more relevant partner in defence and security cooperation. We will develop sovereign space capabilities for reconnaissance and surveillance as well as launch capability, and will leverage the potential of our national space value chain.

Sweden will act together with others when possible, and alone when necessary. We will contribute to the space domain by being a credible Ally of NATO and an engaged Member of the EU. We prioritise defence and security space cooperation with our Nordic neighbours and strategic partners.

Defence and security are becoming increasingly important in Swedish space policy. We will therefore pursue a cohesive and knowledge-based space policy that contributes to the development of our crisis preparedness and total defence. We will ensure that we have human capital with interdisciplinary competence and knowledge to understand and use space as a physical, strategic and operational domain.

With this strategy, we are strengthening the defence and security dimension of space policy to make Sweden better equipped to face challenges in space and more capable of utilising space for defence and security.

Sweden from space.

Photo: NASA

Strategic context

The use of space has made our societies stronger, safer and more prosperous, and has become part of everyday life. With space systems, one can observe, communicate and navigate almost anywhere on earth. Space is a strategic domain upon which we have become increasingly dependent.

Space – the new high seas

In an ever uncertain world with increasing geopolitical tensions, space continues to be an arena for cooperation. However, with renewed great power competition there is increased risk of conflict. States are using the political and technological prestige of space programmes to advance strategic and political interests. Space systems have dual-use applications, and commercial space systems are increasingly used for military purposes. In recent years, there has been an increase in the number of cyberattacks, disruptions and conflict-inducing manoeuvres in space. These have also targeted civil and commercial space infrastructure, often in the form of hybrid threats and attacks.

Today, development largely takes place in the commercial sector, with great opportunities linked to research, development and new services that benefit society. Rapid technological development, innovation and application of new business models, with commercial actors at the centre, have resulted in space services and data being more accessible than ever to a growing number of actors. The growth of the space sector contributes to greater societal reliance on emerging space infrastructure, with an increasing number of space services being integrated into various societal functions.

Earthrise from the moon. Image from Apollo 11, 1969.

Photo: NASA

Illustration of space debris.

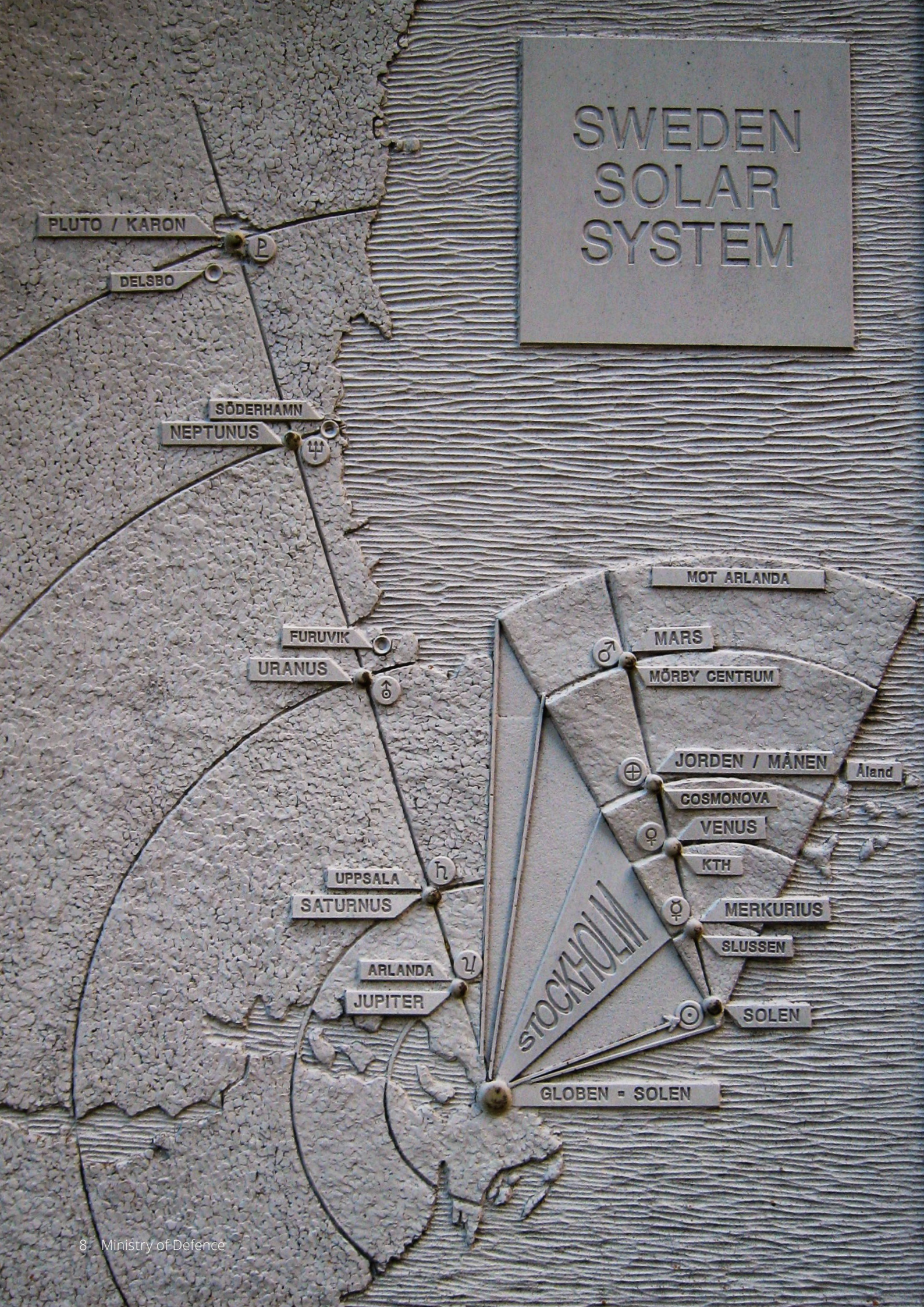
Photo: ESA

Global competition for access to the radio spectrum for space infrastructure and services, and a lack of launch capacity are partly driven by the establishment of new satellite megaconstellations. Space technology, combined with other disruptive technologies such as AI and quantum technology, can transform warfare and is increasingly the result of technology-intensive innovation in the civilian sector.

The evolution of space flight was driven by military interests and benefits, such as strategic intelligence-gathering and early warning systems. The ongoing operationalisation of the space domain is a result of increasing numbers of states defining space as an operational domain along with the maritime, land, air and cyber domains, which is manifested, among other things, through military doctrine and capability development. The interweaving of the space domain with other domains is becoming more tangible.

Challenges in space comprise a wide range of physical threats and hazards, political challenges, and the fact that the Earth orbits are a finite and economically exploitable resource. More actors in space equals more objects in orbit around the Earth, jeopardising the sustainable use of space. Moreover, exploration of outer space and other celestial bodies may result in conflicts of interest in the future. The development and use of counterspace capabilities, aimed at denying an adversary access to space infrastructure or space services, continues.

In 2021, Russia conducted an anti-satellite test against its own satellite by using a ground-based missile, resulting in a long-lasting field of space debris. Just before the full-scale invasion of Ukraine began, Russia carried out a cyberattack against a commercial satellite communications provider, disabling tens of thousands of European modems. Russia also engages in electronic warfare to disrupt GNSS services for positioning, navigation and time, and thus affecting civil maritime shipping and aviation in Sweden's neighbourhood.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SOLAR
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SATURNUS
ARLANDA
JUPITER
MOT ARLANDA
MARS
MÖRBY CENTRUM
JORDEN / MÅNEN
Åland
COSMONOVA
VENUS
KTH
MERKURIUS
SLUSSEN
SOLEN
STOCKHOLM
GLOBEN = SOLEN

The Outer Space Treaty of 1967 is the foundation for the international legal framework for space. Among other things, it stipulates that states must conduct their exploration and use of space in accordance with the rules of international law, including the UN Charter. The Treaty also prohibits the placement of weapons of mass destruction in orbit. States are responsible for both governmental and non-governmental activities in space and for these to be conducted in accordance with the Treaty. The UN Charter contains rules on states' right to self-defence in the event of an armed attack according to Article 51, as well as rules for the peaceful resolution of conflicts. In addition to binding international law, there are also norms, rules and principles of responsible behaviours in space.

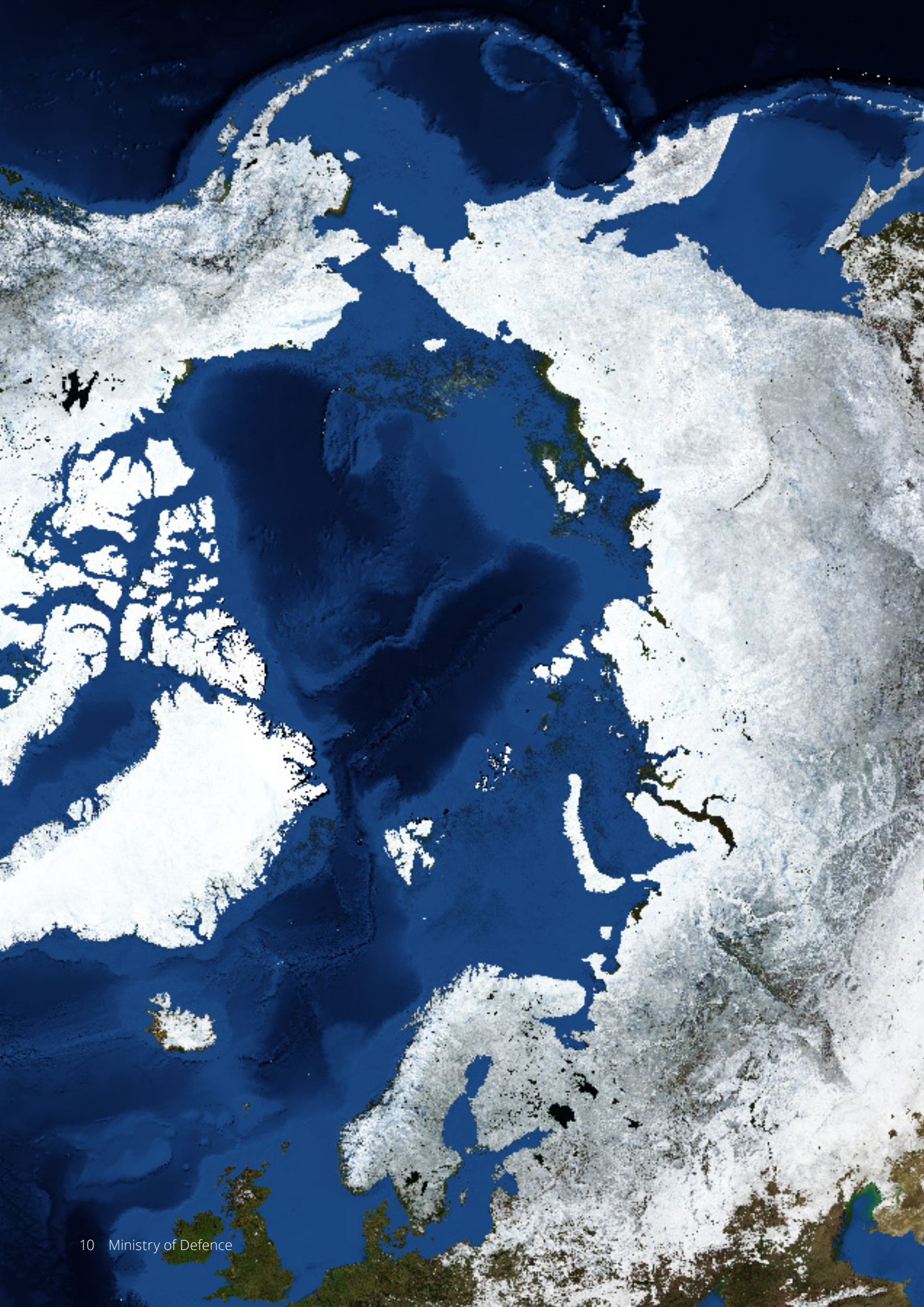
The increased activity in space necessitates joint development of international norms, rules and principles of responsible behaviours in space. This takes place mainly within the framework of the UN. In light of the consequences of destructive anti-satellite tests with ground-based missiles in recent years, a growing number of states are making unilateral commitments to ban such tests, which may become the norm in the long term. All EU Member States have already made such commitments.

Sweden has the world's largest scale model of the solar system.

Photo: Wikimedia Commons

Signing of the Outer Space Treaty in 1967.

Photo: UN Photo



A transformed Europe

Europe is facing possibly the most challenging security situation since the Second World War. The war in Ukraine has cemented the critical role that space services play in modern warfare. Satellite communications enable contact with the rest of the world, and satellite imagery provides a unique insight into the brutality of war. The war has also highlighted the vulnerability of space infrastructure and reliance on access to space services and launch capacity.

NATO

Strategically, space is increasingly important to NATO. In 2019, the Allies adopted a comprehensive Space Policy, declaring space an operational domain alongside the air, maritime, land and cyber domains. This Policy is a step towards establishing space as an operational domain, and strengthening the Alliance's core tasks of deterrence and defence. The Policy states that strategic competitors and potential adversaries are developing and operationalising technologies that could threaten Allies' freedom of action in space.

The role of space in NATO's 360-degree approach is emphasised in the Alliance's Strategic Concept of 2022. The Concept also states that a single or cumulative set of malicious cyberactivities or hostile operations to, from, or within space, could reach the level of armed attack and result in the North Atlantic Council invoking Article 5. NATO's first Space Symposium in 2024 served as a stepping stone to advance NATO's space agenda.

EU

Russia's full-scale invasion of Ukraine has led to a transformation of the EU's security and defence policy, also including the space domain. In recent years, the EU has developed the foreign and security policy dimensions of its space policy, all the while links between space and defence industrial initiatives have been strengthened. The most important instrument for this is the 2023 EU Space Strategy for Security and Defence, which was announced in the EU's Strategic Compass for Security and Defence in 2022.

The Space Strategy represents a paradigm shift in the EU's approach to space. It aims to strengthen the EU's strategic position and independence in the space domain, and to increase the EU's ability to face the increasing competition and potential for conflict in space. The Strategy conveys an ambition to increase the use of the EU's civil space programme for defence and security purposes by integrating defence and security requirements into the evolution of the program. The Strategy is a security policy instrument that strengthens the EU's credibility as a space actor in the global arena and contributes to its common security and defence policy.

Arctic region

In Sweden's immediate neighbourhood, the European part of the Arctic region together with the Baltic Sea have a special geostrategic significance. The region has emerged as a strategically important arena for several actors including NATO. Many strategically important reconnaissance and surveillance satellites pass over the Earth's poles. Protecting critical infrastructure in the region is becoming increasingly important. Access to space capabilities and space services for navigation, communication and surveillance will play a critical role in conducting safe and effective operations in the region.

The new security situation and the region's increased geostrategic importance call for an adaptation of the Nordic defence cooperation. With all the Nordic countries now in NATO, it heralds a new era of Nordic defence cooperation.

Arctic region.

Photo: ASP GeoImaging/NASA

Paradigm shift in Swedish security policy

Sweden is in a serious security situation and a strong total defence is crucial to deal with it. Sweden's security policy, which is based on solidarity, constitutes the foundation of Swedish defence and security policy. Sweden's security policy also forms the basis for Swedish involvement in space-related matters.

A loyal NATO Ally and EU Member

As in other domains, Sweden builds security in space together with others: as a loyal NATO Ally and EU Member, and through cooperation with other Nordic countries and strategic Allies. Sweden pursues an Alliance policy based on solidarity with the aim of strengthening security and stability in Sweden's neighbourhood and in the entire Euro-Atlantic area. The transatlantic link between Europe and the US is crucial to our security. NATO membership has shifted the defence of Sweden to NATO's outer border. Thus, Sweden must have the capability to act for the common security within the Alliance, where national defences contribute to the Alliance's combined strength.

A space nation with a geostrategic location in the north

As a space nation with industrial capability in almost the entire value chain, Sweden is well-positioned to contribute to the region's common security. Infrastructure, industrial capability, innovative power and space expertise are assets that can be used strategically to support Sweden's security policy and strategic objectives.

Sweden's proximity to the North Pole provides ideal conditions for operating, monitoring and launching polar satellites. Sweden is developing the capability to launch satellites into space from the Esrange spaceport, thus becoming one of few countries with launch capacity. The geostrategic situation in both the Arctic and Baltic Sea regions means that Sweden can play a significant role in developing and providing space capabilities and space services within NATO and the EU. Sweden will likely also be affected in the event of an armed conflict in the Arctic.

Swedish soldiers mark Sweden's NATO accession on 7 March 2024, the day Sweden became a full member of NATO.

Photo: David Kristiansen/Swedish Armed Forces

Security-threatening operations

Due to Sweden's geostrategic location and space capabilities, several antagonistic actors are carrying out activities that threaten Sweden's security. The acquisition of and access to Swedish infrastructure, technology and knowledge in the Swedish space sector by foreign actors is a threat to national security and competitiveness. Foreign intelligence threats to Sweden's space activities are directed against authorities, partners, industry and the research community.

Russia, China and Iran conduct intelligence operations against Swedish actors. Russia presents the greatest military threat in Sweden's close neighbourhood. China uses space activities to strengthen its role in the global arena and pursues a policy of civil-military fusion. To gain influence in the Arctic, China is establishing ground stations for data collection from Chinese satellites in the Nordic countries and taking advantage of research collaborations.

Swedish space policy

Several entities within central government administration are involved in space policy and utilise space infrastructure. The space domain's development and its growing importance lead to the involvement of more actors. Several government agencies are implementing organisational changes in order to manage space-related issues and activities. Today, space services are already integrated into some of the Swedish Armed Forces' operations, and will in future become further integrated and support multi-domain operations. Space services also contribute to civil preparedness and there is great potential for the use of space data in law enforcement. At the same time, Sweden's growing societal dependence on space puts it in a more vulnerable position.

Defence, security and foreign policy aspects are becoming increasingly important in Swedish space policy. As stated in Sweden's national space strategy of 2018, space activities should be conducted with a holistic approach, based on ensuring societal benefits and national security. Space activities should also be based on a strong Swedish space industry and high-quality space research.

The defence and security strategy for space complements the national space strategy by emphasising total defence and security as the ultimate guarantor of a free and democratic society. By strengthening the defence and security dimension in space policy, Sweden will be better equipped to face the challenges in space and more capable of using space for defence and security.

The overall objective of the strategy is to secure Sweden's defence and security interests in and through space. In order to achieve this, Sweden aims to establish itself as a significant and responsible space actor in defence and security through national and international activities. The strategy is based on four pillars that include eight strategic goals with accompanying measures.

Cyber soldiers.

Photo: Mattias Andersson/Swedish Armed Forces

Freedom of action in and through space

Given Sweden's growing role as a space actor in defence and security, it is of the utmost importance to ensure Sweden's access to and use of space, as well as assured access to robust space services and data in all situations. Sweden must mobilise its capacity to understand, counter and respond to aggressive behaviour and threats connected to space. Challenges and threats should be met as far as possible in cooperation with other states and organisations. This includes a toolbox consisting of political, technical, diplomatic and military measures.

Strategic objective 1: Sweden will ensure its political and military freedom of action in and through space.

Strategic objective 2: Sweden will have the ability to avert, detect and manage security-threatening operations against Sweden or its Allies in the space domain, both on Swedish territory and against Swedish infrastructure in space.

Peace in outer space

Sweden will contribute to a peaceful, secure and sustainable use of space by:

- developing and pursuing an active space diplomacy;
- ensuring continued compliance with our international commitments and encouraging more states to accede to the Outer Space Treaty;
- maintaining a rules-based order and international coordination within the UN-structure; and
- maintaining transparent communication on our actions in space.

Peace in outer space must be preserved. Threats and attacks are averted by promoting stability and security in space, thereby preventing space from becoming an arena for warfare. As a global commons, space is non-territorial and is not subject to national appropriation by claim of sovereignty in accordance with the Outer Space Treaty from 1967. Sweden is party to four of the five international space treaties. As a space nation, Sweden acts in accordance with the principle of due regard to the corresponding interests

of other actors when conducting space activities, in line with Article 9 of the Outer Space Treaty. Sweden, together with other Member States of the EU, has made the commitment not to conduct destructive, direct-ascent anti-satellite missile testing.

Sweden actively participates in cooperation formats on international export control related to the space domain. As a nation with launch capacity, Sweden will provide notifications before satellite launches, in accordance with the Hague Code of Conduct. In addition, Sweden will ensure public safety with respect to other states that may be affected in connection with launches. Sweden is a member of the Missile Technology Control Regime, the activities of which mainly concern the export control of complete robotic systems (ballistic missiles, sounding rockets and space launchers) and other unmanned aerial vehicles.

Sweden is a member of the International Telecommunication Union (ITU), which maintains the Radio Regulations on the global use of the radio-frequency spectrum, and coordinates satellite orbits for all types of wireless communication. Frequencies are a vital resource for all space infrastructure and Sweden will protect both the rules-based order and the associated processes as coordinated through the UN. A well-functioning and rules-based international collaboration is crucial for Swedish security interests in this aspect.

Transparent communication on behaviour in space helps to reduce the risk of misunderstanding and builds trust between space actors,enhancing possibilities for diplomatic efforts. The development of a code of conduct for military activities in space together with others is an important part of this. The communication of this defence and security strategy on space issues is a trust- and confidence-building measure in itself.

Europe.

Photo: ESA

Deterrence and defence

Sweden will, individually and together with others:

- act to mitigate conflict and prevent war in order to preserve peace in space;
- take political and military action when necessary.

Credible deterrence is achieved together with Sweden's Allies. Total defence, as part of NATO's collective defence, contributes to NATO's collective deterrence and thus to peacekeeping and prevention of war. It can also help to deter hybrid threats during peacetime. Through proactive engagement during peacetime, Sweden can help strengthen NATO's collective defence and thuscollective deterrence. Political measures are taken individually and together with Allies in NATO, and within the framework of the EU and UN with the aim of attaining freedom of action in space without military measures.

If necessary, Sweden will take military action through appropriate defensive and offensive measures, individually or together with Allies in NATO, and in accordance with international and national law. The collective defence commitments in Article 5 of the North Atlantic Treaty also include the space domain, as an armed attack in, from or to space could lead to the invocation of Article 5. As a member of the EU, Sweden can invoke the mutual assistance clause in line with Article 42.7 of the Treaty on European Union in a situation where a space-related attack would amount to an armed attack on Swedish territory.

A real-time situational awareness of the space domain is key to identifying conduct that poses a threat to Swedish interests and to preventing the escalation of conflicts in space. Furthermore, it contributes towards accountability and to verification of compliance with national and international regulations.

The Swedish Air Force on a flyover exercise.

Photo: Antonia Sehlstedt/Swedish Armed Forces

The overall threat landscape

Sweden will take measures to ensure that relevant actors have access to a comprehensive and shared threat landscape of the space domain through enhanced collaboration.

The threat landscape in the space domain is complex as the lines between external and internal security are blurred. Threats to space infrastructure are also a threat to military capabilities, as space capabilities and space services support capabilities in other domains. Access to information on multi-dimensional threats facilitates space-linked vulnerability analyses by actors in civil defence.

Civil and commercial space infrastructure that can be used for military purposes runs the risk of being perceived as a military target and subject to transferred threats. For this reason, it is important that the public and private sectors have a dialogue so that an adapted threat analysis is made available to military, civil and private actors. By enabling situational and demand-driven information-sharing between government agencies and the commercial sector in an organised and structured manner, joint capability for space intelligence can be obtained.

A security-based approach

Sweden will take measures to:

- expand collaboration between relevant government agencies with the aim of enhancing security work in the space sector;

- expand collaboration with the commercial space sector, which develops dual-use technology and services with the aim of raising awareness about the protection of sensitive information and to strengthen Swedish crisis preparedness;

- to evaluate and, if necessary, adapt Swedish space legislation to ensure Sweden's security and other defence, security and foreign policy-related interests, in line with international law.

Rapid developments in the space sector are leading to the emergence of sensitive technologies, products and information, which require taking protective measures at an equally high pace. Within the Swedish space sector, a high level of awareness of what needs to be protected and how to protect it is paramount in order for Swedish space activities to support total defence and crisis preparedness. By applying a strategic and security-based approach to space activities, Sweden is establishing an international reputation as a space actor, defence and security partner, and as an Ally.

Legal instruments, such as the Screening of Foreign Direct Investments Act, provide a framework for managing threats from foreign entities to security-sensitive activities. Given developments in the space domain, it is vital to have a national legislation adapted for space activities that, in line with international the rule of law, takes national security needs into account.

Agricultural monitoring by Copernicus Sentinel-2 over Malmö and Lund, Sweden.

Photo: Copernicus Sentinel data (2021)/ESA

Increased resilience

Sweden will take measures to:

- ensure that actors in the emergency services sectors increase their knowledge of the reliance on space services and conduct comprehensive risk and vulnerability analyses within each sector;
- ensure that Swedish space infrastructure in space and on the ground, including the radio links, is based on a strong security architecture;
- obtain redundancy in access to space services and robustness of space services;
- strengthen collaboration with the commercial space sector that develops dual-use technology and services.

The ability to withstand and recover from threats and attacks can be achieved through resilience, robustness and redundancy. Increased resilience requires a comprehensive approach from a technical and operational perspective as well as from a policy perspective that includes civil, commercial and military infrastructure and international cooperation. Space is one of the sectors encompassed by the EU cybersecurity directive (NIS2) and the critical entities resilience (CER) directive. The space sector includes operation of ground-based infrastructure owned, managed and operated by Member States or private parties that support the provision of space-based services, such as the Swedish Space Corporation (SSC) with operations at Esrange.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Dependencies

One objective of civil defence is the ability to ensure the maintenance of essential societal services in wartime. It is therefore important that there is a comprehensive understanding of society's dependence on space services and space data. Such dependencies exist within all ten emergency services sectors.

Resilient space infrastructure

Resilience is the ability to recover in the event of a disturbance. A resilient space infrastructure is important for Sweden's total defence capability as it helps to ensure that correct data is available to Swedish users at the right time, even in the event of major incidents such as physical and cyberattacks, as well as electromagnetic interference. One way to ensure access to space services can be the ability to rapidly replace physical systems with the help of responsive space capabilities.

Alternatives with redundancy

Redundancy in the provision of space services can be achieved by using several alternative systems for similar services in one or more domains and through strategic collaborations, including with commercial actors. With systems both in orbit and within the atmosphere, such as ground-based navigation services, the vulnerability to interference can be reduced.

Robustness for reliable data

Robust space services are important to obtain reliable data and undistorted signals. This can be achieved through a robust infrastructure, including by having ground stations in Sweden so that critical information can reach Swedish actors, without going through other countries with the risk of information manipulation. Interference with GNSS services affects civil aviation and maritime shipping. A national infrastructure with an alarm function for monitoring the GNSS services supports the understanding and management of disturbances.

Preparedness in the space domain

Sweden will further develop national preparedness for incident management in the space domain with relevant actors, including through exercises. A good preparedness for crises and wars involving space is a prerequisite for preventing, resisting and managing incidents involving the space infrastructure and for ensuring the availability of space services within total defence and crisis preparedness. Sweden participates in exercises within the EU and together with Allies and partners. Exercises at national level contribute to a better understanding and knowledge of how to manage threats and incidents in the space domain.

European Space Operations Centre in Darmstadt, Germany.

Photo: ESA

A space portfolio to support total defence and crisis preparedness

Space systems enable navigation, global monitoring and communication over long distances. Space services and space data contribute to crisis preparedness and civil and military defence, which all are part of the machinery maintaining societal security. A space portfolio consisting of capabilities, services and capacities increases Sweden's strategic independence and makes it a more significant Ally and defence and security partner.

Strategic objective 3: Sweden will be a significant and sought-after partner in the area of defence, security and space.

Strategic objective 4: Sweden will have assured access to a broad set of space services and space data in support of total defence and crisis preparedness.

Strategic objective 5: The Swedish space industry will, through the development of dual-use space services and space data, help to strengthen Sweden's security.

A balanced space portfolio

Sweden will take measures to:

- maintain a space portfolio of capabilities, services and capacity to ensure access to space services and space data within total defence and crisis preparedness;
- harness the potential of space services and space data that contribute to national decision-making and the maintenance of national security.

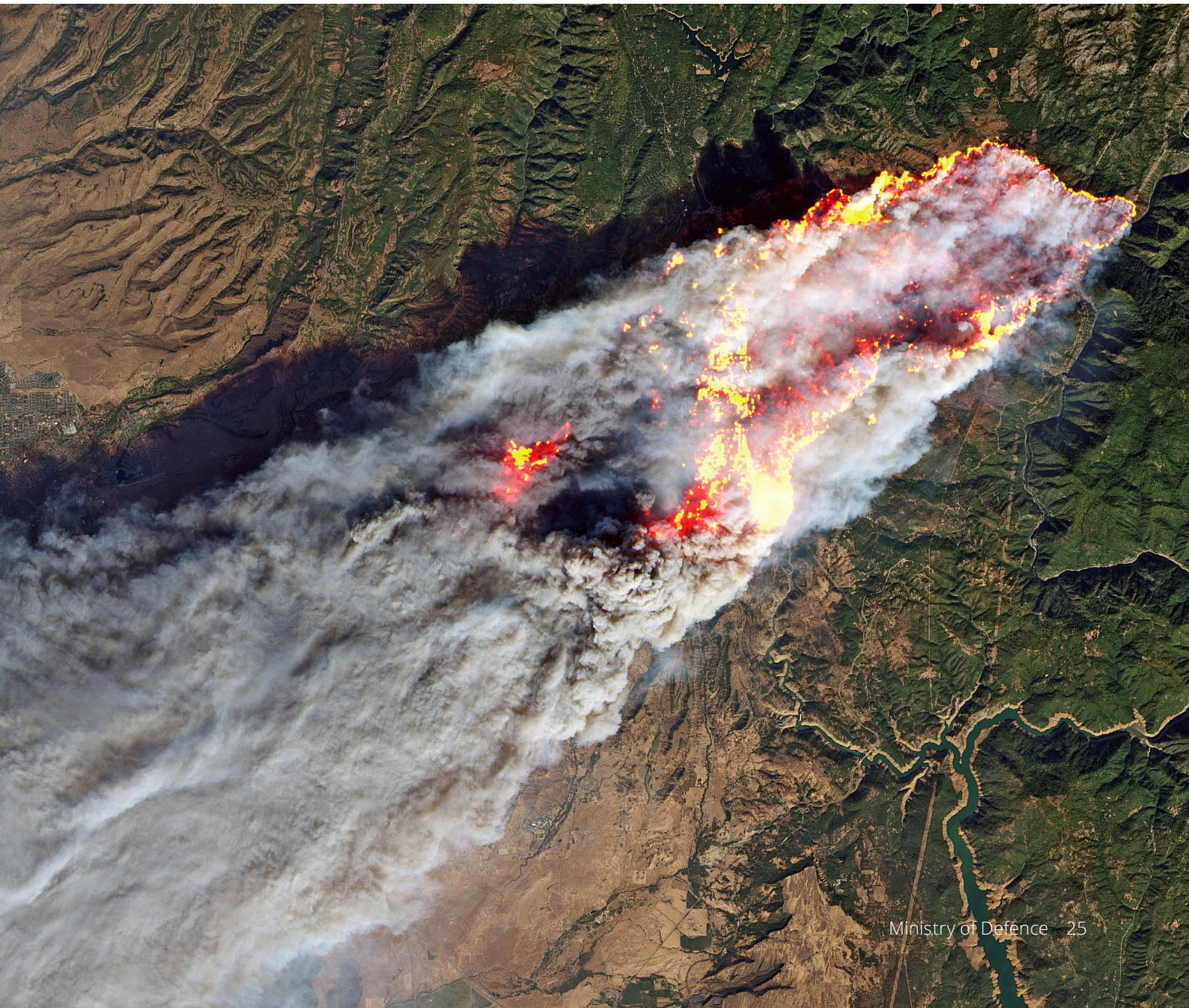
The Swedish space value chain encompasses development, launch and control of space systems as well as processing and utilisation of space data. As a small nation, Sweden does not have autonomy in the entire value chain, nor complete space capability. Rather, assured access is achieved nationally and together with strategic partners and Allies as well as through the use of commercial services. The space value chain is a strategic resource that enables collaboration with others, and in doing so fulfils strategic objectives.

The total defence is structured to defend Sweden and Allies against armed attacks based on the collective defence within NATO. The national defence capability, including the space portfolio, is part of NATO's collective defence. The space portfolio is dimensioned according to both national and NATO capability needs.

The space portfolio is a strategic balance between national ownership, cooperation and commercial access. Sweden's space capabilities enable sovereign control of and guaranteed access to space services and space data. International cooperation provides interoperability and cost sharing with access to space services and space data. Procurement of space services and space data from commercial suppliers results in lower investment costs and increased flexibility. The portfolio will comprise space solutions that fulfil the needs of key actors regardless of the security situation, leveraging dual-use and cost sharing when possible.

Satellite image of a forest fire in California, USA.

Photo: NASA



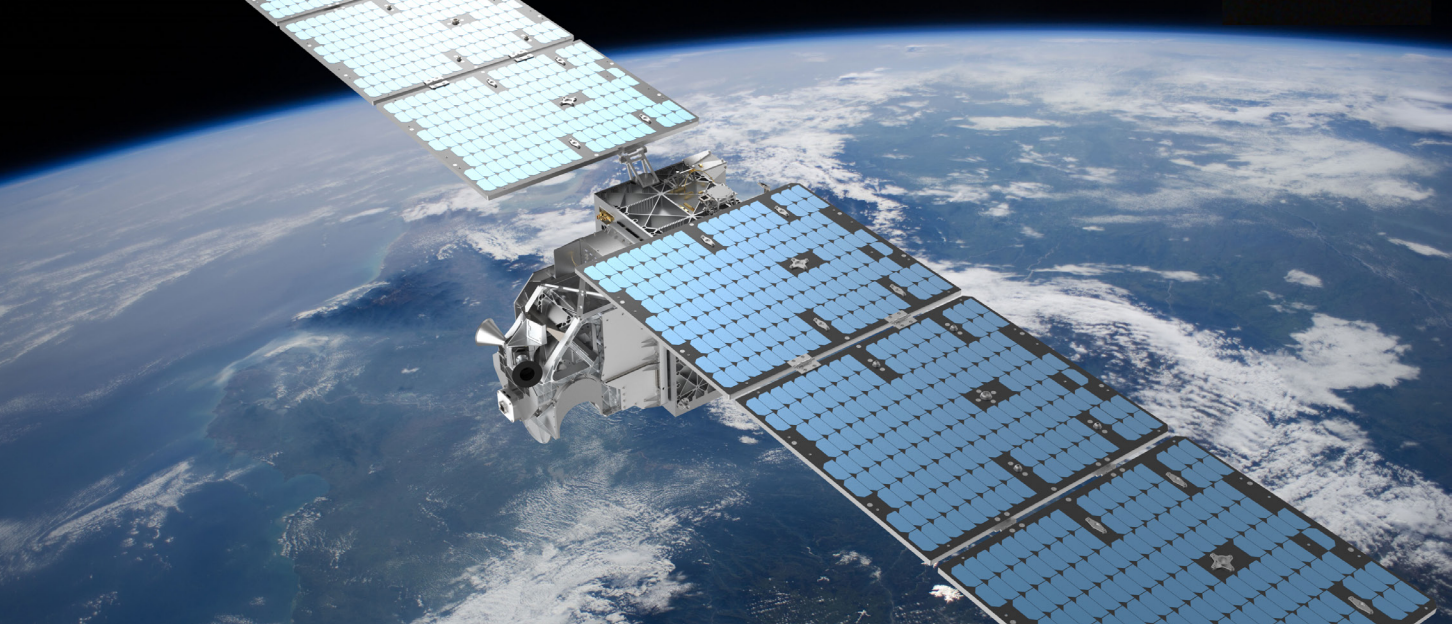


Illustration of Arctic weather satellite.

Photo: OHB/ESA

Space services

Sweden will take measures to:

- ensure that the potential of geodata from the European Union Satellite Centre (SatCen) is utilised and developed to create added value for total defence and crisis preparedness as well as law enforcement;
- achieve more autonomy by developing national space capabilities for reconnaissance and surveillance in support of situational awareness for Sweden and its Allies;
- gain assured access, together with Allies, to secure satellite communication providing coverage over the Arctic in support of command and control (C2);
- be able to use space services for connectivity as a redundant solution for Sweden to be globally connected;
- effectively utilise space services and space data being developed within the EU Space Programme for total defence and crisis preparedness.

In military defence, space services contribute to enhancing the effectiveness of existing defence capabilities, and are essential to the intelligence and kill chain that enables multi-domain operations. In civil defence and crisis preparedness, space services help to ensure essential societal services such as transport, rescue services, energy supply, and public order and security.

Intelligence, Reconnaissance and Surveillance (ISR)

Space-based reconnaissance, surveillance and Earth observation support intelligence production, situational awareness, planning, command and control, including through image and signal collection and measurements from space. Today, Sweden uses space services for ISR from commercial providers and through international collaborations with strategic partners and organisations such as the EU and the European Weather Satellite Cooperation (EUMETSAT). The ability to use AI for the analysis of these complex and large data sets is central.

Early warning capabilities contribute to deterrence, defence and increased protection by providing surveillance and warning of robotic launches and other threats over time. This capability is being developed together with close partners and Allies.

Satellite communications (SATCOM)

Robust satellite communications support activities critical to society. Satellite communications contribute to multi-domain operations and control of unmanned systems over large distances. They are also an alternative communication route in the event that ground-based electronic communications are severely limited, and are used by emergency authorities during both national operations and international missions as a supplement to ground networks and fibre. Sweden uses SATCOM-services from commercial providers and from cooperation within the framework of the European Defence Agency (EDA). Today, there is an opportunity to make greater use of international initiatives in this regard.

Positioning, navigation and time synchronisation (PNT)

Robust and accurate time and position are a prerequisite for our modern society and part of total defence. Space-based PNT-systems are used for positioning of forces, navigation and control of platforms, time reference in systems for C2 and situational awareness. Today, services from several global navigation satellite systems (GNSS) are used. Ground-based infrastructure is crucial for enabling access to space services, and thus needs to be maintained, modernised and expanded.

Launch of the James Webb telescope from the European Space Base in French Guiana.

Photo: ESA/CNES/Arianespace

Space operations support

Sweden will take measures to:

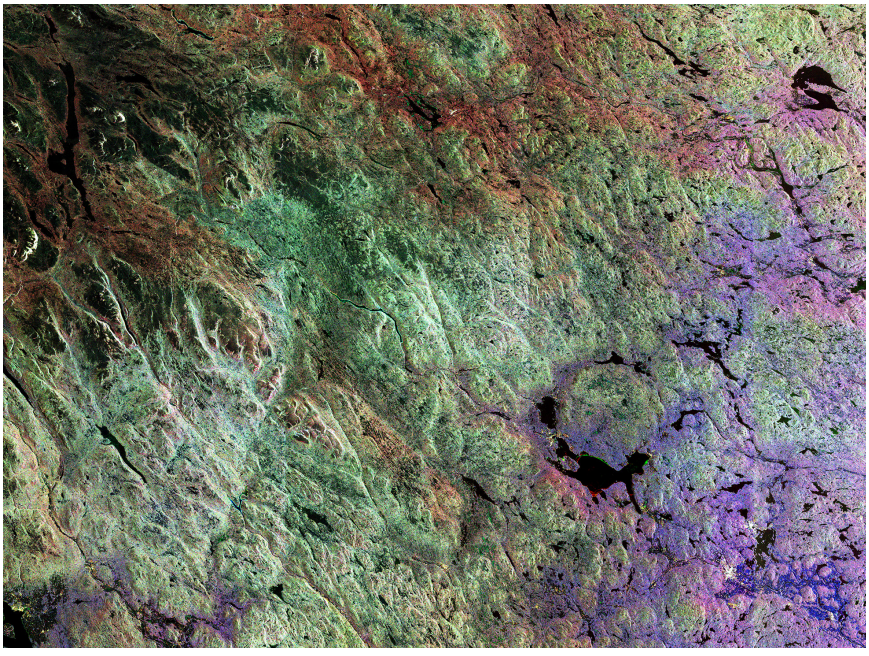
- develop a national responsive launch capability;
- continue developing a space domain awareness (SDA) capability together with strategic partners and through the EU's partnership for space surveillance and tracking (EU SST). Synergies with and sharing of civil and commercial capacity will be leveraged when possible.

Satellite launch and control

Launch and control of satellites enable and support space operations. Esrange is a strategic resource and is owned and operated by the state-owned company SSC. SSC and Esrange provide access to a global network of antennas for satellite operations and to national capabilities for launching satellites into orbit. Responsive space capabilities enable rapid adaptation to time-critical and dynamic requirements in the space domain, such as the ability to quickly replace or deploy satellites in orbit. Access to launch capabilities for the total defence and Allies in all conflict situations is of crucial importance.

Space situational awareness

Space situational awareness (SSA) is an overview of the space environment and space flight, as well as the most important risks in space. It provides information to actors in the total defence and preparedness system, and can be used to issue warnings about, for example, space weather and collisions between objects in space. Space domain awareness (SDA) includes space intelligence and can be used to assess, understand and act on threats and events in the space domain. SDA is a prerequisite for command and control of space operations. It enables taking protective measures against other actors' space-based intelligence-gathering and provides the necessary conditions to protect own forces and the space infrastructure.



Composite of radar imagery of Siljan in Dalarna taken by Sentinel-1A.

Photo: Copernicus Sentinel data (2015)/ESA

Security of supply

Sweden will take measures to:

- expand and strengthen the interaction forum where users in total defence and crisis preparedness can engage with space sector contractors;

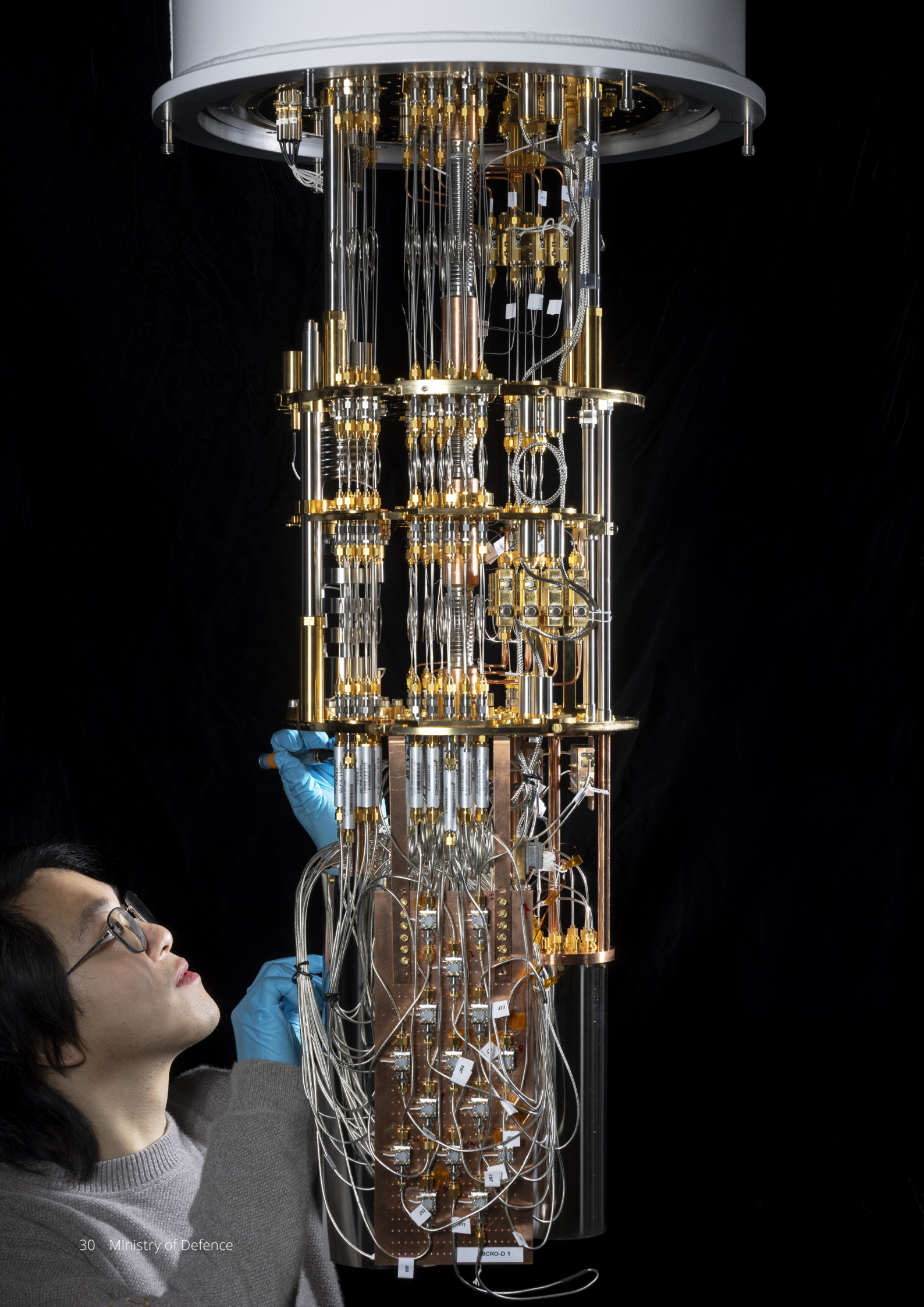
- enable innovation and development of space solutions that can be rapidly adapted to new threats and tasks in the space domain.

Competitive defence and space industry

A solid industrial base, industrial capability, as well as research and innovation in the space sector are crucial to ensure long-term security of supply in the space sector. In addition to providing highly-skilled expertise, the industry plays an important role in identifying and managing vulnerabilities, not least regarding security of supply in the value chain. A good supply-chain readiness, for example through contracts with suppliers, enables the provision of space capabilities during heightened states of alert. Access to future-proofed space services and space data warrants a competitive defence and space industry with a research, development and production capacity that can meet the requirements. A collaboration between Government and industry that is based on trust is a prerequisite for securing the supply for total defence and crisis preparedness in the short and long term, as well as for rapid adaptation in crisis and wartime.

Dialogue meeting on defence innovation at the Ministry of Defence.

Photo: Niklas Forsström/Government Offices of Sweden



Research, development and innovation

Critical knowledge can only be achieved through homegrown efforts, which is why Sweden needs to take responsibility for maintaining the necessary level of expertise needed in critical technologies. Ensuring critical knowledge and access to disruptive technologies contributes to the country's strategic and security independence. Space technology is a field that includes critical knowledge.

Priorities for technologies in support of total defence and crisis preparedness will be based on capability needs, Swedish strengths and a collective monitoring and understanding of the potential application of disruptive technologies. Technology in the following areas is of particular interest to space activities in the Swedish total defence sphere: cyber security, encryption, AI and data processing, stealth and protection of satellites, sensors for reconnaissance and surveillance from and in space, maritime communication and responsive satellite launch.

Development of research satellites for demonstration and testing of defence and security applications support the long-term development of operational capability in total defence. The rapid pace of development in the space sector necessitates innovation and application of new space technology in the procurement of defence materiel and other space-related services and capabilities. Development of new technical solutions often takes place in small and medium-sized companies. An important tool in the Government's strategic direction for defence innovation is the innovation programme for civil-military synergies, which will increase opportunities to make use of disruptive technology, including space technology, for military applications, as well as enhance conditions for commercial procurement.

Participation in various research collaborations, especially with strategically important partners, is an important means of securing access to knowledge and disruptive technologies and for keeping pace with the technology development within the space industry.

Quantum computer at Chalmers University of Technology in Gothenburg.

Photo: Sofia Sabel/Imagebank.sweden.se

Sweden in the international space arena

Sweden participates in many international organisations, multilateral contexts and in bilateral space collaborations of strategic importance to Sweden's defence and security interests in the space sector. It is therefore vital to avoid duplication as much as possible, and to achieve interoperability and cost-sharing when developing capabilities. As a NATO Ally and EU Member, Sweden will act to foster close cooperation between the organisations on space-related issues where appropriate.

Strategic goal 6: Sweden will be an active and responsible partner and NATO Ally in space-related defence and security contexts where Sweden, together with others, influences international space policy based on national interests.

Strategic goal 7: Based on Swedish interests, Sweden will prioritise and play an active role in space collaborations of strategic significance to defence and security.

A credible Ally in NATO

Sweden will take measures to:

- contribute to the development of NATO's space policy, strengthen the Alliance's collective space capabilities and harness the Allies' collective space infrastructure for the benefit of Sweden's defence and security;
- contribute to NATO within space-based reconnaissance and surveillance, secure satellite communications in the Arctic, responsive launch of satellites and maritime situational awareness;
- ensure that Swedish innovation and accelerator environments and test centres are linked to NATO's innovation accelerator;
- ensure that Swedish companies and entrepreneurs are given the opportunity to contribute to space capability development within NATO.

Sweden's membership in NATO strengthens the transatlantic link and NATO becomes Sweden's most important arena for defence policy. As an Ally, Sweden contributes to NATO's efforts in managing the threats in all domains in accordance with the 360-degree perspective and in line with NATO's capability planning. Sweden is one of the

The Swedish flag is raised at NATO headquarters in Brussels to mark Sweden's NATO accession.

Photo: NATO

few Allies that can contribute to the Alliance's capabilities in all five domains (air, land, sea, cyber and space). Sweden's total defence is part of NATO's collective defence.

As a credible, reliable and loyal actor, Sweden participates in and contributes to NATO's space cooperation and to the Alliance's common understanding of the role of space in crisis preparedness and crisis management. Sweden's geostrategic position and security interests are the basis for Sweden's contribution to the Alliance. With Swedish defence and space industry and innovation power, Sweden can develop space capabilities that contribute to NATO's collective defence capability. The satellite launch capability at Esrange can contribute to Allies' access to space. Sweden is part of the NATO innovation fund (NIF), which invests in start-up companies with defence potential and which is also linked to NATO's defence innovation accelerator (DIANA). This sets the framework for small and medium-sized companies in Sweden to participate in international collaborations. NATO's commercial platform for space, SPACENET, enables enhanced interaction between business and the Allies' defence authorities.

An engaged EU Member

Sweden will take measures to:

- contribute to fortifying the Union's role as a leading space actor and benefit from the Union's common space infrastructure for Sweden's defence and security;
- ensure that the launch capacity at Esrange can contribute to the EU's access to space;
- play an active role in EDA in order to influence the evolution of the EU's space programme and to ensure Member States' exclusive competence on defence and national security;
- monitor the development of the EU space policy to align it with Swedish defence and security interests in space as well as Sweden's competitiveness on the global market.

The EU is Sweden's main foreign policy arena and has financial, legislative and political instruments, also within security and defence policy. European security and Europe's position as a global space power are strengthened through EU cooperation with NATO and states such as the USA, Canada, Norway, Iceland, Switzerland and the UK.

In accordance with the EU Space Strategy for security and defence, the EU civil space programme will be used to a greater extent for security and defence, while retaining its civil nature. The EU's space industrial base will be strengthened. Swedish actors participate in international defence cooperation for technology, materiel and capability development related to space within the framework of EDA, the Permanent Structured Cooperation (PESCO) and with the support of the European Defence Fund (EDF).

As an EU Member State, Sweden co-finances and has ownership and control over the EU Space Programme. As such, Sweden has access to data and services that support total defence and crisis preparedness. The EDA plays an important intergovernmental role by supporting Member States in shaping the military requirements for the EU Space Programme.

Model of a rocket located at the space campus in Kiruna.

Photo: Jonathan Nackstrand/EU


Europeiska Unionen,
AC och BD län
i samverkan
– för ökad tillväxt
Mål 1 Norra Norrland

Antenna at the Esrange Space Center.

Photo: Angela Teale/SSC

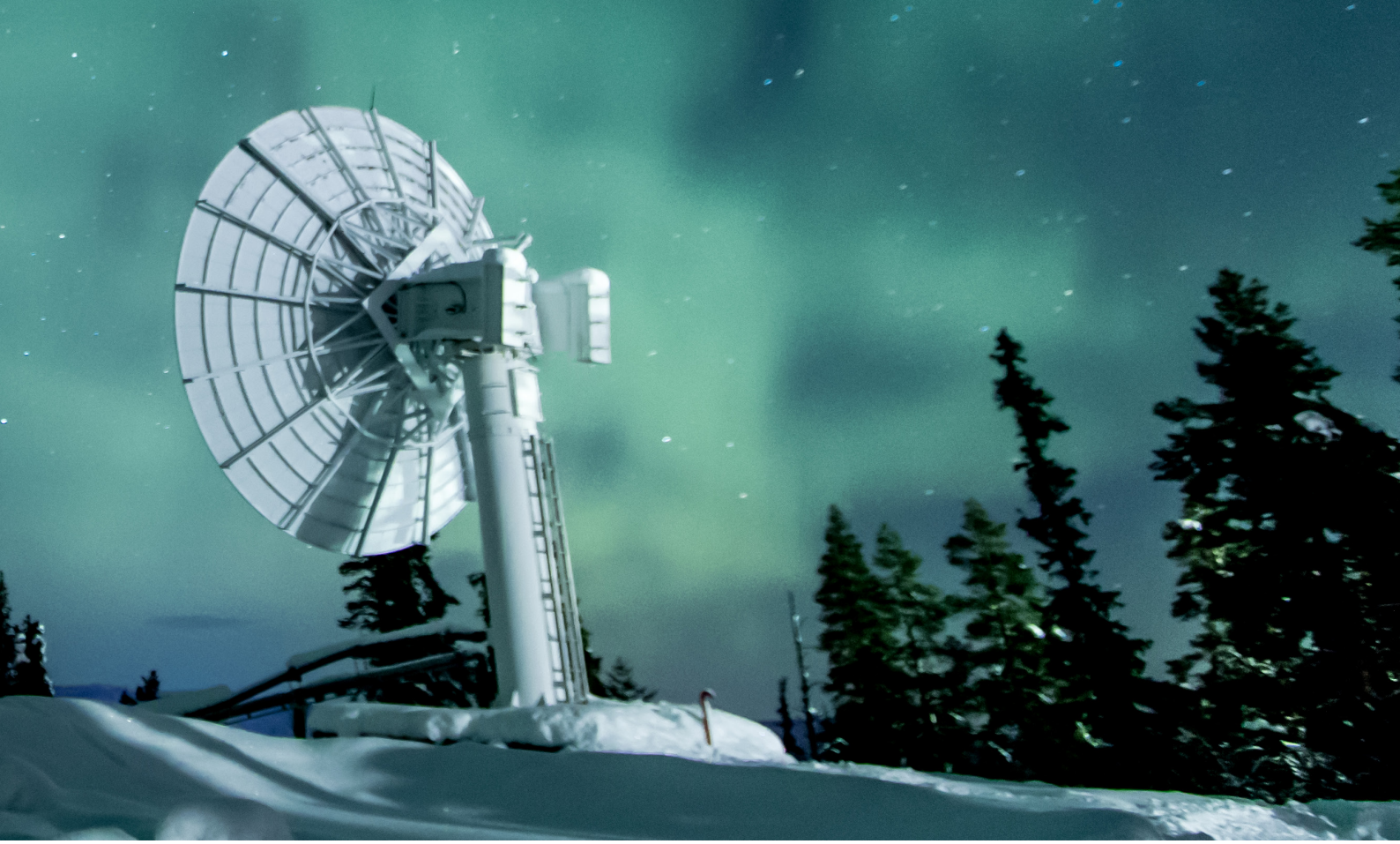
A strong voice in the UN

Sweden will:

- through negotiations in the UN, continue to actively contribute to the development of global norms and rules for responsible behaviour in space, thus reducing space threats and the risk of conflict;
- actively participate in the ITU's international coordination of radio spectrum for satellites and satellite orbits;
- defend existing international law.

The Outer Space Treaty and general rules and principles of international law applicable in space must be complied with. Sweden's position is based on our overall national defence, security and foreign policy interests and we act in close cooperation with Member States of the EU, NATO and with the Nordic countries.

Sweden actively participates in the UN's open-ended working groups on responsible behaviour in space. Sweden contributes to stability in space and its international reputation as a responsible launching state by acting in accordance with international law and by introducing national legislation that ensures that Sweden fulfils its international commitments. During the ITU's World Radio Conference, the Radio Regulations (RR) are reviewed and revised if necessary. The RR regulate obligations and rights for the use of the radio spectrum and satellite orbits on an international level. By enforcing the RR, the ITU acts so that harmful radio interference can be avoided.



The Nordic community

Sweden will take measures to:

- continue developing space cooperation within NORDEFCO and bilaterally with the Nordic countries;
- promote the Cap of the North as an important region for European space activities.

Finland's and Sweden's membership in NATO creates new possibilities for the Nordic defence cooperation NORDEFCO. For example, the Nordic countries' defence and security policy and military planning can be coordinated and even integrated to a greater degree. The Nordic countries share geographical conditions, which provides unique opportunities for cooperation in the space field. The Cap of the North could become an important region for European space activities, and space cooperation could potentially complement the declaration of intent between the Nordic air forces.

Cooperation with strategic partners

Sweden will take measures to:

- deepen and broaden cooperation with like-minded nations within the EU and NATO, as well as with partner nations in the Indo-Pacific region;
- apply a holistic perspective before participating in new international cooperation formats to ensure that each cooperation contributes to the whole and provides added value.

International cooperation enables access to knowledge that is not available in Sweden and opens up export opportunities for Swedish space technology. The space industry in Sweden is dependent on cooperation with strategic partners outside the EU, especially the USA, with its extensive space sector and capital strength. Space cooperation with the USA, both civil and military and in research, should be further enhanced. Sweden currently has bilateral defence and security cooperation formats with the USA as well as with other strategic partners such as Canada, France, Germany and Great Britain. These cooperation formats should be further developed in the field of space. Sweden also participates in multilateral research cooperation on navigational warfare and responsive space capabilities.

Cooperation with strategic partners in the southern hemisphere is also of interest from a space capability perspective. As the Euro-Atlantic and Indo-Pacific regions are becoming more intertwined, there is potential to broaden cooperation with partner countries such as Australia, South Korea, New Zealand and Japan.

The space sector is largely internationalised and Sweden must take part in international cooperation formats that are relevant and/or appropriate in terms of defence, security and foreign policy. This warrants effective export control measures as space activities involve a large amount of dual-use technology and products. Space cooperation within defence and security will be assessed from the following perspectives: opportunities for and impact on national security, capability enhancement within total defence, Swedish areas of strength and opportunities for industry as well as other defence, security or foreign policy considerations.

Norwegian Prime Minister Jonas Gahr Støre and Swedish Prime Minister Ulf Kristersson agree to develop bilateral space cooperation.

Photo: Tom Samuelsson/Government Offices of Sweden

Space policy in a new security situation

In light of the deteriorating security situation, the strategic and operational importance of space has increased within total defence and crisis preparedness. This calls for a cohesive space policy in which all perspectives are included. In order for Sweden to be able to make informed decisions and be a relevant space actor, an increase in awareness and knowledge about space, defence and security is needed.

Strategic objective 8: Sweden will pursue a coherent and knowledge-based space policy that responds to the new security situation and contributes to the development of crisis preparedness and total defence.

Integrated governance and coordination of space policy

Sweden will take measures to:

- apply a central and integrated governance and management approach to issues related to space;
- act in concerted manner in international contexts and forum, and communicate as one;
- ensure that the responsibilities for coordination of space-related issues within the structure of total defence and crisis preparedness are fit for purpose.

Cross-sectoral character

Space activities involve several policy areas. Swedish space activities are conducted in the public and private sector, with the public sector consisting of a civil part, a military part and an intelligence part. No single actor has the ability to manage the entire spectrum of space activities from all perspectives. Hence, space policy has a cross-sectoral character that requires integrated governance.

Concerted action

Space-related issues in international bodies such as the UN and EU engage a variety of actors in Sweden at different levels. The committees in the EU Space Programme are primarily staffed by actors in the civil sector, while the defence dimension of the programme is growing. In the UN, space-related issues of a military nature are discussed within the framework of the UN Disarmament Forum, while issues of a civilian nature are discussed in the United Nations Committee for the Peaceful Uses of Outer Space (COPUOS). Due to the dual-use nature of space technology, it is sometimes difficult to separate civil from military space activities.

This necessitates clear coordination and communication across the authorities and organisations involved. It also requires a sufficient level of resources. Further development of coordination at national level is likewise necessary to proactively engage and influence new proposals for initiatives and programmes in international forums at an early stage.

Clear responsibilities

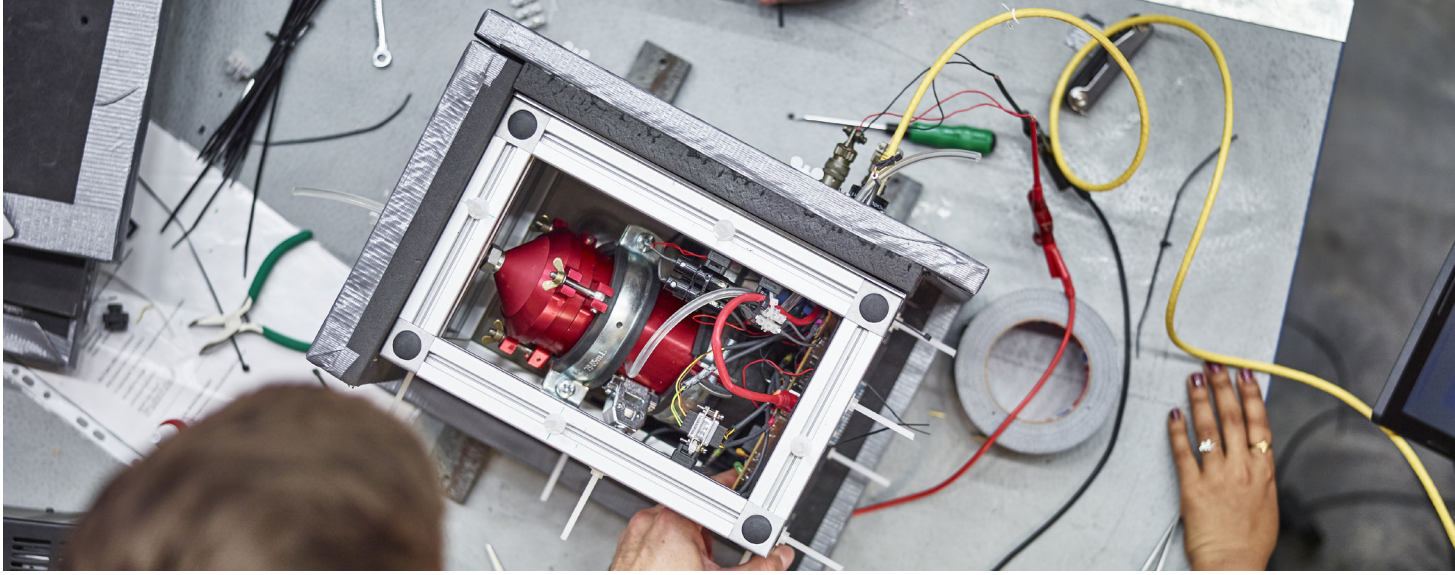
The ability to identify measures and allocate funding in a systematic manner necessitates clear roles and responsibilities for the actors involved. With the global development and emergence of a national total defence, more government agencies need to consider and manage space-related issues.

With increased space traffic, such as the launch of satellites, there is a growing overlap between space and airspace. Within civil aviation there is an increased use of space infrastructure. A developed cooperation between the space and aviation sectors contributes to more effective coordination and safety.

Building a total defence capability inevitably requires a well-formed and coherent process for direction, planning and monitoring that includes the space domain. A governance structure for space, defence and security with clearly designated responsibilities is an important piece of the puzzle.

United Nations Office in Geneva, Switzerland.

Photo: Violaine Martin/UN Photo



Space research at the Esrange Space Center in Kiruna.

Photo: Hans-Olof Utsi/Imagebank.sweden.se

Human capital in space, defence and security

Sweden will take measures to:

- ensure domestic human capital in order to be able to understand and utilise space as a physical, strategic and operational domain;
- continue to promote and, to a greater extent, use national competence centres with interdisciplinary comprehensive knowledge in space, defence and security to ensure continuous supply of knowledge;
- promote civil-military cooperation in technology development in order to be able to maintain a critical mass of capabilities, competence, resources and infrastructure.

A skills supply perspective in space policy serves to secure access to knowledge, skills and expertise in the field of space. Such domestic human capital in both the public and private sectors is a prerequisite for the development and use of space capabilities within total defence and crisis preparedness. Sweden must also be able to contribute with a space-competent workforce internationally, for example within NATO and the EU.

Active participation in an international context places demands on and expectations of Sweden to possess an adequate level of knowledge. This applies, for example, to negotiations on international space policy and international space law. An understanding of the importance and use of space for defence, crisis management and security is central, as are the defence and security-related consequences of space activities.

To understand and use space as a physical, strategic and operational domain, knowledge and skills supply are needed in all the scientific disciplines and social sciences, including war studies. At the same time, raising the level of knowledge about total defence is also important. The development of educational programmes with a comprehensive approach to space, defence and security is an important part of the skills supply. National knowledge and skills constitute a strategic asset for Sweden. Building long-term knowledge through education, research and development linked to space in total defence ensures access to knowledge over time.

Antenna at the Esrange Space Center.

Photo: SSC

Implementation and evaluation

This defence and security strategy for space will guide the work on matters of importance for space, defence and security. The Government will assess the fulfilment of the strategic objectives after five years. The Government Offices (Ministry of Defence) is responsible for implementation and evaluation of this strategy. A working group will be established with the aim of supporting the Government Offices in the implementation of the strategy, as well as advising on matters of space, defence and security at a strategic level.

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