



Finland's space strategy for years 2013 to 2020

To space with Europe – global benefits
and prosperity to Finland

Publications of the Ministry of Employment
and the Economy
Innovation
49/2014



TYÖ- JA ELINKEINOMINISTERIÖ
ARBETS- OCH NÄRINGSMINISTERIET
MINISTRY OF EMPLOYMENT AND THE ECONOMY

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Tekijät Författare Authors Finnish Space Committee	Julkaisu-aika Publiceringstid Date October 2014 Toimeksiantaja(t) Uppdragsgivare Commissioned by Työ- ja elinkeinoministeriö Arbets- och näringsministeriet Ministry of Employment and the Economy Toimielimen asettamispäivä Organets tillsättningsdatum Date of appointment
Julkaisun nimi Titel Title The national strategy for Finland's space activities in 2013–2020 – to space through Europe, global benefits and prosperity to Finland from space activities	
Tiivistelmä Referat Abstract The Finnish Space Committee appointed by the Ministry of Employment and the Economy guides the Finnish publicly funded space activities. In 2012 the committee formulated the Finnish space strategy under the heading: "The national strategy for Finland's space activities in 2013–2020 – to space through Europe, global benefits and prosperity to Finland from space activities." The strategy presents the main objectives for the publicly funded space activities. They are in the areas where Finland is most active: space science, earth observation, global positioning, satellite telecommunications and space industries. The objectives of the strategy focus on applications that are important to society. The strategy fosters the development of a few large spearhead actions aiming to raise the level of the chosen activities to the world's top level by the year 2020. The key development objectives are: <ul style="list-style-type: none">• Developing space-based applications that respond to the growing demands of the Arctic area relating to e.g. natural resources, climate change, security, and the environment in research, the creation of public sector operational services and commercial services.• Fostering services based on open data to be utilized nationally and in export: These services include intelligent transport, location-based business based on earth observation, and applications based on large volumes of open data.• Raising the level and societal impact of scientific research based to a large degree on the ESA's and EU's programs.• Advancing the specialization of the space industry and its applications development to tackle tightening competition. Implementation of the strategy is defined, guided and monitored by the Finnish Space Committee. Contact person within the Ministry of Employment and the Economy: Enterprise and innovation department/ Marjaana Aarnikka, tel. +358 50 338 4350	
Asiasanat Nyckelord Key words space, national strategy, research, international cooperation, space technology, satellite telecommunications, satellite navigation, remote sensing, space science, space industry, arctic region, open data	
Painettu julkaisu Inbunden publikation Printed publication ISSN	Verkkojulkaisu Nätpublikation Web publication ISSN 1797-3562
ISBN	ISSN 978-952-227-904-0
Kokonaissivumäärä Sidoantal Pages 15	Kieli Språk Language Suomi, Finska, Finnish
Julkaisija Utgivare Published by Työ- ja elinkeinoministeriö Arbets- och näringsministeriet Ministry of Employment and the Economy	Vain sähköinen julkaisu Endast som elektronisk publikation Published in electronic format only

Summary

Finnish space activities are scientific research of space and the Earth, operational Earth Observation, satellite telecommunications and satellite positioning. Industrial activities relate to all these.

The Finnish Space Committee (founded in 1983) under the Ministry of Economy coordinates the Finnish public sector space activities bringing all involved Ministries together. It gives guidelines for the development and exploitation of the related knowledge and technologies. The goal is that the public space research would foster business activities and public services for the society.

The Finnish Space Committee published the tenth national space strategy on 28 February 2013. The duration of this strategy is longer than any of its predecessors, spanning years 2013 to 2020. The strategy focuses on applications on Earth that use space technology, because these are seen more and more important to society. The aim of the strategy is: Finnish space activities and their applications will be - in the selected areas - on the world's top level by the year 2020.

The strategy is built on four "spearheads":

- **Space-based applications respond to the growing demands in the Arctic area.** The satellite data centre in Sodankylä strengthens the research of the Arctic (e.g. climate change and environmental safety) and helps in the utilisation of the Arctic resources (e.g. natural resources, transportation in the Arctic, including the Arctic Ocean). The goal is to create public and commercial services.
- **Open source geographic information boosts the competitiveness of location based services.** Satellite positioning will enable e.g. intelligent transportation system nationally and create export in equipment and services. Open geospatial data released by the government agencies and big data collected by Earth Observation satellites create new applications and boost the competitiveness of services in positioning, remote sensing and geographic information nationally and in export markets.
- **Raising the level of scientific research through participation in the European programmes**
- **Spacecraft equipment industry responds to growing competition by specialisation and through applications.**

The implementation of the strategy is guided by the Finnish Space Committee and its secretariat.

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Finnish space activities in a changing world

Global trends

Since the 1970s the space sector has seen two strong trends: individuals, companies and the public sector have a widening access to applications utilising satellites. Television programmes are distributed via satellites, the daily and weekly weather forecasts are based to the measurements of weather satellites and the use of satellite data has made the forecasts more accurate. Satellite positioning has a presence in everyday living in e.g. cars and cellular phones and in businesses such as transportation. The sales of navigation equipment and location-based services have increased 10-15% annually throughout the early 21st century. The global competition is becoming tougher which encourages innovations.

The second trend is the strong growth of space activities in China, India, Brazil, South Africa and many emerging economies. These countries are expanding the market for space applications. For example, Russia, China and India compete with Europe in the sales of launchers but they are a new market for European telecommunications satellites. For the old strong space nations - the United States, Russia, France, Germany, Italy and Japan - and the European Union as well as emerging space nations, space activities have of a strategic importance: e.g. remote sensing satellites respond to security policy needs of European countries. Markets are regional. The fastest growing markets are outside Europe.

Europe in space

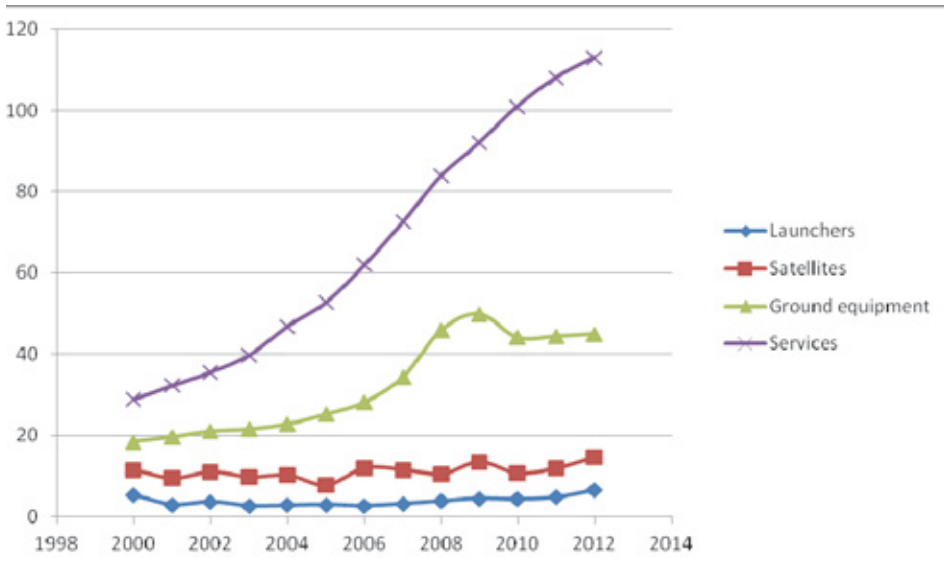
Through the activities since early 1960's the European Space Agency (ESA) and the national space agencies of especially France, Germany and Italy have created the European space industry that has grown into an industrial sector with a turnover of over six billion euro in the design and manufacturing of satellites and launchers. The companies employ over 30,000 people. Figure 1 describes the volume of global space activities.

Present co-operative roles of ESA and the European Commission have been guided by their joint programmes: Copernicus in Earth Observation and Galileo in satellite positioning. During the years 2013-2020 ESA and European Commission invest in their space programmes all-together 40 billion euro. In 2012, ESA's budget was 3.7 billion euro and the volume of national European space programmes was 1.6 billion euro.

Europe is a significant player in space activities in the following sectors:

- spacecraft for space science and satellites for Earth sciences
- telecommunications, navigation and Earth Observation satellites
- satellite ground stations and user terminals
- launchers (Vega, Ariane 5 and Soyuz)
- International Space Station (ISS).

Figure 1. Global volume of space activities in 2000–2011.¹



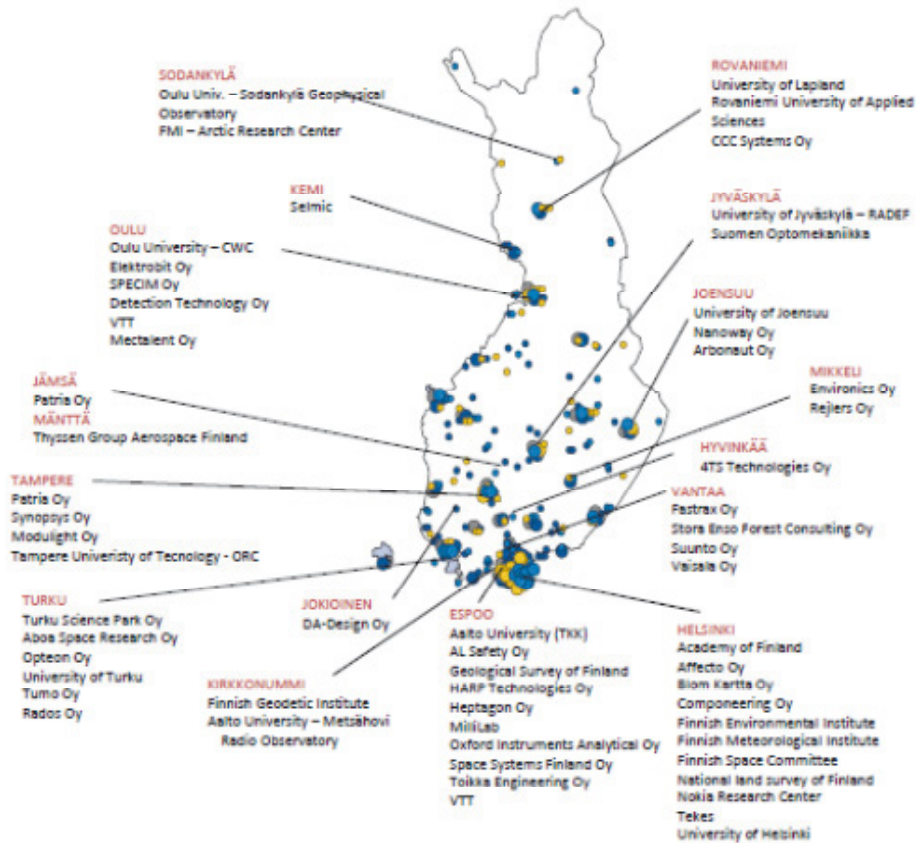
Finland is space

Space technology is an invisible resource in everyday lives of Finns. Finnish space activities started in late 1950's when the Russians and the Americans started satellite based ionospheric research. Space technology has been exploited in Finland since the 1960s in telecommunications and Earth Observation, the latter gaining larger momentum since the early 1980s. Satellite telecommunications in Finland focus on television broadcast since the terrestrial cable and wireless network rule in other domains. In Finland the design and manufacture of spacecraft instruments started only in the latter half of the 1980's. The Finnish space industry has become a part of the European satellite equipment, structures and software supply chains. Satellite positioning applications entered the scene in the late 1990s and now are the most

¹ http://www.sia.org/wp-content/uploads/2013/06/2013_SSIR_Final.pdf State of the Satellite Industry Report, June 2013, The Tauri Group, Satellite Industry Association, 2013.

commercial Finnish space activity. Finland has not participated to launcher and human space flight activities.

Figure 2. Landscape of Finnish space actors.



Public sector space activities in Finland

The main space activities in Finland are space science, Earth Observation, satellite positioning and satellite telecommunications, and the satellite equipment industry. Each area has basic research, applied research, business and applications exploiting space technology for the needs of the citizens, for the public sector and for commercial purposes.

The foundation of Finnish space activities is the participation to European organisations. ESA's programmes are the backbone of the Finnish space activities, which are also influenced by Finland's membership in the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Southern Observatory (ESO) and European Commission's space activities such as Galileo, Copernicus and the space activities in Horizon 2020.

During 2013–2020 Finland will invest 400 million euro in ESA's and European Commission's space programmes. Finland's contribution to the ESA budget is 20 million euro (0.6%) which is less than half of the share corresponding to the Finnish GNP (1.40%). The Finnish public sector funding to space activities is 50 million euro including the payments to ESA, ESO and EUMETSAT.

Science

Spacecraft collect data of the Earth and the universe for the purpose of scientific research. The Finnish space science is performed in the universities of Oulu, Turku and Helsinki, the Aalto university and the Finnish Meteorological Institute. In Earth Observation in addition to the universities, government's research institutes are involved in scientific research. The level of scientific research was evaluated in 2012²

The significance of ground based space observations (e.g. ESO) have increased in the recent years. Measurement systems and various ground reference stations and sites in Earth Observation and satellite positioning – some of which are in Finland – have become more important in both the scientific activities and in the development of various applications.

Spacecraft and ground equipment industries

Since the mid-1980s Finnish researchers and companies have developed scientific instruments for dozens of spacecraft that study the universe (e.g. plasma and particle physics, X-rays, cosmic background, Mars atmosphere) and Earth's atmosphere and land cover. These activities created the Finnish space industry in the 1980's. The industry moved on to the satellite production chains in the European space industry in the early 1990s. Half a dozen Finnish companies design and manufacture satellite equipment, structures and software. Their turnover was approximately 13 million euro in 2011.

Dozens of companies are manufacturing e.g. tracking devices and apply space technologies in service business related to navigation, telecommunications and remote sensing. The estimated turnover of these companies is 240 million euro.

Many Finnish companies are active in the positioning sector. The majority of these companies are SMEs and operate mainly in the national or the European market. Some of them have expanded their activities from GPS to also cover GLONASS, Compass and Galileo positioning systems.

Technological research that supports business is conducted not only by companies themselves but also by the universities and VTT Technical Research Centre of Finland.

2 http://www.aka.fi/Tiedostot/Tiedostot/Julkaisut/7_12_Scientific%20Research.pdf The State of Scientific Research in Finland 2012, Academy of Finland, 2012.

Applications

Earth Observation, satellite telecommunication and satellite positioning applications have global business potential. These applications support many activities that are important to the society in the fields of safety (e.g. maritime safety, forest fires, weather forecasts), in increasing operating capabilities (e.g. sea transportation in the winter, hydroelectric power, mining) and environmental issue (e.g. climate change). These capabilities will be improved through European programmes, e.g. Galileo and Copernicus. The global “Group on Earth Observations” (GEO) promotes the global distribution of Earth Observation data. It is vital for Finland to take part in the key international initiatives.

The main Finnish actors in Earth Observation are research institutes. The volume of entrepreneurial activities is increasing. The data of the Sentinel-satellites that will be distributed free-of-charge from 2014 onward will improve the Finnish companies’ opportunities in global geospatial services market. The arrival of unmanned aerial vehicles in the remote sensing scene will expand business opportunities. Opening of public information will increase the size of the domestic market, especially when the private and the public sector work together. In navigation Galileo will boost commercial activities and integrated applications will tie Earth Observation and navigation to telecommunications.

The goals

The goals for the Finnish space activities are drawn from Finland’s needs in an era of stronger global competition, inter-dependency and collaboration. The strategy focuses on space applications that are most important to society. Finnish space activities aim to raise scientific know-how even higher, to improve the competitiveness of businesses and to enhance the societal impact of space activities. The vision is that in selected areas of sciences, knowledge-based businesses and societal impacts Finnish space activities and applications will be world leaders by 2020. The strategy strives to foster development through four arrowheads.

Arrowheads

The arrowheads define the process of achieving the goals of the strategy. The arrowheads are not programmes as such but rely to combining many resources. They are based on the knowledge and capabilities that has been created earlier. They will exploit both the national and European research infrastructure. The duration of the strategy corresponds to the length of the space programmes of ESA and the European Commission’s Horizon programme. European and national funding are the two parts of the implementation of the strategy.

The arrowheads are:

- **Space applications respond to the growing demands of the Arctic area**

During the strategy period, the influence exerted by Finland through space activities on national and international questions related to the environmental and economic developments in the Arctic area are to be strengthened. The national satellite data centre serving the public sector will be based on the Finnish Meteorological Institute's Sodankylä satellite ground station. The centre will be part of international network and serve as a receiving station which will process and distribute observation data on the Baltic and Arctic region environment, environmental safety and natural resources. Research and public services will create opportunities for business in the Arctic including sea ice services.

- **Open source geographical information boosts competitiveness of services**

The limited natural resources, their increasing consumption, higher prices and emissions trading are creating global demand in the Earth Observation sector. Data produced by new Earth Observation satellites will make it possible to respond to this demand.

Access to public geospatial and environmental data (e.g. water, forest, weather and mineral resources) will increasingly be free and open to all use. In order to promote national and international commercial activities, new processing methods will be developed for handling the increasing data volumes. One foundation of location-based business will be the processing of big data from the new Earth Observation satellites. Operational data services will be turned into business activities in the domestic and the export market.

Positioning applications will be developed for the needs of e.g. intelligent transport and ubiquitous information technology. The national FinnRef network enables precise positioning and will serve as the key national infrastructure in positioning. Smart transport and the extension of positioning from car and mobile phone applications to indoor positioning will create opportunities to develop more extensive location-based service business and navigation devices.

Integrated applications using (satellite) telecommunications and satellite and other positioning techniques and Earth Observation data and data from other sensors will bring space technology applications into new markets, including the energy and health sectors.

- **Raising the level of scientific research through participation in the European programmes**

The strategy aims at improving the level of Finnish space based sciences and significantly boosting their societal impact. The research will exploit the data collected by international satellite programmes and terrestrial observation stations. The biggest programmes are the Space Science and Earth Observation programmes of ESA, European Commission's Copernicus, and ESO.

The Horizon 2020 framework programme and the activities of space nations outside Europe increase the opportunities for space science and Earth Observation science. The funding of the European Research Council will be efficiently exploited. New technologies, including the Cubesat satellites, will be developed in space research and technology development projects.

- **Space equipment industry responds to tougher competition by specialisation and applications**

Finnish space equipment industry will respond to tougher European and global competition in space technology sector by making its cooperation with key European companies stronger and by developing faster and more efficient business processes. Technological competitiveness development projects will be implemented together with selected partners. While new partners also are to be found outside Europe, the main emphasis will be on the space technology programmes of ESA and the European Commission. Cooperation between the industry and universities and research institutes will be improved further with the aim of faster development and synergies between technologies and services.

Implementation

The administration of space activities in Finland is based on a decentralised model. The implementation of the arrowheads is based on the resources of various branches of administration, the national funding agencies for science and technology and to a significant degree on the exploitation of ESA's and European Commission's funding opportunities.

The Finnish Space Committee will guide and supervise the implementation of the strategy with the assistance of its Secretariat. The strategy implementation will be described in the Committee's action plan. The arrowhead projects will evolve over the years.

The indicators of success include the turnover of companies in this sector, the quality of refereed publications and the societal benefits produced.

Appendix

Finnish Space Committee, 15 April 2010–31 March 2013 (wrote the strategy)

- Petri Peltonen, Director-General, Ministry of Employment and the Economy, Chair
- Pekka Plathan, Director-General, Ministry of Transport and Communications, Vice Chair
- Laura Höijer, Research Director, Ministry of the Environment
- Annu Jylhä-Pyykönen, Counsellor of Education, Ministry of Education and Culture
- Tuija Karanko, Secretary General, Association of Finnish Defence and Aerospace Industries AFDA
- Anu Laamanen, Deputy Director General, Ministry for Foreign Affairs
- Susan Linko, Director, Academy of Finland
- Matti Möttönen, Deputy Chief, Rear Admiral, Finnish Border Guard
- Petteri Taalas, Director General, Finnish Meteorological Institute
- Kari Tilli, Director, Tekes
- Raimo Vajavaara, Director, Ministry of Agriculture and Forestry
- Veli-Pekka Valtonen, Chief of Armaments Division, Brigadier General, Defence Command of Finland

Finnish Space Committee 15 April 2013–31 March 2016

- Petri Peltonen, Director-General, Ministry of Employment and the Economy, Chair
- Pekka Plathan, Director-General, Ministry of Transport and Communications, Vice Chair
- Marjaana Aarnikka, Commercial Counsellor, Ministry of Employment and the Economy
- Laura Höijer, Research Director, Ministry of the Environment
- Jukka Juusti, Head of the Resource Policy Department, Ministry of Defence
- Timo Kantola, Deputy Director General, Ministry for Foreign Affairs
- Tuija Karanko, Secretary General, Association of Finnish Defense and Aerospace Industries AFDA
- Petteri Kauppinen, Counsellor of Education, Ministry of Education and Culture
- Susan Linko, Director, Academy of Finland
- Tiina Peltola-Lampi, Head of International Affairs, Ministry of the Interior
- Tuija Pulkkinen, Dean School of Electrical Engineering Aalto University
- Kari Tilli, Director, Tekes
- Raimo Vajavaara, Director, Ministry of Agriculture and Forestry
- Yrjö Viisanen, Director of Research and Development, Finnish Meteorological Institute

Secretariat of the Finnish Space Committee (October 2014)

- Kimmo Kanto, Chair, Secretary General of the Committee, Tekes
- Marjaana Aarnikka, Ministry of Employment and the Economy
- Tuomas Häme, VTT Technical Research Centre of Finland
- Pertti Järvelin, Defence Command of Finland
- Antti Kosonen, National Land Survey of Finland
- Heidi Kuusniemi, Finnish Geodetic Institute
- Harri Lähti, Patria
- Mia Nykopp, Finnish Transport Safety Agency
- Tuija Pulkkinen, Aalto University
- Jouni Pulliainen, Finnish Meteorological Institute
- Marko Sillanpää, Finnish Transport Safety Agency
- Mikko Strahlendorff, Finnish Meteorological Institute
- Yrjö Sucksdorff, Finnish Environment Institute
- Kati Sulonen, Academy of Finland
- Pauli Stigell, secretary of the Secretariat, Tekes

Tekijät Författare Authors Delegationen för rymdärenden	Julkaisuaja Publiceringstid Date Oktober 2014 Toimeksiantaja(t) Uppdragsgivare Commissioned by Työ- ja elinkeinoministeriö Arbets- och näringsministeriet Ministry of Employment and the Economy Toimielimen asettamispäivä Organets tillsättningsdatum Date of appointment
Julkaisun nimi Titel Title Den nationella strategin för Finlands rymdverksamhet 2013–2020 – till rymden genom Europa, globala fördelar och välstånd åt Finland genom rymdverksamhet	
Tiivistelmä Referat Abstract <p>Delegationen för rymdärenden som utses av arbets- och näringsministeriet styr den offentligt finansierade rymdverksamheten i Finland. År 2012 formulerade delegationen en rymdstrategi för Finland under rubriken "Den nationella strategin för Finlands rymdverksamhet 2013–2020 – till rymden genom Europa, globala fördelar och välstånd åt Finland genom rymdverksamhet".</p> <p>Strategin presenterar de viktigaste målen för den offentligt finansierade rymdverksamheten. De finns inom de områden där Finland är mest aktiv: rymdvetenskap, jordobservation, global positionering, satellittelekommunikation och rymdindustrier. Målen i strategin fokuserar på tillämpningar som är viktiga för samhället.</p> <p>Strategin främjar utvecklingen av ett fåtal större spjutspetsåtgärder som syftar till att höja nivån på de valda verksamheterna till världens toppnivå fram till år 2020. De viktigaste utvecklingsmålen är:</p> <ul style="list-style-type: none">• Utveckling av rymdbaserade tillämpningar som svarar mot de ökande kraven i det arktiska området när det gäller t.ex. naturresurser, klimatförändring, säkerhet och miljö inom forskningen, skapandet av operativa tjänster inom offentliga sektorn och kommersiella tjänster.• Utveckling av tjänster som grundar sig på öppna data som ska användas inom landet och vid export: Dessa tjänster omfattar intelligenta transporter, platsbaserad verksamhet som bygger på jordobservation och tillämpningar baserade på stora mängder öppna data.• Höjning av nivån på och den samhälleliga påverkan av den vetenskapliga forskning som till stor del bygger på ESA:s och EU:s program.• Utveckling av rymdindustrins specialisering och applikationsutveckling för att hantera den hårdnande konkurrensen. Genomförandet av strategin definieras, styrs och övervakas av delegationen för rymdärenden. <p>Kontaktperson vid arbets- och näringsministeriet: Närings- och innovationsavdelningen/Marjaana Aarnikka, tfn 050 338 4350</p>	
Asiasanat Nyckelord Key words rymd, forskning, utvecklingsverksamhet, internationellt samarbete, rymdforskning, rymdteknologi, fjärranalys, satellitkommunikationer, satellitpositionering, rymdindustri, arktiska området, öppna data	
Painettu julkaisu Inbunden publikation Printed publication ISSN	Verkkajulkaisu Nätpublikation Web publication ISSN 1797-3562
ISBN	ISSN 978-952-227-904-0
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