



European Space Policy Institute

SPACE IN CENTRAL AND EASTERN EUROPE

OPPORTUNITIES AND CHALLENGES
FOR THE EUROPEAN SPACE ENDEAVOUR

Addendum

Exploratory Study on Estonia and Slovenia

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Executive Summary

Estonia and Slovenia are among the smallest but most dynamic and prosperous new members of the European Union (EU). Both countries have recently expressed their interest in developing their space-related activities and getting closer to the European Space Agency (ESA). Estonia signed a cooperation agreement with ESA in June 2007 and Slovenia is likely to sign a similar agreement in early 2008. These countries have a limited tradition of space activities, especially in comparison with other new EU members who actively participated in the Soviet space programme and have gained significant expertise in particular scientific fields. They perceive a closer relationship with ESA to be a way to achieve further integration into Europe and to create new opportunities for their economy.

Estonia has previous experience in the field of astrophysics and has developed capacities in various areas of remote sensing applications. Slovenia has demonstrated potential in the fields of communications and remote sensing applications. However, both countries are still looking for niches for their industry in the European landscape.

The signing of a first cooperation agreement with ESA is viewed by Estonian and Slovenian decision-makers as an opportunity to prepare their country, and mainly their industry, for the next step of interest to them, the status of European Cooperating State. The two countries have adopted different but very pragmatic strategies for the years to come in order for them to be ready for this next step.

Introduction

Estonia and Slovenia have recently expressed their interest in getting closer to the European Space Agency (ESA). On 20 June 2007, Estonia signed a five-year cooperation agreement with ESA, as a first step towards achieving the status of European Cooperating State (ECS). Slovenia might follow the same path in early 2008. Both countries want to participate in the Agency's programmes and are already taking part in the European Union's (EU) and joint EU/ESA space-related projects, as entitled by their EU membership.

This exploratory study reviews the political, economic, institutional, scientific and industrial environment for space activities in those two countries and examines the opportunities and challenges of developing space and participating in the European space programme. The present report first analyses the political and economic situation of those two new EU members and examines their integration in Europe.

It then reviews their space-related activities and their relationship with ESA. In the annex, both countries' space activities and their environment are illustrated in detail and the main facts and figures of the two countries are summarised.

Political and economic situation

Both Estonia and Slovenia have enjoyed a rather stable political environment since their independence, which has also been beneficial to their economic development.

As presented in Figure 1, Estonia and Slovenia are among the smallest and least populated of the EU member states, with 1.3 and 2 million inhabitants respectively, out of the 493 million inhabitants of the EU 27.

Despite their size, these two countries have been quite successful economically, especially compared to other transition economies. Slovenia is unique in its development in Central Europe and is often referred to as a model of development and stability for its neighbouring countries, as it has quite rapidly caught up with Western standards and practices. As shown in Figure 2, Slovenia has the highest Gross Domestic Product (GDP) per capita of the new EU member states in Central Europe, while Estonia has the third. Both countries have also experienced significant growth of their economy, since in 2006, Estonia's GDP grew by 11.2% and Slovenia's by 5.6%, as shown in Figure 3.

Both countries have an unemployment rate of about 6% and an inflation rate of 2.5% for Slovenia and 4.4% for Estonia.¹ Estonia and Slovenia have developed a good infrastructure, as well as an educated workforce besides benefiting from a strategic location.

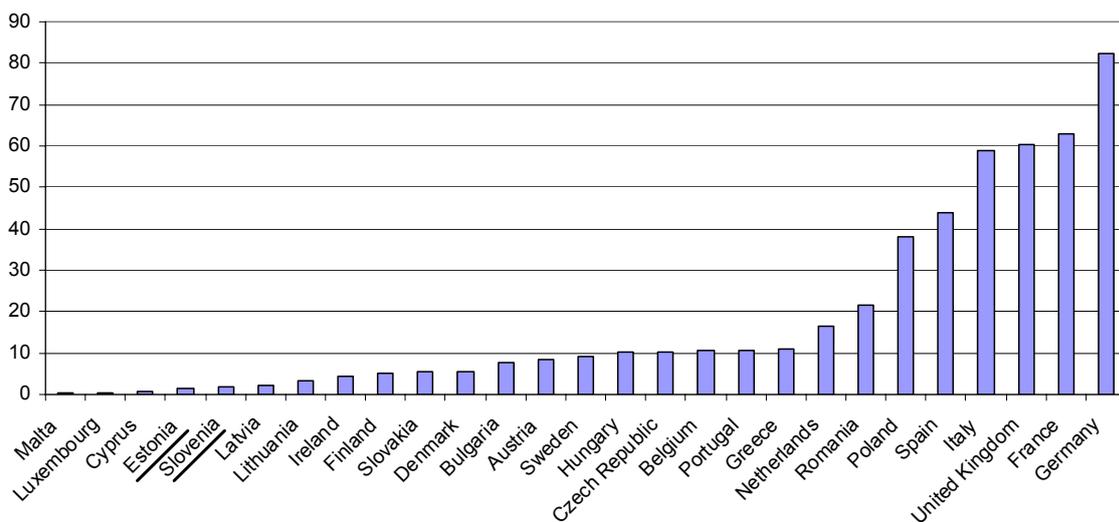


Figure 1: Population of the EU countries (in million inhabitants) Source Eurostat 2006

¹ Eurostat, Inflation rate 2006

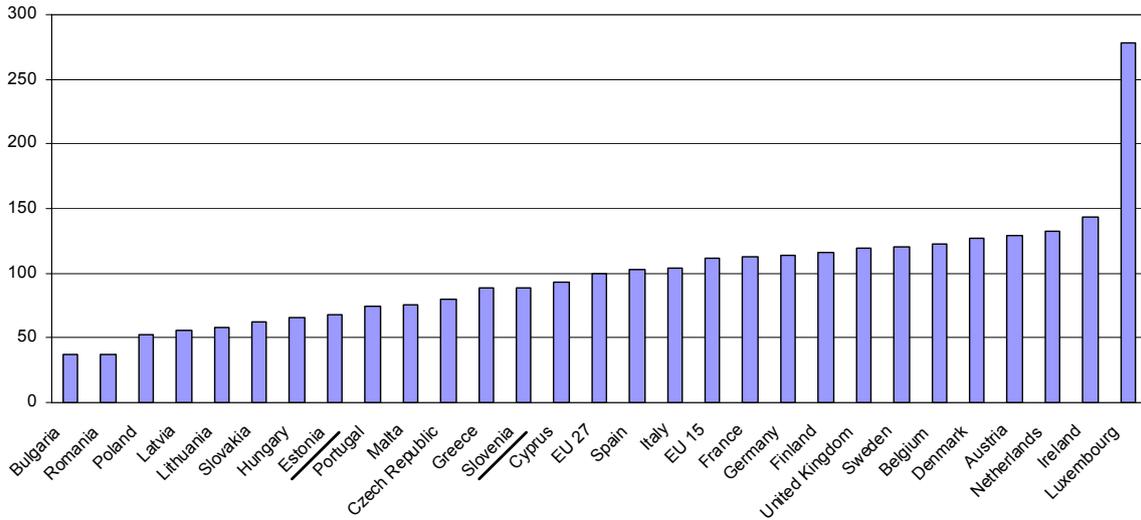


Figure 2: GDP per capita (normalised at GDP EU27=100) Source Eurostat 2006

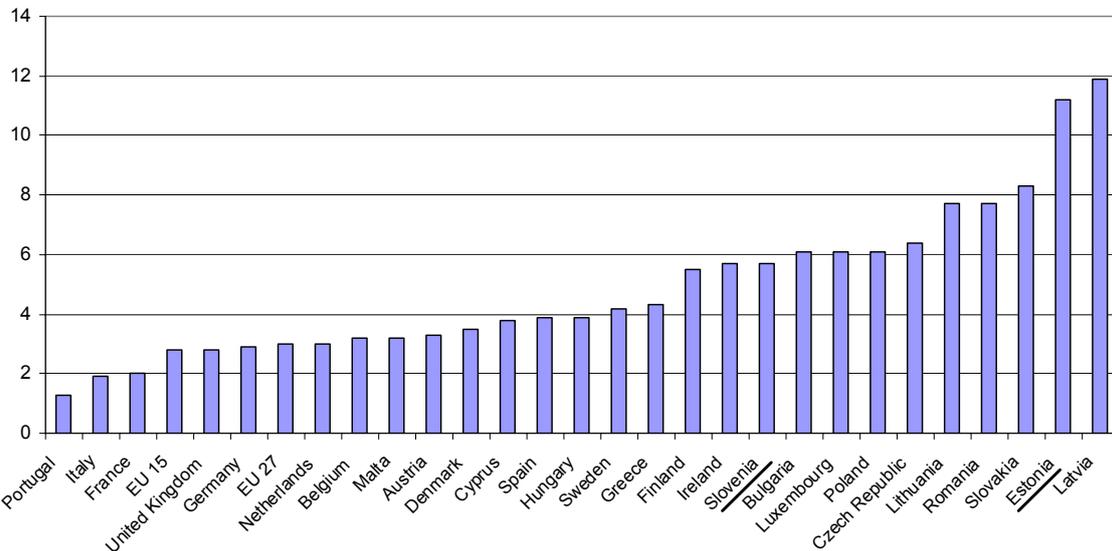


Figure 3: GDP growth (in %) Source Eurostat 2006

European integration

In the past, Estonia and Slovenia have shown an open attitude towards the West – even very early on. Because of their location, both were, to a certain extent East-West gateways during the Soviet era. Slovenia was the main trading region of former Yugoslavia and, even before the country’s independence, its key trading partners were Germany and Italy, who accounted for about 40% of its exports². Estonia’s major trading partners today are EU countries such as Finland, Sweden and Germany. The economic situation in these

countries strongly influences Estonia’s economy. Russia represents only 10% of Estonia’s exports and imports.

Since their independence, Estonia and Slovenia have shown a strong will to become more integrated into the European Union and actively pursue this objective. They joined the Union in 2004 and in January 2007, Slovenia was the first of the new EU members to join the Euro zone. Estonia is planned to join this zone in 2008, but it is likely to be delayed.

Slovenia has additionally demonstrated the will to play a leading role among the “smaller countries” and new members at the European level.

Both countries have been quite successfully cooperating with their EU partners in European projects, as illustrated by their

² Economic Survey, Slovenia, OECD, May 1998

success rate in Framework Programmes for instance. Moreover, compared to other transition economies, they have managed to derive many benefits from their EU membership.

Space in Estonia and Slovenia

Estonia has a lot of experience in one space-related field: astrophysics. Slovenia has no tradition of space.

Both countries are nevertheless very interested in developing space-related activities for similar reasons. Estonia wants to maintain and further develop existing skills and knowledge. In addition both countries perceive this as a way to develop their economy and their industry in high-tech fields. Furthermore, they want to use space systems to the benefits of their society, as well as a tool to support national policies.

Estonia and Slovenia have applied a quite pragmatic approach to the development of a space sector and are looking for niches for their industry. They both have slightly different plans for the years to come. Estonia is preparing a space strategy document and has created a budgetary line for promoting space activities. Slovenia has so far mainly focused on its candidacy for the Galileo Supervisory Authority (GSA) seat. But both countries are driven by their will to be ready for a closer relationship with ESA.

However, as explained in Annex A, the development of their space activities might be held up by a lack of a budget for this purpose. In the case of Slovenia, there are no institutions dedicated to coordinating space-related activities, nor is there the critical mass needed to organise the activities nationally and internationally. In both countries, the division between basic research on the one hand and technology and innovation on the other hand might also prevent desirable developments in the field and create two isolated communities.

Furthermore, it is noteworthy that both countries have not ratified the United Nations treaties governing space activities, especially the Outer Space Treaty, and do not belong to some of the main space-related international organisations, as detailed in Annex A.

In both cases there is an emphasis on the major role the private sector should play in future space-related activities.

Both countries are looking for niches, taking

into account their existing scientific and industrial expertise. Estonia is known for its ICT potential and can for some years benefit from a price-based competitive advantage, but it is unlikely to last. While Estonia's labour is still cheap, Slovenian labour cost is quite high for Central Europe and their competitive advantage appears to be light industries with a high content of R&D and product differentiation.³ These elements make a case for the development of space-based applications, which is in line with their capabilities and competitive advantage, as well as the strong willingness of their governments to use space to the benefit of their citizens.

In addition, both countries have an enterprise structure close to the EU average with a high proportion of SMEs, and most applications are expected to be developed by SMEs, as is already the case for a few of them in each country. Moreover, governments already consider giving seed money to SMEs for the development of such applications.

It is remarkable that so far the Western European space industry has demonstrated only little interest in these countries.

ESA membership

Estonia and Slovenia want to get closer to ESA, primarily as a way to advance their integration into Europe and to create new opportunities for their economy.

The first step taken in the relationships of the two countries with ESA was to sign a general five-year cooperation framework agreement, like the one signed by Estonia. This agreement prevents any exchange of funds and participation in ESA programmes, but will be a unique opportunity for both countries to learn about the Agency's procedures and programmes and to start preparing their industry for the next steps. What the next step is has not yet been defined, but both countries are interested in achieving the status of European Cooperating State (ECS).

ESA cooperation schemes have evolved over time⁴. The step following a general

³ Economic Survey, Slovenia, OECD, May 1998

⁴ Poncelet, J.-P., Fonseca-Colomb, A., and G. Grilli, "Enlarging ESA? After the Accession of Luxembourg and Greece". ESA Bulletin 120, 48-53, Nov. 2004



cooperation agreement used to be the participation in ESA optional programmes, as done by the last countries to join ESA. For Austria, Norway and Finland, the following step after participating in optional programmes was associate membership, before actual membership. The associate membership enables a country to directly participate in ESA programmes, but requires a significant contribution to the budget of the Agency. The next and last countries that joined ESA, i.e. Portugal, Greece and Luxembourg, did not go through the associate membership, and directly became members. A new status was created for ESA partners in Central Europe, for whom the associate membership was not appropriate: the status of European Cooperating State (ECS), which allows an indirect participation in all ESA programmes and activities for a contribution of 5 million euros over the five-year term of the agreement⁵. The status of ECS can then evolve into an associate or full membership with a significant increase both in the possibilities to participate in the Agency's activities as well as in the required contribution. The objective of both Estonia and Slovenia is to continue after their first cooperation agreement with the ECS status.

Space applications are likely to play an important role in their future space-related activities and could be developed without joining ESA through their EU membership. However, joining ESA could create additional opportunities for scientists and researchers, even though different groups have already participated in ESA projects. Then, it is perceived as a way to create new opportunities for their companies in a high-tech sector. Last but not least, both countries have recently joined different European organisations (in space-related fields, Estonia for instance joined Eumetsat in 2006), which reflects their will to be further integrated. Becoming an ESA member is clearly a way to be even more politically integrated and it could provide an impetus that would foster interest for space in those two countries. Their activities would then certainly be driven by European programmes and projects, in the decision of which they will weigh little, but it seems not to be an issue as long as

they can participate and get new opportunities.

Investing in a programme like PECS is considered by both Estonian and Slovenian decision-makers as a good potential investment for the economy and their industry. In fact, the one-million-euro PECS contribution could be secured without much difficulty and would represent significant opportunities for both countries' micro and small companies.

⁵ Baudin, C., and K., Bergquist, "Towards an Enlarged Partnership – ESA's Relations with the Czech Republic, Hungary, Poland and Romania", ESA Bulletin 107, 84-86, August 2001

Annex A

Fact Sheets on Estonia and Slovenia



ESTONIA



KEY DATES

May 2004	EU membership
March 2004	NATO membership
20 August 1991	Independence



Estonia⁷

POPULATION⁶

1,346,097 – 0.26% of the EU 27 population

POLITICS

Government type

Parliamentary republic

Executive branch

- Chief of state: President Toomas Hendrik Ilves (since October 2006)
- Head of government: Prime Minister Andrus Ansip (since April 2005)

Elections

- President
 - Elected by the parliament
 - Five-year term
 - Eligible for a second term
 - Last election held in September 2006
- Prime minister nominated by the president and approved by the parliament

Legislative branch

Unicameral parliament or “Riigikogu”

- 101 seats
- Members are elected by popular vote to serve 4-year terms
- Last elections held in March 2007 (next to be held in March 2011)

⁶ 2005 average population, Source Eurostat

⁷ Map Collection, Perry-Castañeda Library, University of Texas

ECONOMY

<u>GDP (Purchasing Power Standard)</u> ⁸	21.17 billion PPS
<u>GDP at current prices</u> ³	13.07 billion euros
<u>Real GDP growth rate</u> ³	11.4%
<u>GDP per capita (PPS)</u> ³	15,700 PPS
<u>Budget</u> ⁹	Expenditure: 4.34 billion euros Revenue: 4.83 billion euros
<u>Public debt</u> ¹⁰	4% of GDP
<u>Inflation rate</u> ¹¹	4.4%
<u>GERD</u> ¹²	1.07% of GDP
<u>Unemployment rate</u> ¹³	6.0%
<u>Economic aid</u> ¹⁴	
EU pre-accession assistance (2004-06)	0.61 billion euros (2004)
Structural funds (2007-13)	3.05 billion euros (2004)
<u>Military expenditure</u> ¹⁵	2 % of GDP

⁸ 2006 Forecast, Source Eurostat

⁹ 2006 Government accounts, Source Eurostat

¹⁰ 2006 General government debt, Source Eurostat

¹¹ 2006 Inflation rate, Source Eurostat

¹² 2004 Gross Domestic Expenditure on R&D, Source Eurostat

¹³ 2006 Annual average, Harmonised unemployment rate, Source Eurostat

¹⁴ Source EC DG Regional Policy

¹⁵ 2002, The World Factbook, CIA



SLOVENIA



KEY DATES

1 May 2004	EU membership
March 2004	NATO membership
25 June 1991	Independence from Yugoslavia



Slovenia¹⁷

POPULATION¹⁶

2,000,474 – 0.41% of the EU27 population

POLITICS

Government type

Parliamentary republic

Executive branch

- Chief of state: President Danilo Türk (since November 2007)
- Head of government: Prime Minister Janez Jansa (since November 2004)

Elections

- President
 - Elected by popular vote
 - Five-year term Eligible for a second term
 - Last election held in November 2007
- Prime minister nominated by the president and elected by the Parliament

Legislative branch

Bicameral parliament

- the National Assembly or "Drzavni Zbor"
 - 90 seats
 - Members are either directly or proportionally elected (proportion varies with each election) by popular vote to serve 4-year terms
 - Elections last held in October 2004 (next to be held in October 2008)
- the National Council or "Drzavni Svet"
 - 40 seats
 - Members are indirectly elected by an electoral college to serve 5-year terms

¹⁶ 2005 average population, Source Eurostat

¹⁷ Map Collection, Perry-Castañeda Library, University of Texas

ECONOMY

<u>GDP (Purchasing Power Standard)</u> ¹⁸	40.87 billion PPS
<u>GDP at current prices</u> ³	29.74 billion euros
<u>Real GDP growth rate</u> ³	5.2%
<u>GDP per capita (PPS)</u> ³	20,400 PPS
<u>Budget</u> ¹⁹	Expenditure: 13.76 billion euros Revenue: 13.34 billion euros
<u>Public debt</u> ²⁰	27.5% of GDP
<u>Inflation rate</u> ²¹	2.5%
<u>GERD</u> ²²	1.61% of GDP
<u>Unemployment rate</u> ²³	6.1%
<u>Economic aid</u> ²⁴	
EU pre-accession assistance (2004-06)	0.45 billion euros (2004)
Structural funds (2007-13)	4.10 billion euros (2004)
<u>Military expenditure</u> ²⁵	1.7% of GDP

¹⁸ 2006, Source Eurostat

¹⁹ 2006 Government accounts, Source Eurostat

²⁰ 2006 General government debt, Source Eurostat

²¹ 2006 Inflation rate, Source Eurostat

²² 2004 Gross Domestic Expenditure on R&D, Source Eurostat

²³ 2006 Annual average, Harmonised unemployment rate, Source Eurostat

²⁴ Source EC DG Regional Policy

²⁵ 2005, The World Factbook, CIA



Annex B

Space Activities and their Environment in Estonia and Slovenia

ESTONIA

1. Space in Estonia

1.1. Institutional framework

1.1.1. Estonia's Research, Development and Innovation (RDI) System^{26,27}

The stakeholders of the Estonian RDI system are presented in Figure 4. Two ministries are responsible for preparing Estonia's RDI policy: the technology and innovation policy is formulated by the Ministry of Economic Affairs and Communications, whereas the research and development policy is prepared by the Ministry of Education and Research. The Estonian Academy of Sciences is also involved in the R&D policy-making. The Estonian government and finally the Parliament approve the overall RDI policy.

The government is advised on strategic issues in the field of research, development and innovation through a policy advisory council, the R&D Council. This Council is supported by 2 permanent committees: the Research Policy Committee, which advises the Ministry of Education and Research, and the Innovation Policy Committee, which advises the Ministry of Economic Affairs and Communications.

There is an implementing organisation for each part of the RDI policy: the innovation policy is implemented by Enterprise Estonia, while the research policy is implemented by the Estonian Science Foundation.

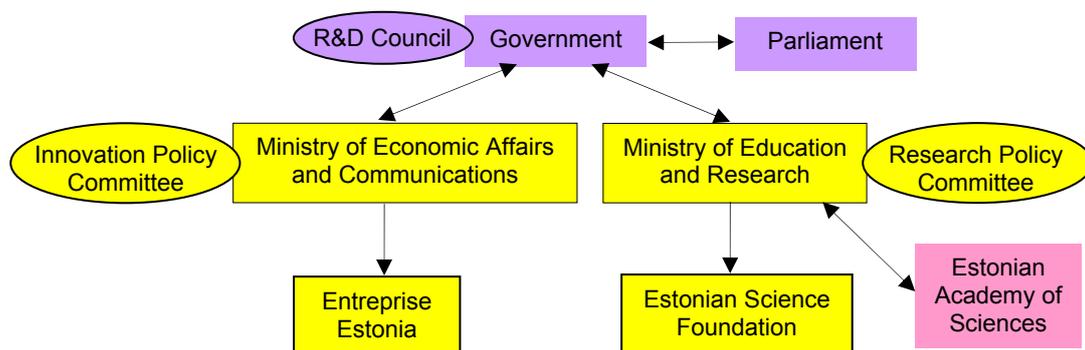


Figure 4: Stakeholders of the Estonian RDI system

The current RDI policy is defined by the document "Knowledge-based Estonia - Estonian R&D and Innovation Strategy 2007-2013" approved by the Parliament on 7 February 2007. This document defines strategic objectives for Estonia's RDI, as well as an implementation plan that includes the identification of key technologies to be further developed, i.e. information and communications technologies, biotechnologies and material technologies.

1.1.2. Institutional framework for space activities

There is no specific institutional framework for space activities in Estonia. Following the recent

²⁶ The State Chancellery of the Republic of Estonia, www.riigikantselei.ee

²⁷ ERAWATCH Research Inventory, cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home



signing of a cooperation agreement with ESA, Enterprise Estonia²⁸ will play a role in the promotion and coordination of space activities in Estonia. Enterprise Estonia is an institution established by the Ministry of Economic Affairs and Communications to promote the competitiveness of Estonian businesses.

Like in other fields in Estonia, space science should be mainly coordinated by the Ministry of Education and Research, and industrial activities by the Ministry of Economic Affairs and Communications.

In addition, a parliamentary space group will be formed in the near future in order to ensure continuous political support for space activities. The key person in establishing this group is Ene Ergma, Vice-President of the Estonian Parliament, both because of her long experience in the space field as well as her high-level political position.

1.2. Financial framework

1.2.1. RDI Funding²⁹

Expenditure

Expenditure for RDI is relatively low in Estonia. In 2006, Estonia's expenditure for R&D (GERD) represented only 0.94%³⁰ of its GDP, to be compared with the Lisbon target of 3% by 2010. The level of business investment in R&D also has to significantly increase, as the business expenditure (BERD) represented 0.42%³⁰ of Estonia's GDP in 2006.

Funding mechanisms³¹

R&D is funded by the Ministry of Education and Research through three main channels presented in Figure 5:

- Targeted funding

The Ministry distributed targeted funding for both basic and applied research with a total budget of about 19 million euros in 2007. The projects can last up to six years and are chosen following the recommendation of the Science Council.

- Basic funding

Since 2005, basic funding is granted by the Ministry to R&D organisations to support both their development and cooperation between academia and industry.

- Research grants

The Estonian Science Foundation awards research grants on a competitive basis with a budget of about 6.5 million euros for 2007.

An additional important source of public funding for R&D is the European Union, with structural funds and framework programmes. The Archimedes Foundation³² plays an important role in coordinating European education and research programmes in Estonia, and implements specific projects to increase the participation of Estonian organisations in European projects and to enhance the innovation capacity in Estonia.

The Ministry of Economic Affairs and Communications finances R&D and product development projects through Enterprise Estonia.

Lastly, four additional national R&D programmes are financed by different ministries.

²⁸ Enterprise Estonia, www.eas.ee

²⁹ ERAWATCH Research Inventory, cordis.europa.eu/erawatch

³⁰ Eurostat, GERD 2005

³¹ Estonian Research Portal, www.etis.ee

³² Archimedes Foundation, www.archimedes.ee

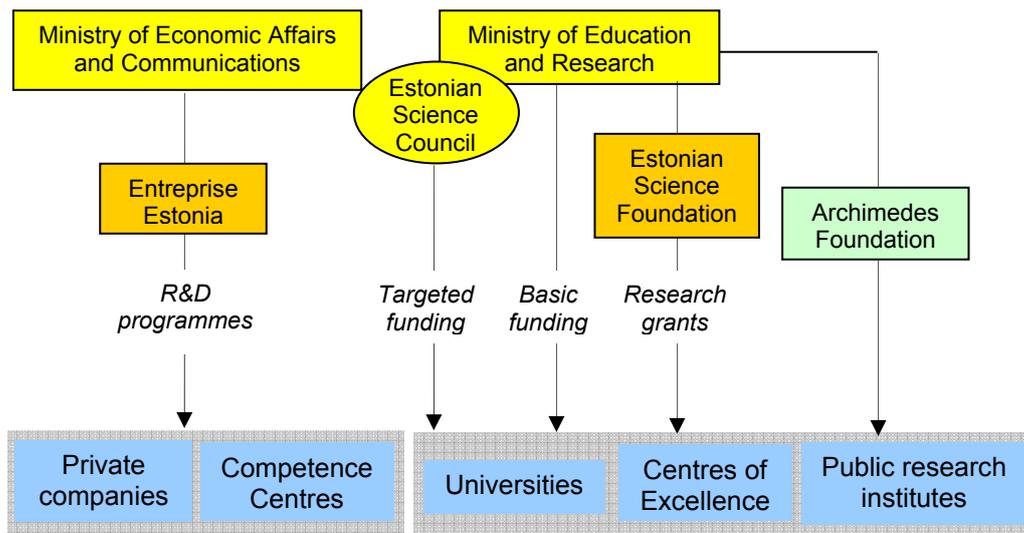


Figure 5: RDI funding mechanisms

1.2.2. Space activities budget and funding mechanisms

Space-related research can be funded by the different funding schemes of the Ministry of Education and Research. In addition, a budget line dedicated to space of 190 thousand euros was created in 2007 in the budget of the Ministry of Economic Affairs and Communications. This budget will be used to raise the awareness of Slovenian entrepreneurs and public about space initiatives and will enable an Estonian participation to different international space-related activities. It will also cover costs related to the preparation of the Estonian policy document.

1.3. Scientific and technical capabilities

1.3.1. Main achievements

Estonia has a long tradition in astrophysics research. The Tartu Observatory was inaugurated in 1812 and was equipped in 1824 with a Fraunhofer refractor telescope, the largest in the world at the time. F. G. W. Struve, famous for his works on double stars and measurement of the distance to stars, became the first astronomer to determine the distance to Vega in 1837. In 1922, E.J. Öpik determined the distance of the Andromeda nebula. In 1974, J. Einasto discovered dark matter in the Universe and provided the model of the cell structure of the Universe in 1977.

Estonia also participated in the Soviet space programme. The Tartu Observatory and the Institute of Physics of the University of Tartu have designed and built several scientific instruments such as light detectors for the astrophysical satellite Kosmos 215, low resolution spectrometer Mikron, and other instruments for Salyut 4, 6 and 7 and the teleradiometer Faza for Mir.

1.3.2. Main activities and capabilities

The key sectors of Estonian space activities are astrophysics and remote sensing applications (mainly for atmosphere, forests, agriculture and water bodies monitoring).

1.3.3. Scientific institutes

The following Estonian institutes have space-related activities.



- Tartu Observatory³³
 - Department of Cosmology (Stellar Physics and Theoretical Astrophysics)
 - Department of Astrophysics (Physics of Galaxy and Cosmology)
 - Department of Atmospheric Physics (Vegetation and Atmosphere Sensing)
- National Institute of Chemical and Biological physics³⁴
 - Laboratory of Chemical Physics (Programme on particle physics)
- Institute of Physics of the University of Tartu³⁵

Relevant research areas: material science, laser physics and technologies, theory of fundamental structure of matter, environmental physics, and biophysics.

Three additional institutes are working on remote sensing applications.

- Meteorological and Hydrological Institute³⁶

Estonia inherited this large meteorological centre from the Soviet Union, which is under the responsibility of the Ministry of Environment.

- The Estonian Marine Institute of the University of Tartu³⁷
- The Marine Systems Institute of the Tallinn University of Technology³⁸

1.3.4. Industry

There are only a few companies with space-related activities in Estonia. Entreprise Estonia is currently mapping space-related capabilities in the Estonian private sector.

An Estonian company, Vertex Estonia³⁹, has already been involved in an ESA project. Vertex Estonia, a General Dynamics company, produces equipment from steel and aluminium:

- Antennas for ground stations used for satellite communication
- Steel construction and industrial equipment

It manufactured the back-up structure of a 35-m antenna built in Australia and used to track Mars Express. It got involved in the project through its sister company, Vertex Antennentechnik, in Germany.

The two main companies working in the field of space-based applications are:

- Cybernetica⁴⁰, a private research and development company in the field of information security, information systems and navigation systems.
- Regio⁴¹, which has four fields of activity: mapping, geospatial data, geographical information systems (GIS) and mobile positioning.

Estonia has other companies with capabilities that could be used for space-related projects, including:

- AS Tööriistavabrik⁴², a supplier of precision tools.
- Interspectrum⁴³, which designs and manufactures optical and Fourier Transform Infrared (FTIR) spectroscopy instruments.
- Laser Diagnostics Instrument⁴⁴, which designs and manufactures LiDARs that can be used for pollution monitoring of terrestrial, river, lake and marine targets, oil and gas pipeline leak detection and oil exploration. These devices can be mounted in aircrafts, on surface vessels, in ground vehicles, or on stationary installations.

³³ www.aai.ee

³⁴ www.kbfi.ee/?id=56

³⁵ www.fi.tartu.ee

³⁶ www.emhi.ee/?ide=1

³⁷ www.sea.ee

³⁸ www.msi.ttu.ee/index.php?toc=41

³⁹ www.vertexestonia.ee

⁴⁰ www.cyber.ee

⁴¹ www.regio.ee

⁴² www.tooriiistavabrik.ee

⁴³ www.interspectrum.ee

⁴⁴ www.ldi.ee

1.4. Legal framework

1.4.1. National space legislation

Estonia does not have any specific national space-related laws.

1.4.2. International treaties and arrangements

Estonia has not ratified the main international treaties governing space activities, as detailed in Table 1.

Outer Space Treaty	-
Rescue Agreement	-
Liability Convention	-
Registration Convention	-
Moon Agreement	-
Nuclear Tests Ban	-
ITU	R

R: Ratified -: Not ratified

Table 1: Ratification of the United Nations Treaties by Estonia

Furthermore, Estonia is not a partner of the Missile Technology Control Regime (MTCR), but is a participating state of the Wassenaar Agreement as well as a subscribing state to the Hague Code of Conduct against Ballistic Missile Proliferation.

1.4.3. Export control

The main authority of the national export control system is the Export Control Division of the Ministry of Foreign Affairs.

2. National Policies

2.1. Rationales for space activities

The main rationales for space activities in Estonia are:

- The maintenance and development of existing space-related knowledge and skills
- The development of the economy and of the industry, and particularly SMEs, along with the development of innovation and new technologies
- The societal benefits from space applications
- The development of human capital, education in a challenging field, and inspiration for the younger generations

2.2. National priorities in the space field

A space policy working group was recently created in Estonia and is currently preparing an Estonian space strategy for the next five years. This working group consists of 14 people from scientific, political and economic areas. It is chaired by Mrs Ene Ergma from the Estonian Parliament and vice-chaired by Mr Võõras from Enterprise Estonia.

Priorities that can be identified today include:



- Getting ready for the next step in their cooperation with ESA, the status of European Cooperating State (the five-year period for their strategy document coincides with the 5-year period of their cooperation agreement with ESA)
- Working with their European partners
- Using space for citizens
- Providing seeds for development of space-related activities to the private sector

Estonian policy-makers are trying to identify niches in which the country could develop space-related activities. For instance, because of its location, Estonia could play a significant role in the surveillance of the Schengen border, or could develop systems to monitor ports and ships.

2.3. Foreign policy objectives

The main foreign policy objective that influences space activities is the strong will to be further integrated into Europe. ESA is considered to be a good tool for European integration.

2.4. Existing international cooperation

Estonia does not belong to the main space-related international organizations, as illustrated in Table 2.

ITSO / Intelsat	-
Intersputnik	-
Intercosmos	-
IMSO / Inmarsat	-
Eutelsat	-
Eumetsat	Cooperating State

Table 2: Membership of Estonia in space-related international organizations

Estonian research institutes have developed bilateral relationships with the Scandinavian countries and the other Baltic States.

3. Relationship with Europe and contribution to the European space activities

3.1. European Union

3.1.1. Participation in EU projects

Estonia is quite successful in taking part in EU-funded projects (especially in contrast with other new EU members).

Research institutes, such as the Tartu Observatory, have been participating in several FP5 and FP6 projects, including VALERI (Validation of Land European Remote Sensing Instruments), FP5 CROMA (Crop Reflectance Operational Models for Agriculture) and EDUCE (European Database for UV Climatology and Evaluation), and FP6 HYRESSA (Hyperspectral Remote Sensing in Europe's specific Support Actions).

Companies, like Regio, have been participating in FP6 projects such as WISECOM (Wireless Infrastructure over Satellite for Emergency Communications).

3.2. European Space Agency

3.2.1. Milestones in the cooperation with ESA

20 June 2007 | Signing of a Framework Cooperation Agreement

3.2.2. Participation in ESA projects

Estonia's participation in ESA projects is so far limited to the participation in the following missions:

- Planck

The Tartu Observatory has been working with the University of Turku (Finland) on data reduction algorithms.

- GAIA

The Tartu Observatory has been involved in GAIA's Photometry Working Group, responsible for the selection of photometric filter systems.

- Mars Express

Vertex Estonia got involved in the construction of a ground receiver antenna that was used to track Mars Express through their sister company, Vertex Antennentechnik (Germany).

The Tartu Observatory has also exploited ESA data for scientific purpose through the EO Principal Investigator Portal⁴⁵.

3.3. Participation in the joint EU/ESA activities

3.3.1. European Space Policy

Estonia has been represented in the High-Level Space Policy Group in Brussels by Dr Leedjärv, Director of the Tartu Observatory.

⁴⁵ ESA Earth Observation Principal Investigator Portal, eopi.esa.int



SLOVENIA

1. Space in Slovenia

1.1. Institutional framework

1.1.1. Slovenia's Research and Technology Development (RTD) system

The stakeholders of the R&T development system in Slovenia are presented in Figure 6.

The Ministry of Higher Education, Science and Technology prepares a R&T policy proposal, along with its advisory body the National Science and Technology Council, which is then approved by the Parliament and implemented by the two agencies:

- The Slovenian Research Agency (ARRS), established in 2003, started operating in 2004
- The Slovenian Technology Agency (TIA), established in 2004, started operating in 2004

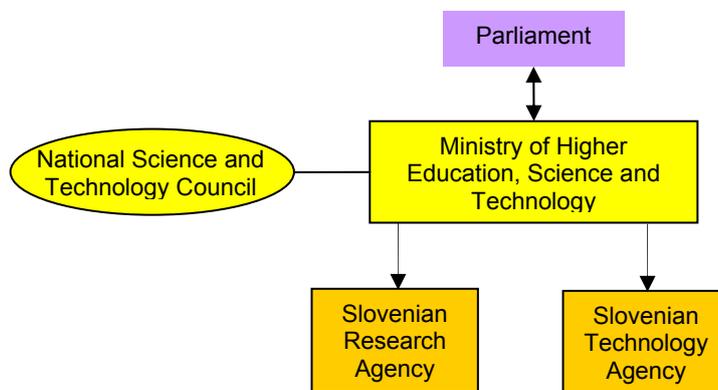


Figure 6: Stakeholders of R&T policy-making in Slovenia

The documents defining the R&D and Technology policy in Slovenia are:

- The *Slovenia's Development Strategy*⁴⁶ adopted in 2005 by the government for the period 2006-2013. It defines four strategic goals for Slovenia's development and five key development priorities with associated action plans.
- The *Resolution on National Research and Development Programme (NRDP)*⁴⁷ prepared by the Ministry of Higher Education, Science and Technology and adopted by the Parliament in 2005 for the period 2006-2010.

Research priority areas of Slovenian RTD as defined in the NRDP are:

- Information and Communication Technologies
- Advanced New Materials and Nanotechnologies
- Complex Systems and Innovative Technologies
- Technologies for Sustainable Development
- Health and Life Sciences

⁴⁶ Slovenia's Development Strategy, Adopted at the 30th Regular Session of the Government of the Republic of Slovenia on 23 June 2005

⁴⁷ Resolution on National Research and Development Programme (NRDP), Adopted by the Parliament on 15 September 2005

1.1.2. Institutional framework for space activities

There is no specific institutional framework for space activities in Slovenia. The Ministry of Higher Education, Science and Technology will coordinate most of the space-related activities.

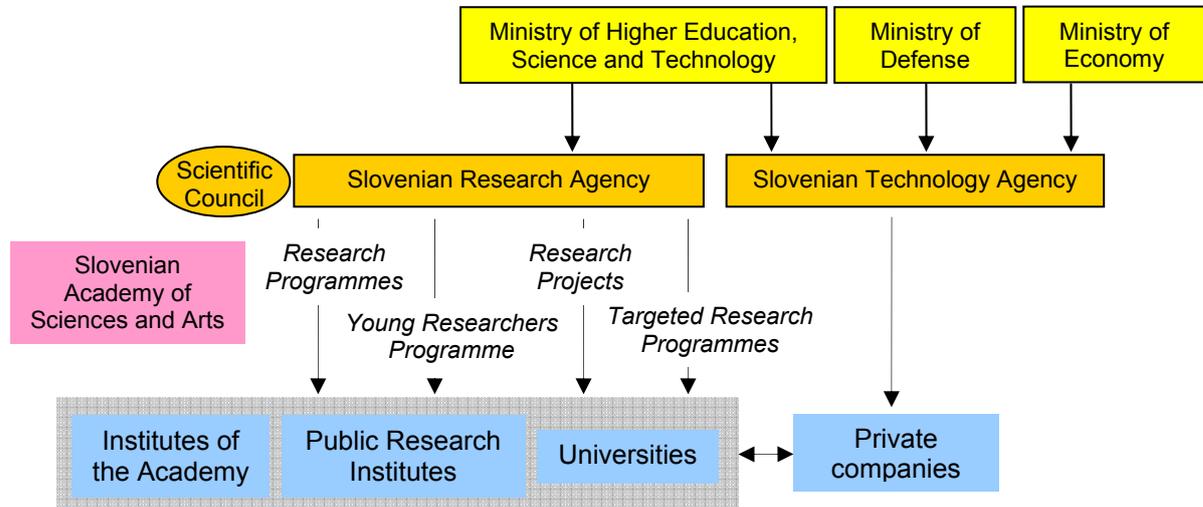


Figure 7: Public funding of RTD in Slovenia

An inter-ministerial working group was formed in July 2006 in order to coordinate activities for the Slovenian candidacy to host the Galileo Supervisory Authority (GSA) seat. This group includes representatives from the Office of the Prime Minister, the Ministry of Transport, the Ministry of Higher Education, Science and Technology, the Ministry of Public Administration, the Ministry of Finance, the Ministry of Foreign Affairs, the Government Office for European Affairs, the Ministry of Defence, the Ministry of Economy and the Ministry of Justice. It could become an inter-ministerial group for space.

1.2. Financial framework

1.2.1. R&D and Technology funding in Slovenia

Expenditure

Since Slovenia's independence in 1991, its R&D sector has benefited from a rather stable budget in comparison to other transition countries.

In 2006, Slovenia's expenditure for R&D (GERD) represented 1.22%⁴⁸ of its GDP, to be compared with the Lisbon target of 3% by 2010. The level of business investment in R&D is rather low, as in 2006, the business expenditure for R&D (BERD) represented 0.87%³⁰ of Slovenia's GDP.

Public funding mechanisms for RTD in Slovenia

The budget of the Ministry of Higher Education, Science and Technology is about 240 million euros. As presented in Figure 7, research and technology are funded through separated channels by the two implementing agencies of the Ministry, the Slovenian Research Agency and the Slovenian Technology Agency.

The Slovenian Research Agency has a budget of 145 million euros (2006) and implements the R&D policy with the following instruments:

⁴⁸ Eurostat GERD 2005



- *Research programmes* (5-year programmes undertaken by research groups that ensure stability in research funding)
- *Research projects* (shorter projects for up to 3 years that include basic projects, applied projects as well as post-doc projects for both basic and applied research).
- *Targeted Research Programmes* (projects for 1 to 4 years in support of Slovenia's development strategy and as a form of inter-ministerial cooperation)
So far, two targeted research programmes have been undertaken:
 - Slovenian Competitiveness 2006-2013
 - Science for Peace and Security 2004-2010
- *Young Researchers Programme* (funding of post graduate studies and research training)
This programme, created in 1985, has been quite successful in increasing the number of researchers in Slovenia and lowering their average age.

In addition, the Slovenian Research Agency provides statutory funding to the universities and public research institutes and subsidises the purchase of research equipment.

The Slovenian Technology Agency has a budget of about 50 million euros (2007) and has the responsibility of:

- Managing and funding the projects for the Ministry of Defence's programme "Technology for Security and Peace"
- Training young researchers from the economy (80 to 100 researchers from private companies are trained each year in public research institutes)
- Supporting the continuity of technology platforms and funding R&D projects of the technology platforms
- Funding organisations which support innovation
- R&D projects in companies in collaboration with knowledge institutions with the aim of developing new products prototypes
- R&D projects in companies in collaboration with knowledge institutions with the aim of bringing new products to the market

1.2.2. Space activities budget and funding mechanisms

There is no dedicated budget for space in Slovenia. Space-related projects are funded by the different funding schemes of the Slovenian Research and Technology Agencies, as summarised in Figure 8.

Some activities related to space applications are funded by other ministries, such as the Ministry of Economy or the Ministry of Environment. Other activities are also funded by European projects, in which Slovenian organisations are participating quite successfully.

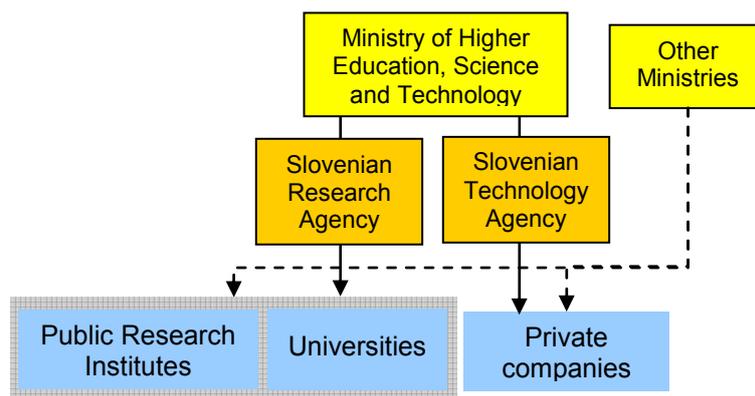


Figure 8: Funding of space activities in Slovenia

1.3. Scientific and technical capabilities

1.3.1. Main activities and capabilities

The key sectors in Slovenia are remote sensing applications and communications. The main fields of applications of remote sensing are: land use and cover, digital elevation modelling, agriculture, forestry, geology, environmental changes, disaster management, meteorology and archaeology.

1.3.2. Scientific institutes

The main scientific institutes with space-related activities are the following ones.

- Institute Josef Stefan⁴⁹
 - Department of Physics
 - Department of Chemistry and Biochemistry
- The Department for Communications Systems of the Institute Josef Stefan⁵⁰
 - Development and performance evaluation of telecommunication systems, networks and services

Remote sensing

- The Institute of Anthropological and Spatial Studies of the Slovenian Academy of Science and Arts⁵¹ (6-8 researchers)
 - Distribution of satellite imagery in Slovenia
 - Land cover and change detection, digital elevation modelling, disaster monitoring, archaeology, lidar data processing, modelling of temperature from satellite data, paleo-environment detection, Interferometric Synthetic Aperture Radar (InSAR) data processing
 - Geological Survey of Slovenia⁵² (2-3 researchers working with remote sensing)
 - Geology, hydrological cycles, landslide, active tectonics, permanent scatterer InSAR (PSInSAR)
 - Slovenian Forestry Institute⁵³ (2-3 researchers working with remote sensing)
 - Forestry, LIDAR data processing, habitat and land cover maps, estimation of forest stand biomass
 - Faculty of Civil and Geodetic Engineering, University of Ljubljana⁵⁴ (2 researchers working with remote sensing)
 - High-resolution image processing, geo-referencing, ortho-photo, LIDAR, photogrammetry
 - Statistical office of the Republic of Slovenia⁵⁵ (1-2 researchers working with remote sensing)
 - Periodical land cover mapping, change assessment, statistical estimation of diversity
- The Slovenian Association of Surveyors⁵⁶ is a national organisation of experts in geodesy, organised in three commissions, including one on remote sensing.

Medicine

The Hospital Valdoltra in Ankaran has organised bed-rest studies.⁵⁷

⁴⁹ www.ijs.si

⁵⁰ www-e6.ijs.si/indexeng.html

⁵¹ iaps.zrc-sazu.si/index.php?q=en//node/20

⁵² www.geo-zs.si

⁵³ petelin.gozdis.si/splet/index.php

⁵⁴ fgg.uni-lj.si

⁵⁵ www.stat.si

⁵⁶ www.zveza-geodetov.si

⁵⁷ www.ob-valdoltra.si



1.3.3. Industry

There are few companies with space-related experience in Slovenia, mainly SMEs. The Slovenian company Dewesoft⁵⁸ provides data acquisition products and has participated in a NASA project of telemetry acquisition. The company C3M⁵⁹ is involved in the SURE experiment to be flown by ESA onboard of the ISS. This experiment deals with the "Development of a numerical-experimental system for inverse identification of biomechanical changes of skin properties during the ISS mission". It is also investigating innovative satellite propulsion systems with national and international partners. Other companies with space-related activities are working in the field of applications, such as:

- CIFRA⁶⁰ (Telecommunications, GIS and GPS products)
- DFG Consulting⁶¹
- GISDATA⁶² (GIS, remote sensing and GPS products and distribution of satellite imagery)

1.4. Legal framework

1.4.1. National space legislation

Slovenia does not have any specific national space-related laws.

1.4.2. International treaties and arrangements

Slovenia ratified some of the main international treaties governing space activities as detailed in Table 3.

Outer Space Treaty	-
Rescue Agreement	R
Liability Convention	R
Registration Convention	-
Moon Agreement	-
Nuclear Tests Ban	R
ITU	R

R: Ratified -: Not ratified

Table 3: Ratification of the United Nations Treaties by Slovenia

Furthermore, Slovenia is not partner of the Missile Technology Control Regime (MTCR) but is a participating state of the Wassenaar Agreement as well as a subscribing state to the Hague Code of Conduct against Ballistic Missile Proliferation.

1.4.3. Export control

The main authority of the national export control system is the Ministry of Defence.

⁵⁸ www.dewesoft.si

⁵⁹ www.c3m.si

⁶⁰ www.cifra.si

⁶¹ www.dfgcon.si

⁶² www.gisdata.com

2. National Policies

2.1. Rationales for space activities

Slovenia does not have any tradition of space. The main rationales for developing space activities are:

- The development of the economy
- The development of high-tech skills
- The societal benefits from space applications
- The use of space capabilities to support national policies

2.2. National priorities in the space field

Slovenia does not have any specific space programme.

2.3. Foreign policy objectives

The main foreign policy objective that influences space activities is Slovenia's strong will to be further integrated into Europe and to make the most of its EU membership.

2.4. Existing international cooperation

Slovenia belongs to two of the main space-related international organisations, as illustrated in Table 4.

ITSO / Intelsat	-
Intersputnik	-
Intercosmos	-
IMSO / Inmarsat	-
Eutelsat	X
Eumetsat	Cooperating State

Table 4: Membership of Slovenia in space-related international organizations

Slovenian organisations have developed bilateral and multi-lateral cooperations with several European countries, including Italy, England, Austria, Germany and France.

3. Relationship with Europe and contribution to the European space activities

3.1. European Union

3.1.1. Participation in EU projects



Slovenia participates in ERA-STAR Regions (Space Technologies Applications & Research for the Regions and Medium-Sized Countries)⁶³ under the ERA-NET scheme of the FP6.

Slovenian organisations have taken part in space-related European projects, such as SatNEx (Network of Excellence in Satellite Communications), a FP6 project in which the Josef Stefan Institute has participated.

3.1.2. Support for the participation of Slovenian organisations in European projects

In 1999, the Slovenian Business and Research Association was established in Brussels to connect business and research communities in Slovenia with the EU institutions and other public and private bodies at EU level.

3.2. European Space Agency

3.2.1. Milestones in the cooperation with ESA

Expected in early 2008 | Signing of a Cooperation Framework Agreement

3.2.2. Participation in ESA projects

Slovenia was selected to participate in the SURE (The International Space Station: a Unique Research Infrastructure) programme with one experiment that will be flown onboard the ISS. SURE is a four-year project managed by ESA and fully funded by the EC.

The University of Maribor and the Scientific Research Centre have both exploited ESA data for scientific purpose through the EO Principal Investigator Portal⁶⁴.

3.3. Participation in the joint EU/ESA programmes

3.3.1. European Space Policy

Slovenia has not been represented in the High-Level Space Policy Group.

3.3.2. Galileo

Slovenia is a candidate to host the Galileo Supervisory Authority (GSA) seat in Ljubljana. This action has been under the responsibility of the Ministry of Transport⁶⁵.

3.3.3. GMES

The Geological Survey is a partner of GMES Terrafirma⁶⁶, an ESA-supported GMES project.

⁶³ ERA-STAR www.era-star.net

⁶⁴ ESA Earth Observation Principal Investigator Portal, eopi.esa.int

⁶⁵ www.mzp.gov.si

⁶⁶ www.terrafirma.eu.com

Acronyms

BERD	Business Expenditure on R&D
EC	European Commission
ECS	European Cooperating State
EO	Earth Observation
ERA	European Research Area
ERA-STAR	European Research Area - Space Technologies Applications & Research for the Regions and Medium-Sized Countries
ESA	European Space Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FTIR	Fourier Transform Infrared Spectroscopy
FP	Framework Programme
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D
GIS	Geographic Information System
GMES	Global Monitoring for Environment and Security
GPS	Global Positioning System
GSA	Galileo Supervisory Authority
HLSPG	High Level Space Policy Group
InSAR	Interferometric Synthetic Aperture Radar
LIDAR	Light Detection and Ranging
NATO	North Atlantic Treaty Organisation
NCP	National Contact Point
PPP	Purchasing Power Parity
PPS	Purchasing Power Standards
PSInSAR	Permanent Scatterer Interferometric Synthetic Aperture Radar
R&D	Research and Development
RTD	Research and Technology Development
RDI	Research, Development and Innovation
SME	Small and Medium Enterprise
SURE	International Space Station: a Unique Research Infrastructure



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The author would also like to thank Dr Serge Plattard and Prof Kai-Uwe Schrogl for their supervision, insights and feedback.

Interviewees

Slovenia

Dr Mihelič	General Director	Directorate for Technology, Ministry of Higher Education, Science and Technology
Mr Cvelbar	Secretary	
Mrs Zalar	Undersecretary	
Dr Gider	Director	Slovenian Technology Agency
Dr Pukl	Assistant Director FP7 NCP for Space and Security	Jozef Stefan Institute
Mrs Rataj	Technology Development Director	Centre of Competitiveness, Chamber of Commerce and Industry of Slovenia
Dr Mohorčič	Assistant Professor	Department of Communications Systems, Jozef Stefan Institute
Dr Oštir	Senior Research Fellow	Institute of Anthropological and Spatial Studies, Scientific Research Centre of the Slovenian Academy of Sciences and Arts
Dr Komac	Director	Geological Survey of Slovenia

Estonia

Dr Ergma	Vice-President	Estonian Parliament
Dr Võõras	Director	Business Development Division, Innovation and Technology Development, Enterprise Estonia
Dr Uska	Development Consultant	
Dr Leedjärv	Director	Tartu Observatory
Dr Viik	Senior Research Fellow	
Dr Mikson	FP7 NCP for Security and Space	Research Cooperation Centre, Archimedes Foundation
Dr Rulkov	Director	Vertex Estonia
Dr Veebel	Technical Director of Antenna Products	



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The mission of the European Space Policy Institute (ESPI) is to carry out studies and research to provide decision-makers with an independent view on mid- to long term issues relevant to the governance of space.

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