2014/02

Austria in Space

Strategy of the bmvit for Austrian Space Activities

bmvit

Bundesministerium für Verkehr, Innovation und Technologie

Executive Summary

Modern space technologies have become an indispensable part of our daily lives. Television, telecommunications, navigation and weather forecasts rely on satellites. The importance of satellite-based information and services for many sociopolitical priority areas, such as climate research and monitoring, weather forecasting, and transport is becoming increasingly clear.

The reasons for undertaking space activities have expanded since satellites first started to be launched: in recent years strong user-oriented considerations have been added to the scientific, political and strategic motivations. Space systems that previously were mainly addressed to scientific users are now provided to operational user groups, such as satellite communication, meteorology, satellite navigation, climate monitoring and land use. The operational and sustainable provision of satellite infrastructure raises new questions as to its use.

At the same time, the international environment is changing: new, emerging powers such as China and India are pushing into the field. Space powers such as the U.S. and Russia are redefining their priorities. The economic, scientific and geopolitical environment is changing. Europe is realigning its space sector in this new environment: the European Union has put space on its agenda. The Treaty of Lisbon, which entered into force in December 2009, specifies a shared competence for space between the European Union and its member states and specifically notes the importance of ESA in this triangle.

After a long history of developing the space expertise of industry and research institutes in Austria, impressively demonstrated by the Austrian Ministry for Transport Innovation and Technology, bmvit, in its recent publication on the overview of Austrian space industry and research (www.spacetechnology.at), the future development of Austrian space activities has been charted through a robust dialogue among many players within the space industry and research bodies, the Research Promotion Agency FFG, and with the ministries and institutions relevant to space activities, resulting in the following agreed objectives:

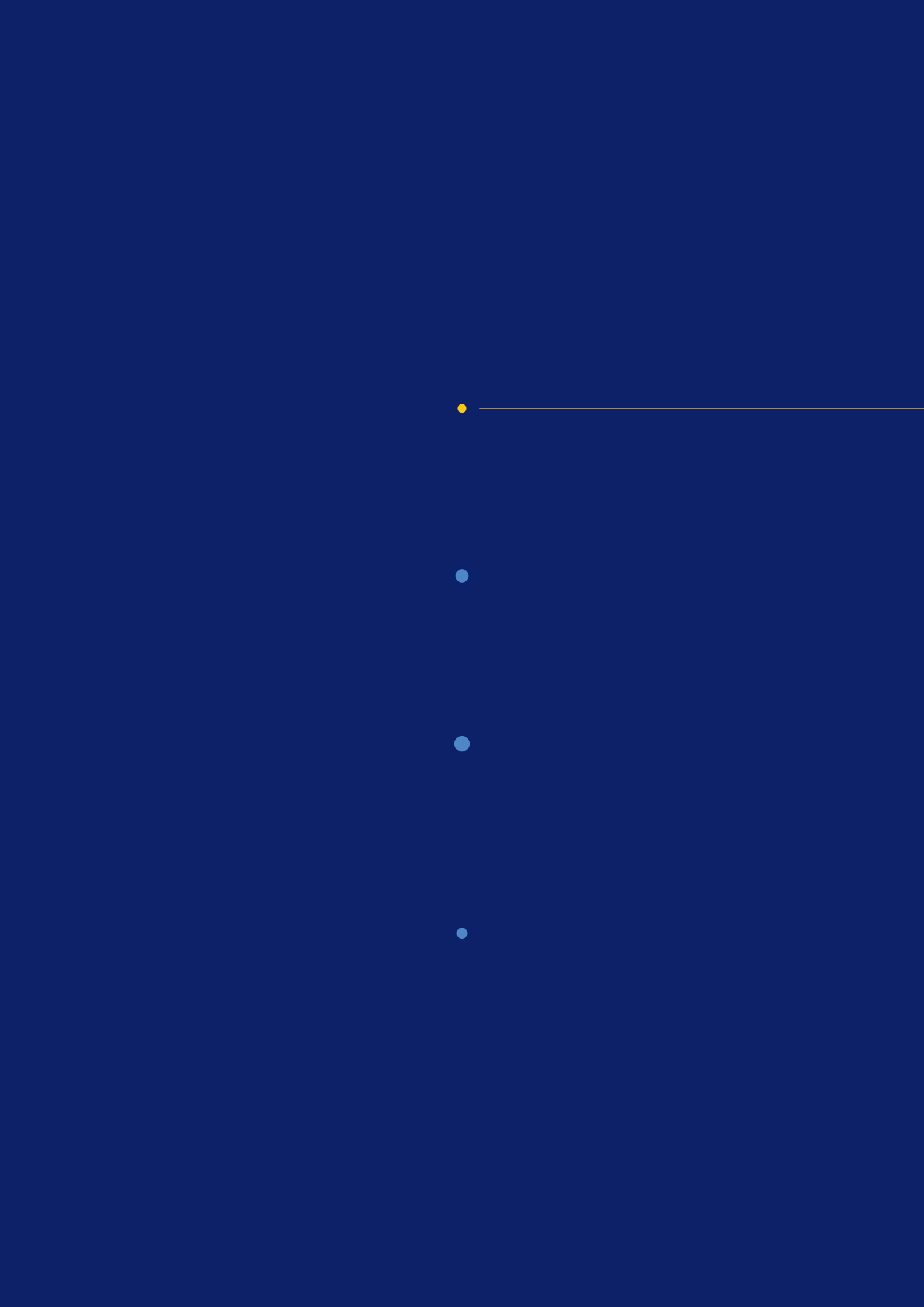
1. **Being an Internationally Recognized and Visible Partner in Europe**
2. **Strengthening the Competitiveness of the Austrian Space Sector**
3. **Orientation towards Application Potentials of Satellite-based Data**
4. **Providing the Bases for Austrian Space Activities**

The above objectives inspired the elaboration of Austria's positions in the negotiations on the European Space Policy and in the preparation of a European industrial policy, and are guiding policy on the retention of a competitive Austrian space sector and its use of European space infrastructure.

Moreover, the objectives facilitate clear, transparent and efficient organisation in terms of cooperation and coordination, monitoring and evaluation, programmatic long-term planning, implementation of international space law, and regulatory support of the space sector in Austria, and the appropriate involvement of the various stakeholder groups. The objectives enable a targeted programmatic orientation of bmvit space activities on the following topics: ensuring sufficient funding, the programmatic setting of priorities in ESA as well as in planned EU space programmes, further development of the Austrian space programme, promoting the use of satellite-based space technologies, taking positions in defining space infrastructures and contributions to their operational phases, priority areas of bilateral and multilateral cooperation, contributions to the European space policy, promotion of fundamental space sciences as well as the contributions of space research and space for the education and training of Austrian experts.

The strategy will guide the scope of action of the bmvit until 2020 and in particular constitute a basis for Austria's policies with regard to recent and upcoming milestones in the development of the European space sector: the programmatic decisions of the upcoming ESA Council meetings at Ministerial level, and the preparation and implementation of the EU space programmes within the multiannual financial framework from 2014 to 2020.

Investments in space activities are an investment in the future, also in times of economic crisis. The bmvit is convinced that this future, created by European partners such as the EU and ESA, should be actively shaped by Austria, based on the competences developed to date.



The Austrian Space Sector

Introduction
Border-crossing Vision and Benefit-creating Reality

The European Union has put space on its agenda and the Treaty of Lisbon defines a shared competence for space between the EU and its member states. With this, Europe is sending a clear signal that it recognizes the strategic importance of space and assumes responsibility for it. With this shared competence, space becomes a policy field, in addition to a pure research and development topic, in which all member states of the EU – and thus also Austria – are called upon to develop an appropriate policy.

Planned space activities in the multiannual financial framework of the EU, in particular the future operating phases of the satellite infrastructures Galileo and Copernicus, broaden the scope of action. Austria has to take a position regarding the stronger integration of space topics within the EU budget.

As the department responsible for space, the bmvit's role is to facilitate the active participation of Austrian companies, research institutions and prospective users of satellite based services in the development and use of space infrastructures. Through publication of the present strategy, the bmvit is opening discussion on future guidelines to optimally represent Austrian interests from both from the public, industrial-scientific perspective and the user perspective.

Looking at the decade ahead to 2020, a bmvit strategy for Austrian space activities was elaborated, based on the successes of Austrian space industry, science and research institutes. This strategy should, inter alia, enhance the established industrial and scientific capacities and skills, take the new European and international framework conditions into account, exploit the results of analyses and evaluations, and define new objectives and measures for their implementation.

40 Years of Space Activities in Austria

Science Leads the Way

Years before the first Austrian developed equipment for scientific experiments flew into space aboard a sounding rocket in 1969, scientific activities in space research had led Austria's way into space. These activities were given an institutional basis and important boost in the 1970s by the foundation of the Austrian Academy of Sciences, in Graz.

Member of ESA for 25 Years

Austria's ambitions and further development of space activities quickly led to an approach to ESA. In the early 1980s, Austria joined the Agency as an associated member, followed by full membership in 1987. Since that time, Austrian research institutes and companies have been actively involved in the development of space missions, providing measuring instruments as well as parts of satellites and launcher systems, and developing useful space-based applications. Austria is defined as a medium-sized space nation. Its contributions to ESA were raised to about 54 Million Euro in 2011 (Figure 1).

Figure 2 compares the share in the different activities of ESA after the Ministerial Conference in 2008, and clearly shows the Austrian setting of priorities compared to the average contributions of all ESA member states. Priorities were set in the topics of Earth observation and climate research, telecom and technology development. The possibility of different contributions to ESA optional programmes constitutes a major advantage in implementing national priorities at international level. Financial returns from ESA programmes have developed very positively in recent years (Figure 2).

Active Participation of Austria in the Research Programmes of the European Union

Austria's integration into the EU opened the possibility of also participating in the EU framework programmes that have been funding research projects in the area of space since 2002. The returns from the space programme of the current EU framework programme are higher than Austria's financial contribution, as at November 2012 (Figure 4).

The Austrian Space Programme as Preparation for and Entry Into Space Cooperation

Since 2002, national actors have been additionally supported by the bmvit's Austrian space programme, ASAP. The programme serves as an entry point for space activities and thus facilitates access to international markets and strengthens competitiveness. After eight calls for proposals since 2002, 241 projects with a total funding of approximately 55 Million Euros have been financed within the programme (Figure 5). ASAP has a leverage effect on the international programmes of the EU and ESA, on bilateral programmes and on the commercial market. It has facilitated bilateral cooperation with industrial companies and other national space agencies (Figure 6).

Evaluation of bmvit Space Activities

An external evaluation in 2008 of all space activities and support measures of the bmvit by an international team of experts positively assessed the space strategy pursued by Austria to date. It recognized the strengths of the Austrian space sector in terms of its strong international specialization (48% of companies generate 80–100% of their revenues from exports) and the small and medium enterprises that are very active in the use of satellite technology (81% of companies operating in the area of satellite-based services are SMEs). Nevertheless, ESA programmes still represent the largest market for Austrian actors.

Organisation and Responsibilities

Austrian space activities (ESA, EU, EUMETSAT and ASAP) are under the jurisdiction of the Federal Ministry for Transport, Innovation and Technology (bmvit) and are implemented by the Aeronautics and Space Agency of the Austrian Research Promotion Agency, FFG. An inter-ministerial group ensures cross-divisional coordination and consultation of Austrian space policy and harmonizes Austrian positions for international bodies. The association AUSTROSPACE represents the interests of Austrian space actors in science, research and industry.

1 The Austrian ESA-Budget 2011

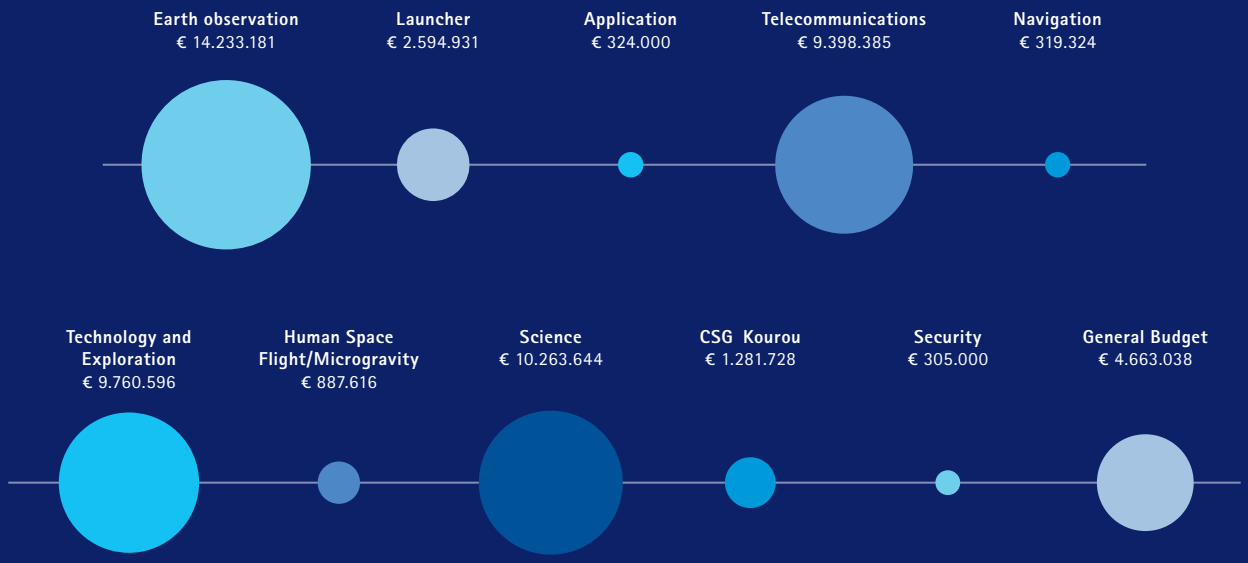


Figure 1: The Austrian ESA budget 2011, Source: FFG

2 Austrian Priorities in ESA

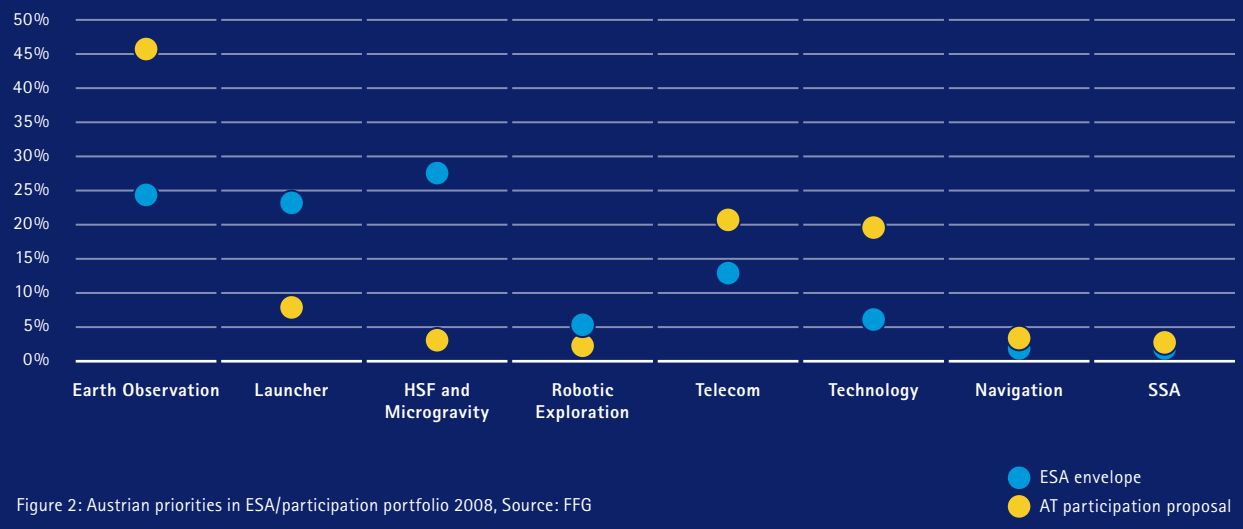


Figure 2: Austrian priorities in ESA/participation portfolio 2008, Source: FFG

3 Austrian Return Flows From ESA-Programmes

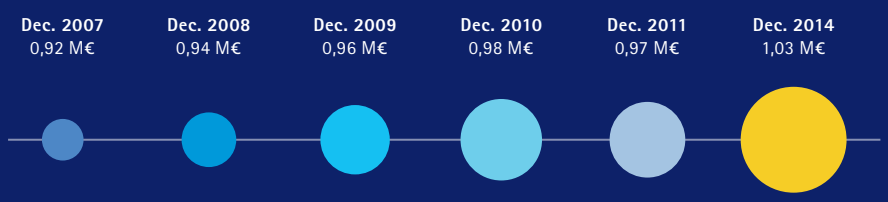


Figure 2: Return flows in form of contracts from ESA programmes to Austrian actors, Source: FFG

4 Austrian Share of Retrievable Fundings in the EU-Research Programme

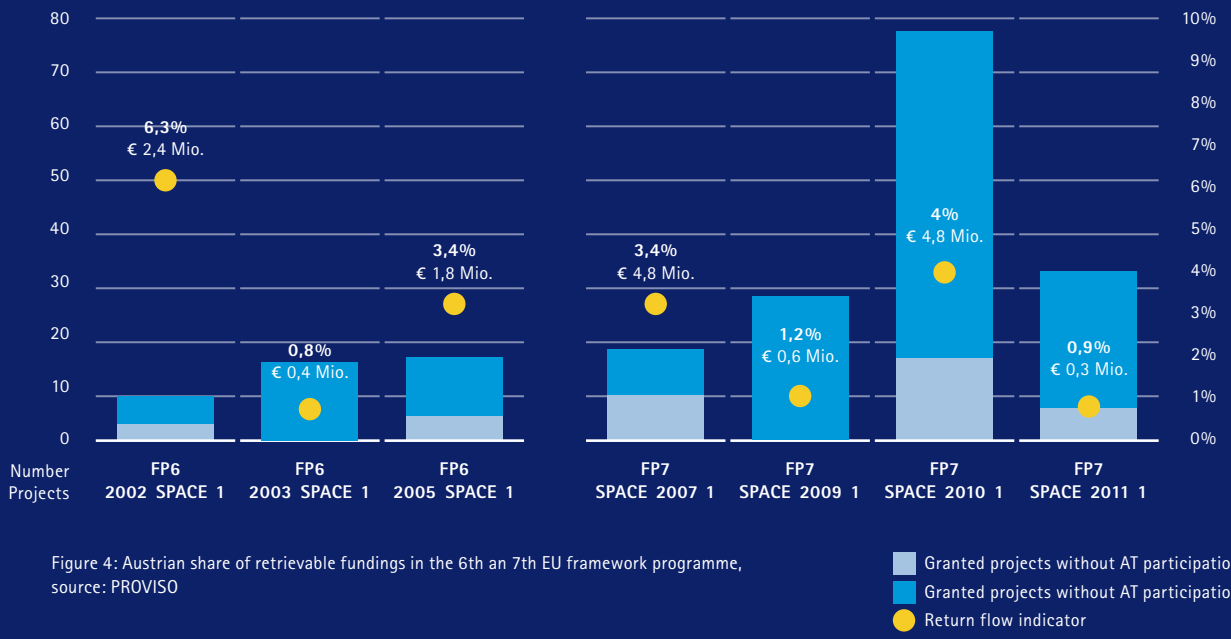


Figure 4: Austrian share of retrievable fundings in the 6th an 7th EU framework programme, source: PROVISO

Granted projects without AT participation
Granted projects without AT participation
Return flow indicator

5 Austrian Space Programme ASAP Fundings 2005–2011

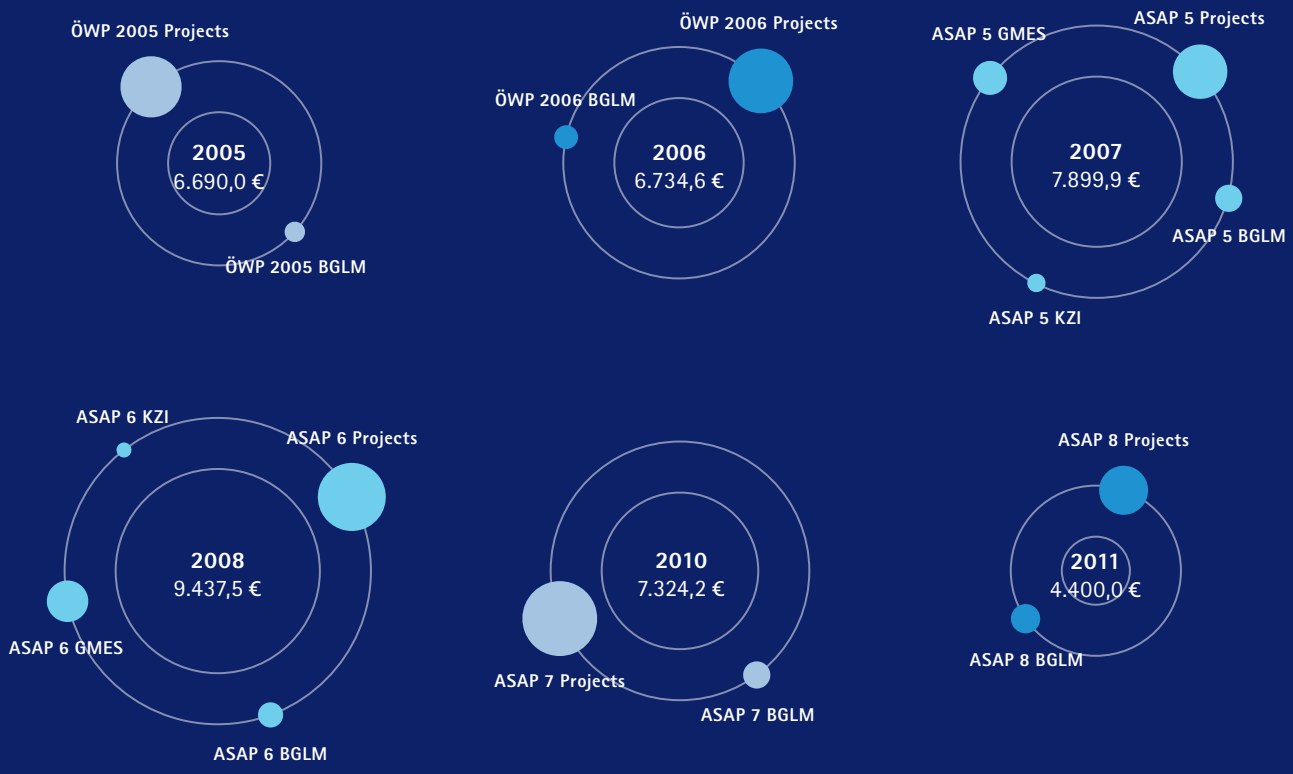


Figure 5: Austrian space programme ASAP fundings 2005 2011 (no call in 2009), Source: FFG

BGLM: Accompanying measures
KZI: Concept initiative
GMES: Global Monitoring for Environment and Security (now Copernicus)

6 Austrian Space Programme Has a Leverage Effect

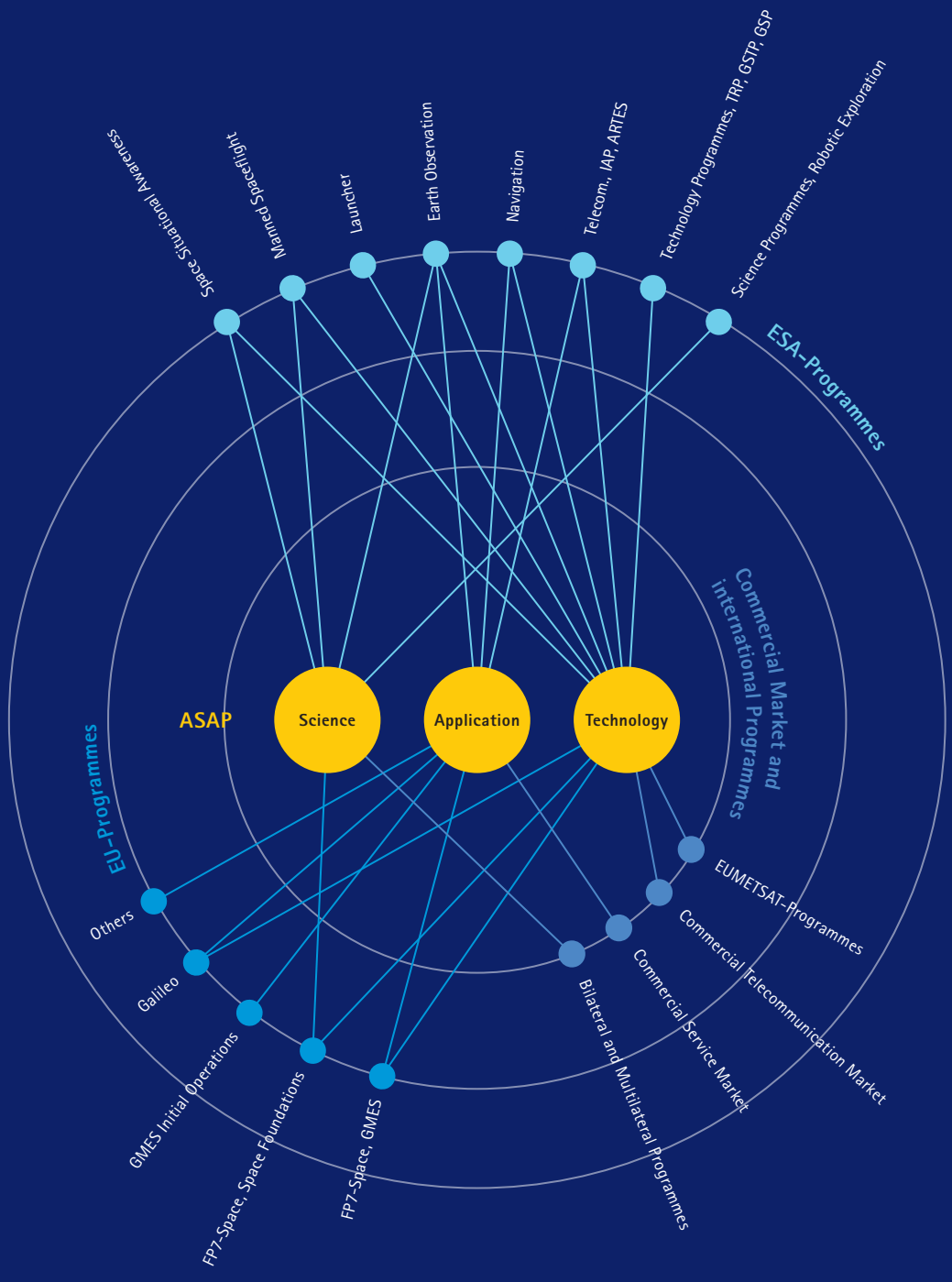


Figure 6: The Austrian space programme as lever to international and European space programmes, Source: FFG

Ready for a Step-Change in Development

7 Space Industry in Austria

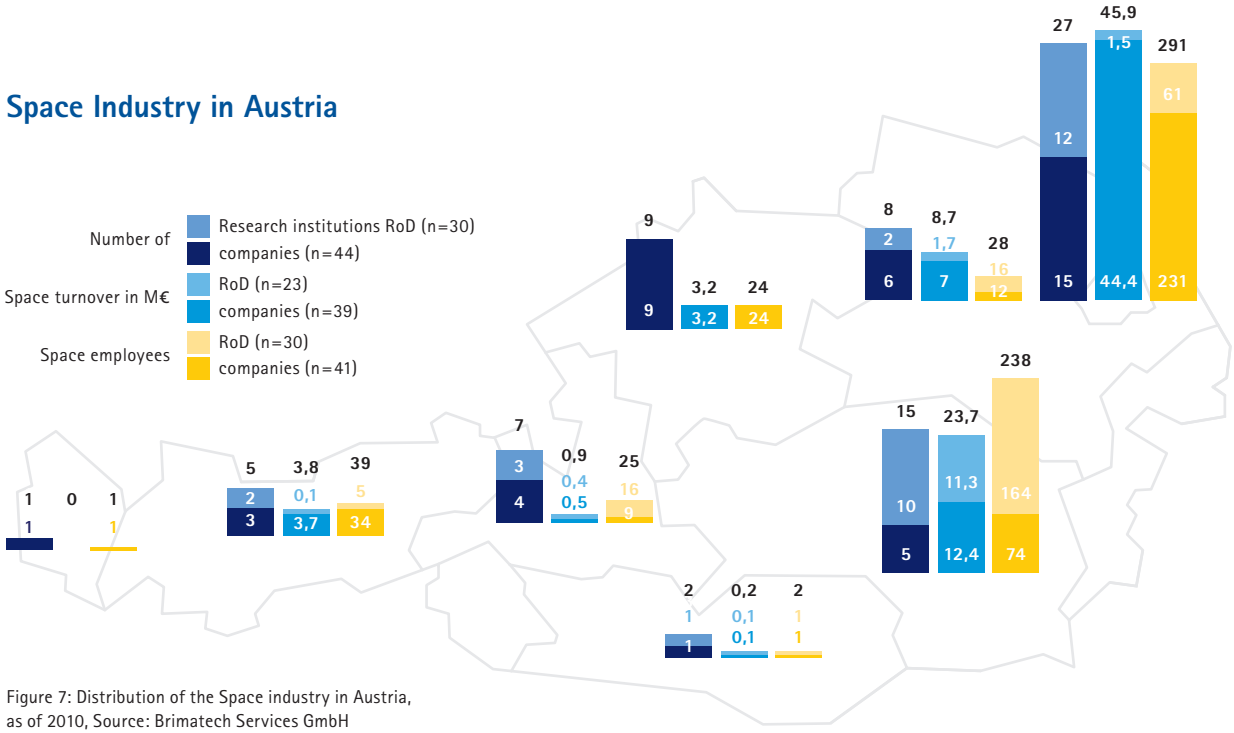


Figure 7: Distribution of the Space industry in Austria, as of 2010, Source: Brimatech Services GmbH

The Austrian space sector is an internationally recognized player with a vital cast of successful developers and suppliers of innovative applications of space technologies. A traditional and at the same time innovative scientific space research community provides the basis for achieving a technological cutting edge position.

According to a current competence overview of the Austrian space industry and research,[1] which provides a basis for the space strategy, 114 organisations are active in the space sector with an annual turnover of about 125 Million Euros and 934 employees. Most organisations are in the satellite-based applications segment. Intellectual capital is reflected by an average of about 20 patents and slightly more than 1.000 publications per year.

1 BRIMATECH Services GmbH: Ö-SPACE Austrian Space Industry and Research: Database of Market Participants, Vienna 2011

Priorities and Competencies of the Austrian Space Sector

Space Technology

International Leadership Positions

In recent years, Austria has developed internationally recognized and visible skills, especially in the areas of space technology and scientific data analysis, as well as in the technology areas described below.

Thermal and Mechanical Subsystems for Satellites and Launcher Systems

Austria achieved a leading market position in Europe with thermal insulation that protects spacecraft and subsystems from extreme temperatures. Fuel lines from Austria supply the main engine of the Ariane 5 rocket with liquid hydrogen and liquid oxygen. Furthermore, precision mechanisms and structural elements from Austria are used in numerous ESA projects. The expertise gained in these areas is being successfully used for technology transfer in terrestrial applications and the integration of telecommunication satellites in the commercial market.

Electronics for Control and Signal Processing Tasks

Navigation receivers from Austria provide highly accurate positioning on all ESA and EU Earth observation satellites currently under development and construction. Furthermore, the generation of navigation signals and the control of several processes on the first operational Galileo satellites are managed with the help of electronic assemblies from Austria.

Subsystems for Testing and Operating Satellites

Test systems from Austria ensure quality in the important area of integration and testing satellites processes. In fact, 30% of all satellite transponders worldwide are automatically and continuously controlled with the help of signal monitoring technology from Austria.

Prospects for 2020

These successes constitute the conditions for the expansion of Austrian market position in the coming decade, with new opportunities in the emerging space markets in Asia and Latin America. Highly attractive opportunities for Austria can be identified in all priority areas.

Thermal and mechanical subsystems

Austria's longstanding experience, good knowledge base and available test infrastructure constitute excellent conditions for national actors in the field of thermal and mechanical subsystems. Increasing demands on materials are generating a need for new and innovative developments, which are an opportunity for future product development.

Electronics for Control and Signal Processing Tasks

Due to the ever-increasing resolution of Earth observation instruments there will also be increasing demand for highly integrated navigation receivers that are compatible with GPS and Galileo. Improved future navigation satellites will use the increased performance of signal processing technologies.

Subsystems for Testing and Operating Satellites

Standard platforms for the construction of test facilities for satellites and areas such as the testing of high data transfer rates, accuracy, and the reduction of power consumption are becoming more important. Latest developments in the semiconductor industry and in software algorithms will give decisive impulses in this direction.

Innovative Propulsion and Power Systems for Future Satellites

In recent years, field emission engines were developed in Austria that allow for the accurate positioning of scientific satellites. Further developments include chemical engines with environmentally friendly fuels, and mini engines for micro-satellites and hydrogen fuel cell systems that could replace batteries as energy storage systems.

In February 2013, the first nano-satellite developed, manufactured and tested in Austria, BRITE (Bright Star Target Explorer) Austria/TUGSAT-1, was launched. This scientific satellite is a demonstration project for the quality of Austrian space research and technology.

Applications for Space Technologies

International Leadership Positions

Austrian companies and research institutions have occupied key positions in the application segments of spatial planning, hydrology, environmental monitoring and crisis management. They are also at the forefront of ensuring the optimal added value of the future Galileo system through services and product development in the field of satellite-based navigation. Furthermore, Austrian actors are now internationally recognized in the development, optimization and use of satellite-based communication systems for fixed and mobile applications.

In the application fields of Earth observation, satellite-based navigation and satellite communications, new and innovative developments have also been supported through the national space programme ASAP.

Earth Observation

Austrian companies and research institutions were able to achieve excellence in Earth observation applications. In the field of spatial planning, for example, Austrian service providers have managed to achieve a leading position in the European market. In the field of hydrology, Austria was successful in the development of operational real time services for the detection of snow and soil moisture. National institutions also shaped the application segment of forest monitoring and forest inventories. Austrian actors are internationally very active in the development of operational processing chains for the geometric and radiometric pre-processing of Earth observation data.

Navigation

Austrian companies and research institutions have extensive know-how in the improvement of interference resistance and accuracy of satellite navigation systems, the design of new navigation receivers operating reliably also in disturbed environments, and the development of automatic aircraft precision landing facilities.

Satellite Communications

Austrian institutions are in the forefront of developing and realizing broadband satellite communication systems and services. Examples include cost efficient Internet-based terminals that enable Internet and telephone services in areas without sufficient terrestrial infrastructure. They have also gained an international reputation in the area of distributing large amounts of data from remote sensing satellites. Moreover, Austria is successfully involved in the development of new processes and technologies that ensure reliable transmissions from communication satellites.

Prospects for 2020

In the area of Earth observation, increasing focus should be put on the development of automatic process chains and services in order to manage the enormous data sets from satellites of the latest generation, especially the satellites of the European programme Copernicus.

In the navigation field, the focus of future activities will be in the utilisation of the European navigation systems EGNOS and Galileo. Special attention will be paid to the further development of receiver technology and the marketing of application software for multi-sensor systems for services. In general, satellite navigation will play an important role in the area of "Ambient Assisted Living". Another promising area is the development of highly precise positioning techniques in real-time.

Satellite communications is the crucial technology to avoid the "digital divide" by providing services in areas without adequate infrastructure. The key to success is low-cost devices. Mobile applications for vehicles are becoming more important together with the effective use and development of new frequency domains for commercial use. Optical data transmission is becoming more prominent in addition to microwave technology.

Integrated Applications enable the development of new services or the significant improvement of existing services by using and integrating multiple space assets. These activities will be further expanded and the focus will be put on national and international marketing.

Space Science

International Leadership Positions

In selected areas of science, Austrian institutions have achieved international leadership positions or are getting ready for the next step. Examples include space physics, astrophysics, Earth observation of the climate and environmental change, use of GNSS satellite signals, and quantum physics in space. Outstanding achievements in the past decade in these scientific areas were, for example:

Space Physics

Austria belongs to the top 3 countries in citations per professional paper and citations per population. In the research of our solar system Austria is among the most frequently cited nations relative to population. Austria is ranked number 1 in papers per population in the field of planetary exploration. The IWF, for example, is the largest international partner in the space plasma physics mission MMS of NASA and has a primary role in the development of two instruments for the exploration of Mercury with the BepiColombo mission. Another research group from the University of Graz is a leader in the research areas of solar activity monitoring and space weather.

Astrophysics

Research in astroseismology and the late stages of stellar evolution at the University of Vienna enjoy international recognition, especially as a result of instrument contributions to space missions such as CoRoT and Herschel and the use of their data.

Earth Observation

Research groups from Graz, Innsbruck and Vienna belong to the leading groups in several Earth observation research missions such as the gravity field mission GOCE, the hydrology mission CoreH2O, and the climate monitoring mission ACCURATE. They are leaders in the area of soil moisture monitoring in the frame of ESA's Climate Change Initiative, and land use monitoring within the scope of Copernicus. Austrian research groups belong also to the leaders in the area of satellite orbit calculation and observation.

Satellite geodesy/Global Navigation Satellite Systems GNSS

A group of researchers from the Technical University of Vienna belongs to the leading organisations in the processing of GNSS data and have published important articles based on GNSS data in the areas of plate tectonics, Earth's rotation, atmospheric monitoring for weather forecasting and climate change.

Quantum Physics in Space

Researchers from the Austrian Academy of Sciences and the University of Vienna achieved worldwide leading position in the field of quantum communications. Their experimental tests of quantum physics over a distance of 144 km represent a world record and are internationally seen as proof that quantum communications via satellite is possible. This expertise offers possibilities for an important technological position of Austria in this new area.

Prospects for 2020

The past successes are the basis of excellent prospects for further development of Austrian science in the space domain in the period up to 2020.

Austria should continue its activities in the field of space plasma physics and exploration of the solar system at the highest international level. Furthermore, the planetary research on exoplanets should be expanded and the area of space-based astronomy should be strengthened.

In the area of astrophysics there are increased possibilities in the exploration of gas and dust phases in the cosmic matter cycle on stellar, galactic and cosmological scales, as well as possibilities in astroseismology and exoplanets of near stars.

Enormous potential lies in the research and development of new Earth observation methods for strong contributions to addressing climate and environmental change.

The great potential in the upcoming years in the field of satellite geodesy and GNSS lies in the combined use of all active and currently developed satellite navigation systems and in the possibilities of using GNSS for Earth observation.

In order to maintain and expand Austria's international leadership position in the field of quantum physics, experiments in space are inevitable. Thus, the further development of technologies for quantum communication experiments and for high-precision watches, quantum optomechanics and quantum interference with nanoclusters is of importance.

Objectives for the Further Development of Austrian Space Activities

Orientation in Dynamic Times

Space technologies represent basic infrastructure of the 21st century to overcome economic, environmental, scientific and social challenges and are prerequisites for the efficiency of our modern economy. Europe has recognized the use of space systems for various European policy areas and presented its interest in several strategy papers. Europe wants to be an internationally recognized and strong partner and thus also the question of strategic independence of space-based infrastructure is becoming increasingly important.

Due to these developments, in Austria also there is a growing need for orientation, communication and interaction between research and development and the administrations of the ministries, the operational organisations and the users of systems. Key elements to consider include technological orientation, future industrial structure, programmatic investments and the relevant setting of priorities, scientific coverage of these activities, and the promotion of young people as a basis for the future. To this end, the status and development potential for specific space activities in Austria will be explored as well as objectives until the year 2020. The measures for their implementation will be defined in the following.

Vision and Objectives

"Austria Uses the Potential of Space-based Systems Effectively and Takes Part in Their Construction and Operation in a Coordinated Manner."

Objective 1
Recognized and Visible Partner

Based on the successes achieved so far in science, research, technology and applications, Austria will endeavor to take a position in the European Space Policy in a thematically focused fashion, corresponding to its economic power and its status as medium-sized space nation. Austria will seek to assume international leadership in selected areas and thus support the research, technology and innovation strategy of the "Innovation Leader" in the overall system of innovation policy in Austria. In joint space activities, Austrian actors will attempt to increasingly take over leading and coordinating roles.

Objective 2
Competitive Space Sector

Competitive Austrian companies will continue to be active along the entire industrial value chain in all segments of space activity. Particular attention will be paid to the potential of space applications in creating high quality jobs, and to technologies that enable a strategically advantageous positioning of Austrian companies in the international competitive environment. For Austria to position itself in the operational phases of the European space infrastructure programmes it will need to build on existing competencies of companies and research institutions.

Objective 3
Orientation Towards Application Potentials

The potential of space applications will be sustainably used for the commercialization of high-class products and services and for the improvement of the quality of life and the safety of Austrian citizens. Austrian public authorities will seek to use European space infrastructures.

Objective 4
Sustainable Bases for Space Activities

Austrian competencies and the high expertise in the field of fundamental and application-oriented space science and research will be further strengthened through capacity building, networking and internationalization. The fascination of science and space will be used to arouse the spirit of research and curiosity and the interest in natural sciences of young people in particular.

Objective 1
Being an Internationally Recognised and Visible Partner in Europe

"A Common European Political Agenda in the International Context"

Status and Potential

International cooperation has always been an important factor in the space field as capacity building for technically complex and expensive satellite infrastructure usually exceeds the financial capabilities of single countries. For small countries In particular, cooperation in space – on both bilateral and multilateral level – is essential.

The European Space Agency ESA, founded in 1975, has helped Europe achieve an international flagship position by coordinating European space activities and improving the competitiveness of its space industry. Since the Treaty of Lisbon, the European Union also has a competence in space while the member states continue to be able to conduct their national activities.

Activities of the EU include the promotion of scientificand technical progress, industrial competitiveness and the implementation of programmes in chosen policy areas. With the new shared competence, for the first time space is recognized as a separate policy area of the EU and placed in a global context.

Separation between the civil use of space, handled by ESA with a scientific and technological focus, and the military use of space, organized on a national basis, is characteristic for Europe. In recent years, Europe has been successful in the transition towards the commercial use of space, in which context it should be noted that the civilian use of satellite navigation and of the Copernicus system is paramount.

To avoid distortion of competition on the territory of the EU Austria's position is that a lively exchange of information should take place when developing national space laws in order to create comparable legal framework conditions for European space industry.

Prospects for 2020

The European space sector needs clear responsibility structures at the political level to meet international challenges. This structure must take advantage of the strengths of current actors.

ESA as the main space organisation in Europe should reinforce its relationship with the EU while keeping its strengths (project and programme management), which are characterised by its intergovernmental character. An appropriate distribution of tasks between the EU, the member states and ESA should be tailored to specific strengths and must avoid duplication and overlapping. The already well-established cooperation with EUMETSAT should be complemented and enriched by similar cooperation mechanisms with the European Defence Agency, EDA, and other international organisations. The entirety of European space players must define a coherent research, technology and procurement policy where adequate instruments, procedures and regulations exist.

Objective 2
Strengthening the Competitiveness of the Austrian Space Sector

"Space as a Driver for Economic Development"

Status and Potential

The space sector is institutionally dominated by and strongly based on public procurement and funding. Public investments provide infrastructures that enable downstream services and products from which a commercial market has emerged. According to the Association of the European Space Industry ASD-Eurospace, the total turnover of the European space industry increased from about four billion Euros in 2003 to around six billion Euros in 2010.

The Austrian space sector has its strengths in its strong and international specialization as well as in the innovative small and medium-sized enterprises that are very active in the use of satellite technology for space-based services. Due to the regional situation, topics such as civil protection and traffic telematics are of particular interest. This notwithstanding, ESA programmes provide the largest market for Austrian actors.

Companies see the high costs of qualification of technologies and processes as well as the long investment cycles as entry barriers to engagement in space. Both the financial and the technological risks in the space sector are considered to be significant. To overcome these challenges measures to increase Austrian value creation are sought, including the expansion of specific actions in the areas of basic research, research and development and start-ups. Cooperation, both bilateral and between industry and research, should be expanded. Concentration of expertise, a strong focus and specialization are desirable. Furthermore, the international network and visibility of Austrian actors should be promoted.

Prospects for 2020

Due to the predominance of the public sector in procurement, regulatory standards at national and international level are required in order to ensure the key concept of free and fair competition. Austrian actors have been successful along the entire industrial value chain of space. The structure of Austrian companies is mainly characterized by the following features:

- Recognized and visible international technological competence in selected areas
- Successful technology transfer through concentration on cross-cutting technologies
- Increased national and international network of companies
- Strong networking between industry and research in Austria
- Innovative strength of enterprises and research institutes allowing spin-ins and spin-offs

Figure 8 represents the positive trend of the international network of Austrian space industry in recent years. It shows that expansion to and positioning in the largest market (USA) and the fastest growing market (Asia) have been successful.

Objective 3
Orientation Towards Application Potentials of Satellite-based Data

"Going to Space to Benefit Earth – Austrian Space Activities Are Oriented Towards Application Potentials of Satellite-based Data"

Status and Potential

Space technology and its applications provide valuable contributions to meeting the social challenges of our time with a toolbox of innovative technologies, mainly through information advantage (e.g. Copernicus), through acquisition of information (e.g. the search and rescue function of Galileo), or through information security (e.g. the public regulated service of Galileo). These services are of enormous economic and security-related strategic interest and should increase the safety of citizens. Also, dynamic markets for satellite-based applications are evolving in Austria.

In the past, the space sector was strongly characterized by the upstream area. Through specific measures and promotion in recent years it has been possible to establish a thriving downstream sector. Through projects in the Austrian national space programme, services could be developed in the areas of navigation (e.g. fleet management, transport, agriculture, tourism, search and rescue), Earth observation (e.g. climate and climate change, soil moisture) and disaster and natural hazard management.

The establishment of Galileo and Copernicus will multiply the potential of these applications. A central task for Austrian space policy in the near future will be to take part not only in the development of the satellites but also in the operational phase of these systems. This will offer new development prospects for Austrian companies as application developers.

More and particularly precise data will allow a series of new applications in the downstream sector.

Prospects for 2020

Operational satellite systems offer new market opportunities and provide a basis for managing some major social issues of the future. Topics such as air pollution, biodiversity, natural hazards, and global climate change are of the utmost importance. Space applications are increasingly used for daily life, supporting and facilitating the lives of all people. As a consequence, space-based systems have become a matter of course. This also results in a modified image of the space sector in a social context – on the one hand the sector loses its high visibility in these areas, but on the other hand it becomes socially and technologically self-evident.

Objective 4
Providing the Bases for Austrian Space Activities

"Space Research Opens the Gateway to the Understanding of the Universe and the Earth"

Status and Potential

Space supports fundamental scientific research through the availability of direct measurements in space. In addition to the exploration of the universe and the Earth and the expertise created, satellite-based space science drives research, science and industry to technological excellence and innovation. Therefore, in Europe space science is often called the "backbone" of European space activities. Today, about 30 Austrian scientific institutions are significantly involved in international development and research activities in this high-technology field, with many of them having had and still having leading and coordinating functions in scientific space missions.

The space environment (e.g. vacuum, high reliability with minimal energy consumption) puts the highest demands on engineering and thus remains a challenging research area. Thus space science also furthers the education and training of future experts. Moreover, space and related topics stimulate the fascination for science, technology and mathematics amongst students.

Prospects for 2020

In the future, our knowledge of the Earth, the solar system, and fundamental questions of physics will multiply through the use of scientific satellites. A knowledge-based society requires well-trained scientists and technical experts, which makes it even more important to stimulate the enthusiasm of young people for science and technology at an early stage. Basic conditions for that are an appropriate educational system and desirable careers and in this respect space can make positive contributions. To use human potential effectively, supportive measures and attractive training opportunities are necessary to lead young people to space science. In Austria, a number of initiatives, facilities and networks exist for the purpose of raising interest in research, innovation and technology with space as the stimulus. The challenge is to support increased cross-linking and cooperation between organisations and networks that are engaged in the promotion of young talents in the STEM area (Science, Technology, Engineering, and Mathematics) from different perspectives.

8 International Network of Austrian Space Industry

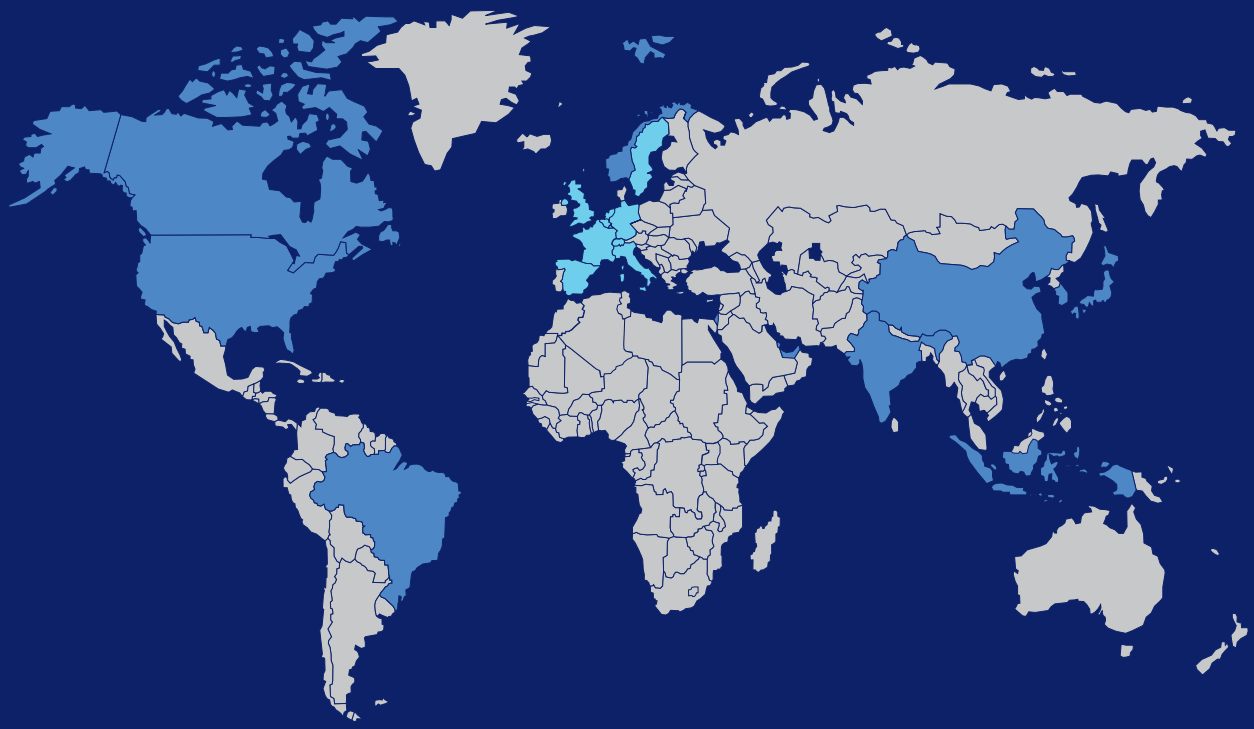


Figure 8: The development of customer relationships of Austrian space industry 2000 2011, Source: AUSTROSPACE

Status 2000
New customers since 2001

Canada	MDA
USA	BSS Intelsat JHU Northrop-Grumann SS/L World Bank UNO
Brasil	Telemar
Indonesia	PT Aneka Spring
India	ISRO
China	Alltech CAST SSMR
Japan	Hitachi JAXA MELCO Sumitomo
South Korea	Seongwoo
United Arab Emirates	Horizon
Bahrain	Noorsat
Israel	IAI Space Communication
Italy	TAS-I ESRIN Alta CGS Telespazio
Spain	CASA Mier Sener
France	Astrium-F Cryospace EUTELSAT TAS-F
Great Britain	Astrium-UK Avanti Inmersat Logica Serco SMT SSTL
Switzerland	RUAG-CH APCO Clemessy
Netherlands	Dutch Space ESTEC Terma
Belgium	EC EEA EIB
Germany	Astrium-D DLR ESOC Tesat Airbus Carl Zeiss Optronics Jena Optronik Kayser-Threde OHB
Norway	VeriSat
Sweden	RUAG-S
Denmark	Terma

Facts

Worldwide Cooperation

Austria is well connected at various levels such as, for example, in the context of scientific missions, industrial cooperation or cooperation in international programmes.

European Space Agency ESA

Since Austria's full accession as member in 1987, ESA is the most important instrument for Austria to implement its space policy. In the period 2002–2006, 85 percent of all expenditure made by the bmvit under its space agendas was allocated to ESA.

→ **www.esa.int/ESA**

EUMETSAT: European Organisation for the Exploitation of Meteorological Satellites

Since 1994 Austria has been a member of EUMETSAT, which has the mandate to develop, operate and use European operational meteorological satellites. This intergovernmental organisation provides the European contribution to the global system of meteorological satellites.

→ **www.eumetsat.int**

Galileo: European Satellite Navigation Programme

Together with the European Geostationary Navigation Overlay Service EGNOS, Galileo represents the European GNSS programme that will provide data for accurate positioning worldwide. The EU is responsible for the coordination of the implementation of Galileo whereas ESA is acting on behalf of the EU in terms of implementation. The European GNSS Agency, GSA, in Prague, deals with security accreditation, certification and market development.

→ **www.gsa.europa.eu**

Support for Developing Countries in the Use of Space Technologies

The UN Office for Outer Space Affairs, UNOOSA, acts as the secretariat of UNCOPUOS and has its headquarters in Vienna. Austria joined in 1959 and held the chair for over 35 years. Austria was significantly involved in the drafting of the five currently existing space treaties of the UN and has also ratified them.

→ **www.oosa.unvienna.org/oosa/COPUOS/copuos.html**

Space Technology for the Prevention and Management of Natural Disasters

Austria also participates in the United Nations Platform for Space-based Information for Disaster Management and Emergency Response UN-SPIDER. Since 2006, this programme has allowed all countries, in particular developing countries, to access current satellite data in case of natural disasters and thus supports better planning and execution of assistance operations.

→ **www.oosa.unvienna.org/oosa/en/unspider/index.html**

European Space Policy

The European Space Policy Institute, ESPI, was founded in 2002 by ESA and the Austrian Research Promotion Agency on behalf of bmvit. The institute provides decision-makers with an informed view on mid- to long-term issues relevant to Europe's space activities. The establishment of ESPI in Vienna strengthened the integration of Austria into European space networks and recognized Austria as a space site in the European framework.

→ **www.espi.or.at**

Space Law in Europe and Austria

The European Centre for Space Law, ECSL, founded by ESA, strengthens European cooperation and competence in space law issues. bmvit and the FFG support the Austrian National Point of Contact for Space Law NPOC at the University of Vienna. This contact point also acts independently in different areas of research, teaching and public relations in order to make the topic of space law accessible to a wider audience.

→ **www.spacelaw.at**

The Space Sector in Europe

Satellite communications is the most commercially oriented and important satellite-based application and has an enormous impact on daily life. It covers 60% of all application activities in Europe. The worldwide turnover of the industry in the associated ground segment is 20 billion Euros whereas downstream services bring about 40 billion Euros. 40% of the space segment is controlled by European companies. Approximately 50% of the total turnover of the European space industry (ca. 6 billion Euros) comes from satellite-based applications in the fields of satellite communications, Earth observation and navigation.[2]

Sales figures in the areas of satellite navigation and Earth observation are slightly smaller but growing. The growth rate of the GNSS market p.a. was about 30% in recent years and 6–7% of the gross domestic product of developed countries depend on GNSS. The annual global turnover of

GNSS should reach around 240 billion Euros by 2020, with Galileo/EGNOS alone bringing about 60–90 billion Euros of direct benefits to society from 2010 to 2027.[3] Socially useful applications in the field of navigation include navigation support for disabled people, tourism information systems as well as search and rescue emergency services.

Austrian Earth Observation Data Centre for Water Resources

Austrian companies and research institutions are leading innovators in processing and preparing Earth observation data for the detection of water resources. Therefore, an Earth observation data centre for water resources had been established. The main goal of this centre will be the provision of high-quality IT infrastructure for operational real-time processing and reprocessing of continental to global data products, which are important for the quantitative detection of water resources (soil moisture, snow, glaciers, water areas, land cover).

The new strategy of Copernicus and the ESA initiative concerning national "Sentinel Collaborative Ground Segment Centres" are decisive for the creation of such a centre in Austria. This development is seen as an opportunity for the federation and consolidation of Austrian core competencies in space-related technology sectors. The main goals are the creation of a "lever" for global space-related services from Austria as well as the economic stimulation of Austrian space industry and the use of know-how for a global problem of the 21st century water resources.

Europe Invests in Space Systems for the Benefit of Mankind

Europe is building large space infrastructures and will operate them in the upcoming years. The mainly commercially driven telecommunication satellites are examples of this infrastructure. Navigation and operational Earth observation are the next large-scale systems, the topics of the present and near future. The use of the generated data will offer huge markets for a variety of applications.

The benefits of Earth observation for Europe – Global Monitoring for Environment and Security

The Copernicus initiative (initially GMES), was initiated in 1998 by the EU and ESA. It collects data generated from remote sensing satellites (Sentinels), and in situ stations in order to generate a comprehensive picture of the state of the Earth. Thus, Copernicus will be one of the most comprehensive systems worldwide for global Earth monitoring and will provide important environmental and safety-related geoinformation.

Copernicus will improve the safety of citizens in many ways: through weather forecasts, analysis of population flows, support of search and rescue emergency services, high-precision field mapping, maritime surveillance, environmental protection, and urban and regional planning, to name just a few applications. According to a report by the European Space Policy Institute ESPI the socio-economic benefit of Copernicus can be estimated at 167 billion Euros for the period 2006 to 2030.[4] This implies that for one Euro invested from tax money to Copernicus a return of 10 Euros of public services for Europe's citizens is expected (economic and social benefits).

Knowing what is happening in space – Space Situational Awareness

In addition to several natural hazards from space, such as cosmic rays, solar winds, asteroids, meteorites and comets, the Earth is threatened by another man-made problem: space debris. Space infrastructures that have become indispensable to our modern society must be protected from these dangers. Therefore, ESA started the Space Situational Awareness programme, SSA, in 2009 in order to enable comprehensive monitoring and cataloguing of objects in space as well as to investigate the effects of space weather on the Earth.

To date, Austria has been successful especially in the areas of space weather and the establishment of data centres. Additional opportunities will be offered for Austrian industry and research in the coming years, in the area of instrument development (magnetometers). Furthermore, international service level agreements with Austrian institutions in the frame of SSA services will present an interesting economic perspective.

Austrian Universities and Research Institutes in Leading Positions in International Space Missions

Since the late 1980s, Austria's integration into ESA has afforded an important possibility for international networking. In the last ten years, this framework has been broadened through participation in science missions of various space agencies such as NASA, DLR, CNSA, CNES, and JAXA. This has enabled continuous access to international research infrastructure.

Current Education and Training Opportunities in the Area of Space in Austria

In Austria, numerous initiatives exist in the area of promoting young talents for the STEM area that use the topic of space as a stimulus as well as various initiatives that introduce space-related topics to a broad audience. In the educational area, in recent decades many activities have been successfully established at universities:

- The University of Vienna offers a major course in astronomy and astrophysics with strong involvement in space astronomical research. Furthermore, the study of astrophysics is offered at the universities of Graz and Innsbruck.

- Based on a successful postgraduate university course ("Space Sciences"), two masters programmes have been established in Graz, which cover space applications (navigation, Earth observation, telecommunication) on the one hand and essential components of space sciences on the other.
- Since 1994, a symposium has been offered in Graz, jointly organized by the UN, ESA and Austria, for participants from developing countries. It provides information on current issues and developments in space.
- A masters programme in "Aerospace Engineering" is offered by the University of Applied Sciences in Wiener Neustadt.

Educational opportunities in space law are becoming increasingly important and in recent years some universities (Vienna, Graz, Innsbruck) have offered seminars and courses. Teaching at the universities greatly benefits from the institutions located in Austria, especially ESPI and UNOOSA in Vienna. Austrian students also have the chance to participate in the European Summer School on Space Law and Space Policy, organized by the ECSL.

With the Summer School in Alpbach, jointly organized by the Aeronautics and Space Agency of the FFG and ESA for more than 35 years, Austria has set a European standard in training activities. It has an internationally recognized reputation and offers a training opportunity for the European space sector. In general, as part of its educational tasks the Aeronautics and Space Agency of the FFG supports young researchers in their career paths.

Some institutes of universities strongly promote the topic of space through public relations and events on current research results. The Austrian Space Forum is a network of space specialists and interested people that conveys the fascination of space to the public through lectures, exhibitions, shows and consultancies. Moreover, the circle of interested parties has been constantly extended in recent years through numerous professional events of the FFG as well as an annual Austrian Space Day.

2 ASD-EUROSPACE: Facts and figures;
The European Space Industry in 2010; 2011

3 Report from the Commission to the European Parliament and the Council:
Mid-term review of the European satellite radio navigation programmes

4 European Space Policy Institute:
The Socio-Economic Benefits of GMES, Vienna 2011

Guidelines and Policies

Guidelines

The following principles provide orientation for Austrian positions in negotiations on the European space policy.

1. European Space Policy and International Space Activities

For Austria, space will continue to be a European and, to a large extent, international task. Therefore, the target-oriented and effective organisation of collaboration is of crucial importance. Austria will consider European and international development and actively engage in the creation of a European space policy. Austria will continue to be an active partner at international level to ensure that national expertise and excellence can find possibilities for participation in international projects. The advice and formulation of these positions will be through coordination of the bmvit in the inter-ministerial group "Austrian Space Policy".

2. Competitive Austrian Space Sector

The desired structure of Austrian industry is supported and developed by an appropriate policy in this area: the implementation of new technologies, products and processes is supported through participation in and funding by appropriate technology programmes at national (Austrian space programme ASAP) and international level (in particular ESA technology programmes but increasingly also EU research and innovation programmes). Cooperation between science and industry supports the sustainable development of pioneering developments in the long term.

Predictability and sustainability will be improved through the process of harmonizing technology led by ESA as well as by the implementation of technology development and technology roadmaps. The economic importance of the Austrian space sector will be further increased, in terms of both revenue and employees and their qualifications. The base of the space sector can also be expanded by the sustainable integration of new companies that were previously not active in the sector.

3. European Industrial Policy in the Space Sector

The bmvit – in consultation with relevant actors – is actively involved in discussions on the further development of industrial policy in the international context. Austria will continue to support the development of a competitive industrial structure along the entire value chain. To ensure proper industrial competition, appropriate regulations have to be established that guarantee free and fair access to this competition at all levels of the value chain.

4. Optimal Use of European Space Infrastructure by Austrian Actors

The aim is to optimally use satellite-based technologies for Austrian citizens as well as for governmental administration, economy and science. Cooperation between the relevant departments of the ministries takes place within the framework of the inter-ministerial group "Austrian space policy". The definition and federation of user demands will be supported and promoted in concrete projects through the Austrian national space programme or other suitable instruments.

With the support of scientific space missions, Austria contributes to the construction of the international research infrastructure.

Organisation and Cooperation

The following measures will lead to the clear, transparent and efficient organisation and cooperation of Austrian actors that are involved and affected by space activities:

1. Improved Coordination and Cooperation
The inter-ministerial group "Austrian Space Policy" with representatives of all federal ministries and agencies coordinates Austrian industrial, scientific and foreign policy positions (also in terms of the office of the UN in Vienna) in all matters of Austrian space policy. It is a central strategic platform for opinion-forming in Austria, as well as a starting point for discussion on positioning space activities within the departmental agendas. The implementation of the space strategy is carried out by the Aeronautics and Space Agency of the FFG.

2. Monitoring and Evaluation
To evaluate the effectiveness of the use of financial resources, reporting duties will be implemented in the frame of theme monitoring, which is currently under development, as well as through the use of the principles of result-based impact assessment. An evaluation on the impact of the measures takes place at intervals of 5–7 years.

3. Austrian Programmatic Long-Term Planning
Long-term programmatic planning for space activities in the areas of research and development, operation and use divided by national funding and contributions to European programmes (ESA, EUMETSAT, EU), provides a strategic framework. Since 2012 this framework has provided support to the financial planning of the bmvit for the preparation of the ESA Council Meetings at Ministerial Level.

4. Implementation of International Space Law
National implementation of the international legal framework in the field of space has been continued since the publication of the federal law on the authorisation of space activities and the establishment of a space register (Austrian Outer Space Act), on 27 December 2011 in the federal law gazette I No. 132/2011.[5] A national registry will be established at the bmvit, in which all Austrian space objects will be entered. Furthermore, an ordinance will be issued by the bmvit for more detailed provisions defined in the act. In this context, questions of international frequency coordination in the International Telecommunication Union ITU as well as at European level are of particular importance.

5. Regulatory Support for the Space Sector in Austria
The application-oriented use of space technology can at the same time serve as a breeding ground for the development of high-quality data products and services based thereon, and thus become an economic factor. New fields of action are being developed in this area, in particular also for SMEs with high innovation potential. In addition to satellite communication, satellite-based Earth observation and navigation – as well as their link to integrated applications – have the potential to open up new user segments and markets. Appropriate regulatory frameworks are central for efficient use apart from innovative methods for data analysis and acquisition of information. This includes an open data policy, which enables as simple as possible, cost-efficient and reliable access to satellite-based data, as well as the establishment of appropriate technical and quality standards.

5 ww.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2011_I_132/BGBLA_2011_I_132.pdf

Orientation of bmvit Space Activities

The following measures lead to a targeted programmatic orientation of bmvit space activities:

1. Austrian Contributions to European Programmes

Austria will seek to provide an appropriate financial contribution according to its economic power, even in times of economic crisis and limited budgets. Financial participation will be based on three pillars: national contributions to intergovernmental programmes, in particular ESA, but also EUMETSAT, contributions that are covered by the EU budget, and the national Austrian space programme ASAP (Austrian Space Applications Programme) which is enabling and complementary to European and international programmes.

2. Programmatic Focus of Austria in the Framework of the European Space Policy

Austria has declared itself in favour of the application-oriented approach of the European space policy. This means that the development of space-based systems has to be oriented primarily towards application potentials of obtained data, be it in the different scientific domains or in the areas of telecommunication, Earth observation, climate research, meteorology, or navigation.

The fundamentals of space, such as space sciences and technology developments, launcher systems and contributions to the international space station, and especially the development of future space infrastructure and the further development of existing space components, should be done by interested states in the frame of ESA. For Austria, the possibility of balanced participation in Europe according to existing capacities is an argument for the support of ESA in designing its future role. The successful ongoing operation and the demand-oriented definition of the development of the two major projects Galileo and Copernicus, as well as the full use of their potential in terms of applications, will require the full attention of the EU in the coming years. When allocating work between ESA and EU programmes national freedom of decision will have to be considered, especially in financial terms.

3. Austrian Priorities in the Frame of ESA

In preparing for the coming ESA Council Meetings at Ministerial Level, the subscription policy will be aligned as before according to the principles of benefit and demand. Criteria for selection are the leverage effect on the targeted broadening of companies and research institutions active with ESA, taking into account also the space activities of EU and EUMETSAT, as well as the leverage effect with regard to the commercial market. For the new commitments, ongoing activities have priority with respect to the start of new activities. This means that priority will be given to programmes where investments have been already made and positions of Austrian industry, science and research could be successfully achieved. Examples are the present focus on the area of Earth observation, technology development and telecommunication. The involvement of stakeholders from science, research and industry in the preparations will be done by the FFG, which submits to the bmvit analyses of potential with regard to planned ESA programmes

4. Austrian Priorities in the Frame of the Planned EU Programmes

As part of the negotiations for the medium-term financial framework of the EU and the planned space activities, Austria will continue to support the active involvement of medium-sized and small member states in the development, construction, and operation of satellite systems. This means that Austria will not only proportionally provide financial resources for this pan-European infrastructure, but also plans to be actively involved through contracts for the Austrian industry.

5. Further Development of the Austrian Space Programme

Together with programme management, the bmvit will further develop and expand the national Austrian Space Applications Programme ASAP. Since 2002, the programme has reached a unique position in terms of national space promotion and shows a good relationship between effort and the benefits of funding. This ensures that appropriate technological contributions can be provided to international and European programmes based on national capabilities and competences. Excellence at the top and broadening of the base should be achieved through national funding. In particular, ideas and technologies that contribute to the strategically advantageous position of Austrian companies in international competition are to be funded. ASAP should remain characterized by the onward support of international competitiveness through its lever effect, and therefore ensure national priorities in the international context.

6. Promotion of the Applications of Satellite-based Technologies

To ensure the diffusion of services that are based on space infrastructure and their optimal use for public purposes,

efforts will be made by the bmvit together with the FFG and relevant stakeholders to promote regional and national setting of priorities (technological, scientific and conceptual preparation activities). In doing so, the potential of the applications of satellite-based technologies will be identified in particular for responsibilities of the bmvit in the following areas: mobility, energy, information and communication technologies, production, safety and human resources, innovative procurement, and technology transfer. The Austrian base of this sector should be expanded by supporting young companies, especially start-ups and spin-offs, in application-oriented research areas.

7. Austrian Participation in the Definition of the Space Infrastructures

In the medium term, Austrian involvement in the definition of space infrastructures should increase. This should be done by: bundling sectoral policies in the institutional environment and active representation of Austrian interests in the preparatory and operational programmes of the EU, ESA, the EU agencies and other relevant international organisations. Coverage of the operating expenditure should be achieved by involving potential users in full accordance with the subsidiarity principle.

8. Austria's Active Contribution to the Operating Phases of Space Infrastructures

Austrian participation in future operating phases should be demand-driven. The bmvit together with relevant stakeholders will investigate the need for the construction and operation of national infrastructures, for example in the establishment of national structures for the utilisation of the public regulated service of Galileo and in the area of the first operational activities of the European Earth observation programme Copernicus. Therefore, the extent to which existing instruments can support the operation of space-related infrastructures should be investigated.

For the further concentration and focus of Austrian space activities, federation of know-how will be promoted through the incentives offered by the use of common infrastructure. To intensify the collaboration of Austrian stakeholders in space activities, the possibility of constructing and operating shared infrastructure, funded by the Austrian space programme, should be investigated. The first topics could be Earth observation in the frame of Copernicus and satellite telecommunication.

Based on existing competencies in Austrian companies and research institutions the establishment of an Earth observation data centre for water resources can be considered as a first step in the orientation of the operational phase of Copernicus. Other approaches for clustering could be investigated, based on the know-how and test infrastructure in industry and research in Austria on construction, testing and qualification of space-qualified hardware and software.

9. Austrian Priorities in the Area of Bilateral Cooperation

Austria's international cooperation takes place primarily through participation in European programmes, especially ESA programmes, through which cooperation is possible worldwide. In addition, cooperation at intergovernmental level is possible, in particular in the area of transnational applications with Austrian neighboring countries based on shared conditions such as, for example, cooperation in the Alps. Also bilateral cooperation based, for instance, on common scientific interests with international partners is possible.

10. Austrian Priorities in Multilateral Cooperation in the Framework of the United Nations

The political commitment of Austria to international cooperation in multilateral organisations in the space sector, in particular for the peaceful uses of outer space within the framework of the UN outer space committee UNCOPUOS, will be maintained. As a consequence of the privatisation and commercialisation of space activities, information exchange on national space laws has become even more important. It ensures that the activities of private and commercial actors are also performed in accordance with public international law and in compliance with international technical standards. A growing issue is the avoidance of space debris to ensure the long-term use of outer space. Optimisation of Austrian UN outer space activities will ideally combine Austrian scientific-technological and foreign policy objectives.

11. Austria's Contribution to the European Space Policy

The bmvit continues to support the European Space Policy Institute, ESPI, a European "think tank" for space policy and a central European forum for discussion of strategic issues of European space activities. With the establishment of ESPI in 2003 in Vienna, the integration of Austria into European space networks has been significantly strengthened.

12. Supporting the Excellent Basic Space Sciences

Support of current competence, and further development or establishment of internationally recognized capabilities in basic and applied research in the space domain will continue to be possible. This involvement is mainly secured through participation in the scientifically oriented programmes of ESA. The national space programme ASAP enables cooperation at bilateral and multilateral levels. This applies both to the development of scientific instruments for European and international space missions, as well as the acquisition of new scientific findings in the frame of space missions. International excellence and visibility is ensured by the international peer review processes of ESA, which are special expert review processes for assuring quality.

The FFG will evaluate possible technical/scientific Austrian participation in research of the solar system/exploration,

in the course of preparations for the ESA Council Meetings at Ministerial Level. It will focus on projects with high scientific value and technological potential for applications in other areas, and will consider the absorption capacity of Austrian companies and research institutions in this area. In this context, Austria will try to ensure that preparatory technology activities within the frame of ESA are in the foreground.

13. Contribution of Space Research and Space to the Education and Training of Austrian Experts of the Future

The requirements of Austrian space actors in terms of human resource capabilities as well as their use of already existing capabilities will be analysed in order to increase Austrian added value. Consideration will be given to further supporting the development of training initiatives, teacher training and courses in the area of space exploration/space and strengthening the already initiated linkage with the interdisciplinary topic of development of human potential.

Ideally, the education initiatives offered by ESA[6] could be better integrated into existing activities[7] to achieve visibility and leverage. According to the strategy on human potential development, space should contribute by being linked to national structures in the educational area and the innovation system. The aim is to reach as many people as possible and to motivate committed teachers to increasingly use the topic and materials (e. g. ESA materials for schools) in their courses, to seek the contribution of experts in the training of teachers, to prepare the topic for target groups such as students and provide internships for students, to mobilise (space) industries to participate in projects with educational institutions, and much more. It would seem useful to encourage structural cooperation between different organisations and networks that deal with the issue of bringing young talents to STEM in order to ensure that space is playing the best possible role.

6 www.esa.int/SPECIALS/Education

7 www.ffg.at/talente-der-foerderschwerpunkt-des-bmvit

Appendix

Glossary and Abbreviations

AIT	Austrian Institute of Technology (AIT), Austria's largest non-university research organisation specialized in central infrastructure issues
ALR	Aeronautics and Space Agency of the Austrian Research Promotion Agency (FFG)
ASAP	Austrian Space Applications Programme
AUSTROSPACE	Association of Austrian Space Industries
bmvit	Federal Ministry for Transport, Innovation and Technology
BRITE Mission	Bright Star Target Explorer BRITE Constellation, the first satellites that were developed, built and maintained in Austria are part of this constellation
CNES	Centre national d'études spatiales French space agency
CNSA	China National Space Administration
Copernicus	Global monitoring of environment and security (in the past called GMES); initiative founded in 1998 by EU and ESA. It collects data from remote sensing satellites, space and ground stations in order to create a comprehensive picture of the state of the Earth
Copernicus-Sentinels	The five space missions (satellites) that are currently being developed by ESA specifically for Copernicus are called "Sentinels". These missions include radar and spectral recordings for land observation and monitoring of the oceans and atmosphere
DLR	German Aerospace Centre
ECSL	European Centre for Space Law
EDA	European Defence Agency
EGNOS	European Geostationary Navigation Overlay Service, a European differential global positioning system as augmentation system for satellite navigation. The European GNSS programme, a joint project of ESA, EU and the European air traffic control EUROCONTROL; is considered as Europe's entry into satellite navigation and as a preliminary stage of the European navigation system Galileo
ESA	European Space Agency; has its headquarters in Paris and was founded in 1975 for better coordination of European space activities
ESPI	European Space Policy Institute; first European think tank for space
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites; founded in 1986, based in Darmstadt, intergovernmental organisation of 25 European states
EUROSPACE	The Association of the European Space Industry; non-profit organisation, founded in 1961, based in Paris. The member organisations of EUROSPACE represent 90% of the total turnover of the European space industry
FFG	Austrian Research Promotion Agency
Galileo	Future European satellite navigation system. It should deliver data for accurate positioning worldwide and is similar in structure to the US NAVSTAR-GPS and the Russian GLONASS system
GLONASS	Global satellite navigation system that is operated and financed by the Ministry of Defence of the Russian Federation
GNSS	Global Navigation Satellite System; to date available systems are the American GPS und the Russian GLONASS system.
GPS	Global Positioning System; system for positioning and timing, developed in the 1970s by the US Department of Defense
IAA	International Academy of Astronautics; non-governmental organisation, international community of experts committed to expanding the frontiers of space
IAC	International Astronautical Congress
IAF	International Astronautical Federation; worldwide federation of organisations that are active in the space sector, organizes the annual IAC together with IAA and IISL
IGS	International GNSS service
IISL	International Institute of Space Law
ILA	International Law Association; non-profit and non-governmental international organisation that promotes the study, clarification and development of international law

ISU	International Space University; based in Strasbourg
IWF	Institute for space research of the Austrian Academy of Sciences
NASA	National Aeronautics and Space Administration, USA
NPOC-ECSL	National Point of Contact for Space Law in Austria (NPOC Austria) of the ECSL
ÖAW	Austrian Academy of Sciences
ÖGAA (ÖGA)	Austrian society for astronomy and astrophysics, an association of important astronomical institutions in Austria that aims at promoting and distributing astronomy and astrophysics in research, teaching and public, established in 2002
ÖWF	Austrian space forum; national network for space experts and interested people
TUGSAT-1	BRITE- Austria, Austrian nano-satellite, part of the BRITE mission (Technical University of Graz)
UniBRITE	Austrian nano-satellite purchased from the Space Flight Laboratory of the University of Toronto, Canada (Institute for Astronomy of the University of Vienna), part of the BRITE mission
UN-COPUOS	United Nations Committee on the Peaceful Uses of Outer Space; with the "Scientific and Technical Subcommittee" and the "Legal Subcommittee"
UN-OOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
ZAMG	Austrian Central Institution for Meteorology and Geodynamics

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8 Text researchers and text editors: Johannes Steiner, Andrea Kleinsasser on the basis of the consultation process among stakeholder of the Austrian space community

9 AUSTROSPACE aims at focusing on comprehensive information about Austrian space activities and the representation of the common interests of members vis-á-vis Austrian authorities and international organisations. www.austrospace.at

Member Organisations of the Inter-Ministerial Group "Austrian Space Policy"

Due to its responsibilities for space and programmes, since the beginning of 2004 the bmvit has organised inter-ministerial meetings to coordinate Austrian contributions to European space policy. The area of responsibility of the group was further enlarged to coordinate Austrian space policy and includes the topics European Space Policy, European Space Agency ESA, Galileo, the European Earth observation programme Copernicus, EUMETSAT, space exploration, space and security, as well as other evolving topics.

The aim of the process is

- Early notification and involvement of all national decision-makers to formulate an Austrian position based on a broad consensus,
- Optimal coordination among various departments in order to best represent the interests of Austrian industry and science,
- An Austrian discussion on strategic and political issues of space, technologies and their applications, and early involvement of users of these technologies.

The group ensures a continuous information flow and an in-depth substantive discussion on various aspects of space policy and programmes with all departments and agencies that are concerned by space activities. Currently, these are:

BEV	Federal Office of Metrology and Surveying
BKA	Federal Chancellery
BMeiA	Federal Ministry for European and International Affairs
BMeiA	Austrian Permanent Representation to the European Union, Brussels
BMF	Federal Ministry of Finance
BMI	Federal Ministry of the Interior
BMJ	Federal Ministry of Justice
BMLFUW	Federal Ministry of Agriculture and Forestry, Environment and Water Management
BMLVS	Federal Ministry of Defence and Sports
bmvit	Federal Ministry for Transport, Innovation and Technology
BMWF[10]	Federal Ministry for Science and Research
BMWFJ[11]	Federal Ministry of Economy, Family and Youth
FFG	Austrian Research Promotion Agency
FFG-ALR	Aeronautics and Space Agency
UBA	Federal Environmental Agency
WKO	Austrian Chamber of Commerce
ZAMG	Austrian Central Institution for Meteorology and Geodynamics

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