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Final Report

Ö-SPACE

Austrian Space Industry and Research: Database of Market Participants

Client

Republic of Austria
Federal Ministry for Transport, Innovation and Technology

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0 Executive Summary

The study entitled "Austria's Space Industry and Research: Database of Market Participants," or Ö-SPACE for short, was commissioned by the Federal Ministry for Transport, Innovation and Technology (German: Bundesministerium für Verkehr, Innovation und Technologie, BMVIT), Division of Innovation/Technology. The aim of Ö-SPACE is to survey and describe participants in Austria's space industry and research market. The survey was conducted between March 2010 and February 2011.

In the course of the surveys carried out for **Ö-SPACE, 114 Austrian organisations** active in the space sector were identified. Of these, 74 took part in the survey, yielding a response rate of 65%.

Extrapolated for all the organisations responding that they were active in the space sector, this amounted to a total volume of 125 M€ and a total employee headcount of 934 for the Austrian space industry and research community. All of the following statements refer to the 44 companies and 30 research institutions from which completed questionnaires were received.

In 2009, the **total volume** of the surveyed Austrian organisations in the space sector was 86.3 M€. Of this figure, 83% or 71.2 M€, is attributed to the space industry and 17% or 15.1 M€, to research institutes.

The geographical concentrations of the space industry and space research are in Vienna and Styria. 27 organisations are based in Vienna (15 companies, 12 research institutes) and 15 in Styria (5 companies, 10 research institutes). Vienna has the largest space turnover (45.9 M€) and at 291, the largest number of space sector employees. The turnover and/or budget of the research institutes is, at 1.5 M€, relatively small compared to the 11.3 M€ recorded in Styria. There are companies and/or research institutes in the space sector present in **nearly every Province**, with the only exception being Burgenland.

The Austrian space industry and research community is quite **heterogeneous** in nature. In the industry, 15% of the companies (6 organisations) are responsible for 80% of the total volume of 71.2 M€. With regard to the research institutes, approximately one fourth of the organisations (26%; 6 organisations) account for 79% of the turnover and/or budget.

This reflects the **structure of the Austrian market** in which there are a small few "big players" and a relatively large number of SME's (small and medium enterprises). Of the 44 companies studied, 43% are very small (< 10 employees, ≤2 M€ in turnover) and 20% small (<50 employees, ≤10 M€ in turnover). Seven companies (16%) are medium-sized (<250 employees, ≤50 M€ in turnover) and 20% large (≥250 employees). In terms of the research organisations, around three-fourths (77%, 23 institutes) fall into the "small" category and one institute (3%) falls into the category of very small organisations. Six institutes (20%) are classified as medium-sized.

49% of the organisations are research institutions, 46% service providers, 31% manufacturing operations and 23% software manufacturers (multiple mentions). Of the 86.3 M€ in total volume, 14.4 M€ are represented by research institutions, 20.5 M€ by service providers, 44.3 M€ by manufacturing operations and 7.1 M€ by software manufacturers.

For 21% of the organisations (13 mentions), spaceflight represents their core business (75% or greater share of total turnover). For nine organisations (15%), spaceflight is their primary activity (50%-75% of turnover) and for three organisations (5%), spaceflight is one field of activity amongst several (25%-50% of turnover). The majority of the companies and research institutions, i.e. 35 (59%) however fall under the category of "also active in spaceflight." They generate less than 25% of their turnover in the space segment.

Focuses of Austrian **competences**, and thus important fields of research, traditionally lie in the field of spacecraft and carrier systems (e.g. mechanics, lightweight construction, material research, cryogen technology), instruments and payloads (e.g. electronic control systems, embedded systems, sensor systems) and satellite-based applications (remote sensing, navigation, satellite communication).

Segment rankings by size vary depending on the approach used. Ranked by number of organisations, segment 5 (satellite-based applications) is the largest, followed by segment 1 (spacecraft) and segment 4 (instruments and payloads). In terms of employees (EMP) as well, segment 5 is the largest (175 EMP), segment 1 is the second-largest (106 EMP) and segment 3 (ground segment, 95 EMP) is the third-largest. Based on total turnover volume,

segment 1 (18.5 M€) is the largest, followed by segment 2 (18.1 M€) and segment 5 (16.7 M€).
The space industry is **export-oriented**, with nearly half of the companies (47%) exporting between 80% and 100% of their products. Europe is by far the largest export market for the Austrian space industry with a share of 54% based on the number of mentions. Asia (17%) and North America (15%) are also relevant markets. The most important customers for the Austrian space industry are the ESA (15 mentions) and EADS Astrium (10 mentions).

The spectrum of **products and services** offered by the space industry and research segment is quite extensive. Examples of products run the gamut from fuel lines for the Ariane 5 launch vehicle, cryogenic tank systems, communications hardware, carrier monitoring systems, ground segment systems, ground station, GPS receivers for high-precision positioning of satellites, earth observation, satellite navigation and communication all the way to software for communication protocols and data communication technology.

With regard to **market entry barriers**, the companies mentioned long investment cycles and long lead times with funding and procurement programmes. Both the financial and technological risks in the space sector were described as obstacles. In the case of ESA procurement programmes, the complex access structures were also perceived as a barrier.

74% (476 persons) of all persons working in the space industry and research segment work in **research and developing**, with 5 companies employing 52% of all R&D personnel. In 2009, 1037 publications were released and 17 patents obtained. Proportionately speaking, satellite-based applications are most significantly represented in terms of publications.

56 of the 74 (76%) organisations in the Austrian space industry and research segment cooperate with other organisations. Universities enter into **cooperative relationships** just as frequently as do companies. In addition to universities, primarily national and international research institutions and space organisations (DLR, ESA, NASA) are sought after as cooperation partners. 45% of the organisations express an interest in developing bilateral cooperative partnerships with Germany and 18% would welcome a strengthening of bilateral relationships with the USA and France, respectively. Moreover, 83% of the organisations seek stronger cooperation with the ESA and 38% with NASA.

56% of the companies and 69% of the research institutions are interested in future collaborations in research & development. Thematic focuses in this regard are above all on satellite-based applications and in the field of materials and drive propulsion.

Financing is at the top of the list of **impediments to cooperation**. The absence of a network and/or a lack of willingness to cooperate and competitive thinking are the second most frequent mention.

Technology Transfer: Overall, technologies from almost half of the organisations (42%) are already being used outside of the space industry and research sector. The most important sectors here are surveying, the aerospace sector, the automotive industry, medical technology, plant engineering and security and the environment. With regard to transferred technologies, the number one type mentioned is satellite-based applications, followed by propulsion technologies and developments in the field of new materials.

According to the organisations, funding measures are needed in the fields of pure research, research and development in general, in young companies and new technologies in order to **increase added value and competiveness.** In particular, more regular and better endowed ASAP calls as well as intensive participation in ESA programmes were mentioned. Increased international networking and visibility was also listed as a measure to enhance value creations as were improvement of training and further training, competence bundling and niche concentration.

Outlook: The study at hand will be accessible to the public from summer 2011 on the BMVIT homepage. This study is one of the foundations for BMVIT's space strategy. As a next step, BMVIT plans to publish a competence atlas for Austria's space industry and research.

1 Introduction

The study entitled "Austrian Space Industry and Research: Database of Market Participants," or Ö-SPACE for short, was commissioned by the Federal Ministry for Transport, Innovation and Technology (German: Bundesministerium für Verkehr, Innovation und Technologie, BMVIT), Division of Innovation/Technology. The aim of Ö-SPACE is to assess and describe participants in Austria's space industry and research market.

Ö-SPACE provides a current competence atlas for the Austrian research institutions and companies in the space sector and analyses their potential for innovation and cooperation. This study forms the basis for future activities and strategic measures by the client. Ö-SPACE began in March 2010 and concluded in February 2011.

In this final report on the Ö-SPACE study, chapter 1 describes the context of the study, i.e. objectives, scope limitations, methodology and execution. Next, in chapter 2, the basic results of the survey are presented. Following a general overview of the industry in Austria, the competences of the Austrian research institutions and companies in the space sector are summarised and individual segments analysed. Customer and supplier relationships are discussed and the value creation chain for the various segments vis-à-vis vertical integration and position in the product hierarchy. Another section is devoted to research and development in Austria. Existing partnerships in R&D, education, production and certification are covered. Technology transfer from space travel to other industry is another topic of importance. Lastly, the steps that could be taken, from the participants' perspective, to increase Austrian added value and competitiveness are analysed.
A forecast is given in chapter 3.

The study team thanks all participants from the fields of industry and research, the Aerospace Agency (German: Agentur für Luft- und Raumfahrt, ALR) and the Federal Ministry for Transport, Innovation and Technology (BMVIT) for their assistance.

1.1 Objectives

Space technologies and their applications represent dynamic growth markets worldwide and are of strategic importance for Austria as well. Austria has successfully established itself in the field of space technology, mainly since joining the ESA in 1987. The strategic orientation of Austria's space engagement was established in 2000 with the Austrian Space Plan. The plan aims to sustainably position and make Austrian science and industry competitive internationally. Promoting a "critical mass" of operating capacities and excellence in R&D and developing a complex supply chain in a very specific field serve to support this objective. These are crucial indicators for ensuring sustainable growth and excellence in Austria's space research and industry.

The aim of Ö-SPACE is to survey and describe participants in Austria's space industry and research. Ö-SPACE provides a current competence atlas of Austrian research institutions and companies in the space sector and analyses the potential for innovation and cooperation as a basis for future activities. The study results and database enable the client to inform companies and research institutions about market perspectives, support them in strategic considerations and where applicable to further develop Austria's space strategy. Ö-SPACE can also contribute to the strategic further development of the Association of Austrian Space Industries (AUSTROSPACE).

Therefore, Ö-SPACE focuses on:

- A full sample survey of market participants in the space industry
- Identifying fields of activity and competences
- An analysis of the potential for innovation and cooperation

This makes it possible to shed light on the Austrian value chains, points out potential hubs for future cooperation and opportunities for (new) market participants, thus providing indications for promotional policy measures.

1.2 Scope Limitations

Ö-SPACE is focused on comprehensive, current presentation of the Austrian companies and research institutions in the space industry including the applications of space technologies and research. Consequently, the survey is limited to companies and university and extramural research institutions and technology-based products, services and research

fields. As such, in agreement with the Client, organisations engaging in following fields of activity are excluded from the study:

- General pure research (e.g. astrophysics, astronomy, microbiology, medicine, etc.)
- Personnel procurement for space companies
- Transport/shipping companies for the transport of spacecraft/parts
- Business, organisation and management consulting
- Trade

International benchmarks are often considered when studying in technology markets. Due to resource constraints, international benchmarks are not dealt with in Ö-SPACE.

1.3 Methodology

The methodology applied to the Ö-SPACE project can be described as follows:

- Dataset research
- Identifying relevant companies
- Preparing the questionnaire
- Conducting the survey
- Analysis
- Conclusions/forecast

Due to the large number of companies and research institutes identified, the study team, in agreement with the client, decided to conduct the survey in the form of a written questionnaire, supplemented by numerous telephone conversations.

The participants were asked to respond to questions on the following topics:

- Key figures
- Chief products/services/research fields
- Business or scientific field
- Research and development activities
- Cooperative partnerships
- Technology transfer

In agreement with the client, the study team pre-defined the following questions relevant to Austria's space industry and research:

Austria Overview

1. - What are the structural features of Austria's space industry and research?
2. - What does a competence atlas look like for the space industry and research in Austria?
3. - What does the sectorial distribution look like for the companies and research institutions active in the space sector?
4. - To what extent are the surveyed companies and research institutions active in the space sector?

Competences

5. - What competences do the companies and research institutions in Austria's space industry and research possess?

Segments

6. - What is the structure of the individual segments?
7. - Who are the principal clients of the Austrian space industry?
8. - What certifications do the Austrian companies hold?
9. - How are the supply relationships of the Austrian companies in the space industry characterised?

Value chain

10. How is the value chain covered?
11. What perceived market entry barriers exist?

Research and Development

12. How many space R&D employees are there?
13. How many publications and patents are there?
14. What topics are dealt with in publications?
15. What general research topics could be dealt with cooperatively?

Cooperative partnerships

16. What existing cooperative partnerships exist?
17. With which countries/institutions do cooperative partnerships or does an interest in cooperation exist?
18. In which areas is there a heightened interest in medium-term cooperation?

19. What impediments to cooperation are there?

Technology transfer

20. What space technologies have to potential to be used in other industries?
21. What organisations are already engaging in technology transfer?

Value creation and competitiveness

22. How -can Austrian value creation and competitiveness be increased from the organisations' point of view?

Austria's space industry and research are then described based on these questions.

Please note that the results presented are based on the statements given by the surveyed organisations and that a projection was only calculated for the number of employees and the total volume of the industry (see page13).

1.4 Execution

The study team used the following sources of data for the purpose of identifying the companies relevant to the study:

- Members of Austrospace and Eurospace
- EMITS database (ESA)
- Attendee lists for events about ASAP
- Attendee lists for pertinent events, workshops and symposia (e.g. How to do Business with ESA, Technology Transfer, etc.)
- ASAP project partners
- Internet research
- Mentions in discussions with experts

Founded on a thorough examination of international space databases and reports, space activities have been divided into seven segments (based on, amongst other things, the ESA industry categories).

1. - **Spacecraft:** Satellites, space probes, spacecraft, space stations and their structure, materials and production techniques, equipment, electronics, avionics, propulsion systems, basic systems, engineering
2. - **Launchers & Manned Flights:** Launch vehicles and space shuttles , their structure, materials and production techniques, equipment, avionics, propulsion systems, basic systems, engineering
3. - **Ground Segment and Ground Support Equipment:** Ground stations, reference stations, telescopes, launch equipment, engineering
4. - **Instruments and Payloads:** for remote sensing (lidar, optical sensors, radar, radiometers, etc.), for navigation, for telecommunications, for security and defence, for space science (robots for missions, etc.), engineering
5. - **Satellite-based Applications (Operational Services and End User Equipment):** Earth observation, navigation, telecommunications, security & defence, end user equipment, engineering
6. - **Space Science:** Pure research for space technology, exploration, microgravity, simulation, other experimental research
7. - **Other**

The "Other" segment applies to all organisations which do not fit into segments 1-6. Figure 1 shows the segments considered in Ö-SPACE.

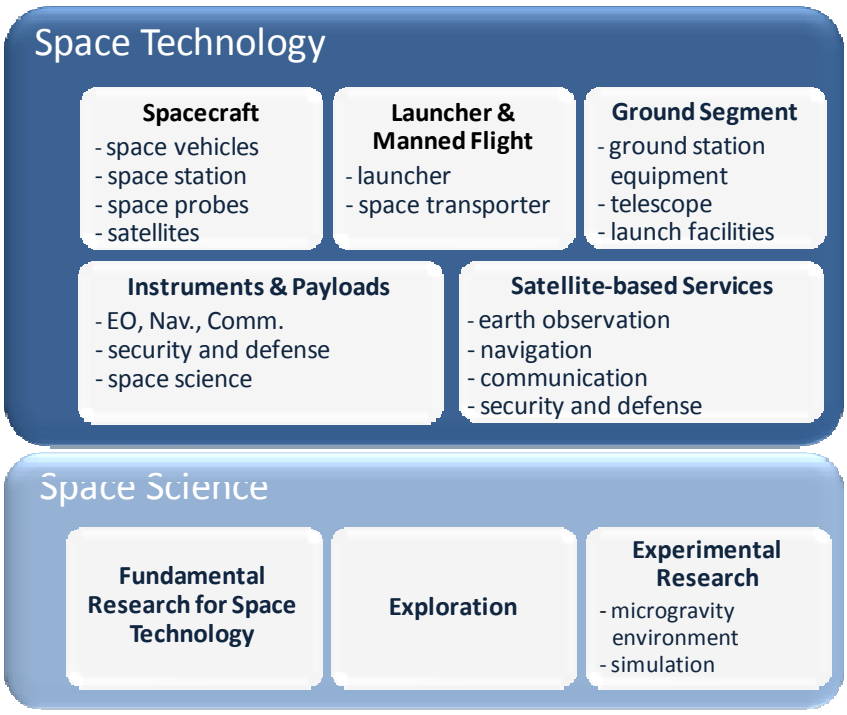

Fig. 1: Space Industry and Research Segments

Initially, 280 companies and research institutes were identified. The survey began in June 2010 at which time a letter was sent out by BMVIT announcing the study. Whilst the datasets were being identified, additional organisations (approx. 30) were identified and contacted.

In total, 309 companies and research institutions were identified as part of the Ö-SPACE project. 114 of these organisations are currently active in Austria's space industry and research. Around 8% of the originally mentioned organisations (25 organisations) were then discarded for various reasons (bankruptcy, insolvency, business consulting firms, distributors, general pure research, etc.). 19 organisations are interested and have the potential to operate in the space sector in the future. They were placed in the "Potential" category but not yet counted as space organisations.

Telephone calls were placed to 114 of the space industry and research organisations to check whether they are active in the space sector. Of these companies, 74 (65%) actively took part in the survey (see Fig. 2).

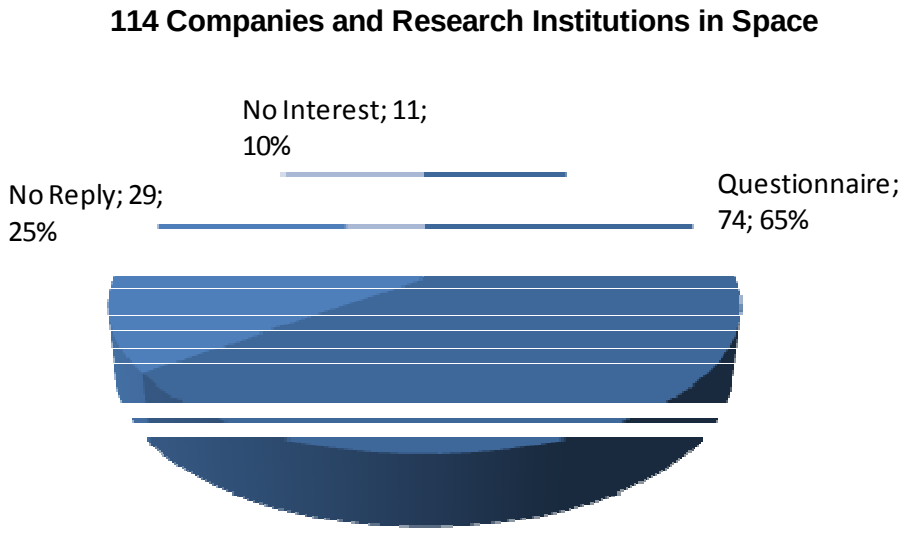

Fig. 2: Survey Response Rate in the Ö-SPACE Project by the 114 Organisations in Austria's Space Industry and Research

The datasets of the 74 companies (n=74) were evaluated and analysed. The results are presented in the following chapter.

The figures on turnover and employees are cumulative and refer to the 2009 fiscal year.

2 Results of the Survey

2.1 Austria Overview

In this chapter, following an observation of the structure of the Austrian companies and research institutions, in terms of organisation size, spaceflight turnover/budget and employees, main fields of activity and attribution to the various segments and a competence map of Austrian space activities is presented. In addition, the sectorial distribution of the organisation and space involvement is analysed.

1. What are the structural features of Austria's space industry and research?

- Extrapolated to all organisations responding in the survey that they were active in the space sector (including those that did not participate in the study), Austria's space industry has a total volume of 125 M€.
- In terms of turnover, there is a predominance of a small number of large organisations: 15% of the companies (6 organisations) are responsible for 80% of the total volume.
- 647 individuals work in the space sector (according to the extrapolation: 934 persons). In the companies, 59% and in the research institutions 96% are employed in research and development.
- A numerical dominance of SME (small and medium enterprises) can be seen in the space industry. The institutes involved in space research also have fewer than 250 employees each.

In 2009, the total volume of the Austrian organisations in the space sector included in this study amounted to 86.3 M€. Of this figure, 83% or 71.2 M€, is attributed to the space industry and 17% or 15.1 M€, to research institutes. (Tab. 1) Extrapolated to all organisations responding in the survey that they were active in the space sector (including those that did not participate in the study), Austria's space industry has a total employee headcount of 934 persons.

In total, there are 647 persons working in the space sector. Of this number, 385 work in the space industry and 262 in research institutes. According to the extrapolation that also

takes those organisations into account that did not participate in the survey, 934 persons work in the Austrian space industry and research. (Tab. 1, Tab. 2)

The research intensity in spaceflight is clear by looking at the percentage of employees working in research and development. In the industry, 59 % of all employees are involved in research and development, compared with 96 % in the research institutes. (Tab. 1)

	Spaceflight Turnover(M€) (n=62)	Spaceflight Employees (n=71)	Spaceflight Employees in R&D(n=71)
Space Industry	**71.2**	**385**	**226**
Space Research Institutes	**15.1**	**262**	**251**
Space, total	**86.3**	**647**	**476**

Tab. 1: Turnover and Employees in Austria's Space Industry and Research (2009)

	Spaceflight Turnover(M€)	Spaceflight Employees	Spaceflight Employees in R&D
Space Industry & Research	**125**	**934**	**678**

Tab. 2: Extrapolation for Austria's Space Industry and Research

Small and very small organisations predominate amongst both the companies and the research institutes. Of the 44 companies studied, 43% are very small (< 10 employees, ≤2 M€ in turnover) and 20% small (<50 employees, ≤10 M€ in turnover). Seven companies (16%) are medium-sized (<250 employees, ≤50 in turnover) and 20% large (≥250 employees). In terms of the research institutes (n=30), around three-fourths (77%, 23 institutes) fall into

the "small" category and one institute (3%) falls into the category of very small organisations. Six institutes (20%) are classified as medium-sized (Fig. 3).

Of 41 companies for which the appropriate data are available, 15 were founded after 2002 and 26 in 2002 or before. This means that more than one third (37%) of the companies were founded after the start of the Austrian Space Programme (2002).

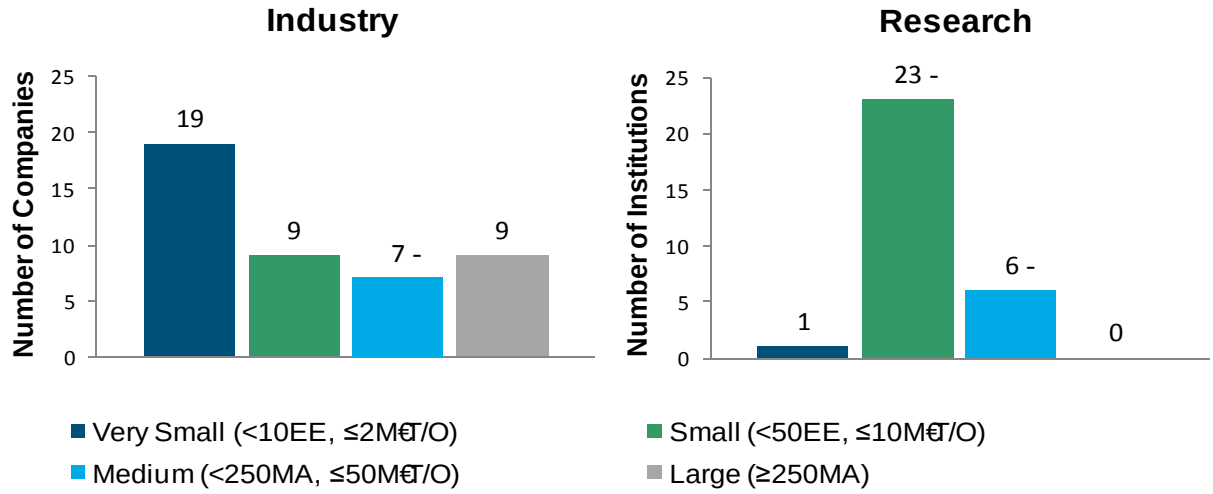

Fig. 3: Distribution of Austria's Space Industry and Research by Organisation Size (n=74)

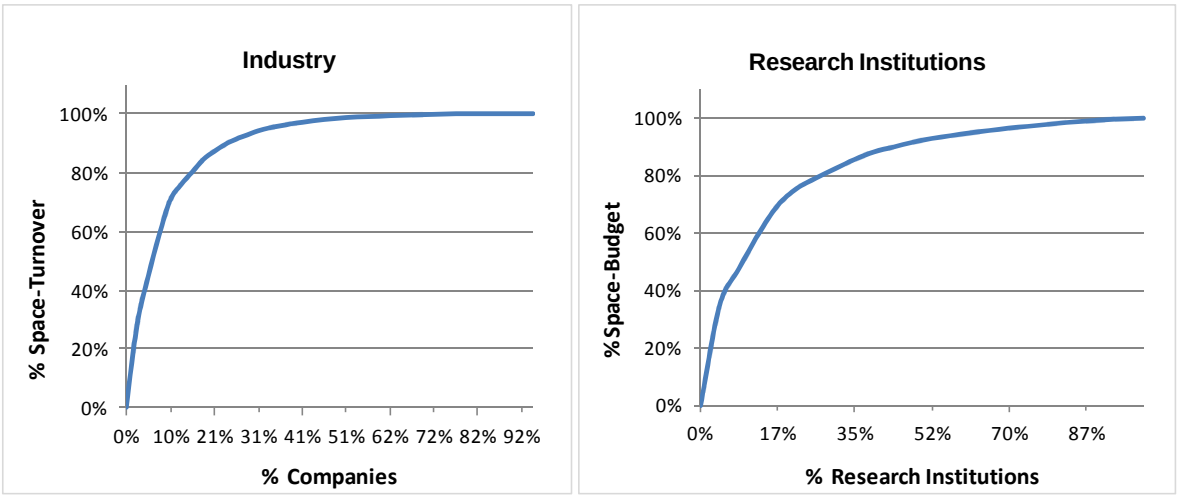

Fig. 4: Distribution of Spaceflight Turnover/Budget of Austrian Companies (n=39) and Research Institutes (n=23)

There is a high concentration of turnover in a few organisations: 15% of the companies (6 organisations) are responsible for 80% of the total volume (Fig. 4) This reflects the structure of the Austrian market in which there are a few “big players” and a relatively large number of SME’s.

This pattern can also be found amongst the research institutes to somewhat lesser extent. Here, around one-fourth of the organisations, (26%; 6 organisations) account for 79% of the turnover and/or budget. The distribution of spaceflight turnover in the industry and in research is displayed in the graph above (Fig. 4).

In this context a comparison with the Austrian aeronautics industry is instructive. Here, 62% of all companies are either small or very small enterprises, 14% are medium size companies and the rest (24%) large enterprises. In aeronautics, 10% of companies are responsible for 81% of the overall aeronautics turnover.[1] Furthermore, the area of information and communication technology (ICT) also consists „mainly of very small companies“[2]: only 3% of companies in Vienna employed more than 50 people in the year 2001, 9% had 10-49 employees and 89% had a maximum of 9 employees. [3] Thus, the structure of space industry and research is very similar to other technology-intensive industry sectors in Austria.

41 organisations responded "space" to the question, "In what sector(s) do you primarily operate?". This category was followed by aviation (16 mentions), the automotive sector (9 mentions) and geoinformation (4 mentions). (Fig. 5)

[1] Ö-Link. Österreichische Luftfahrtindustrie: Datenbank der Marktteilnehmer, January 2010, Brimatech Services.

[2] IKT Standort Wien im Vergleich. Endbericht, December 2007, KMU Forschung Austria, S. 29.

[3] IKT Standort Wien im Vergleich. Endbericht, December 2007, KMU Forschung Austria, S. 30.

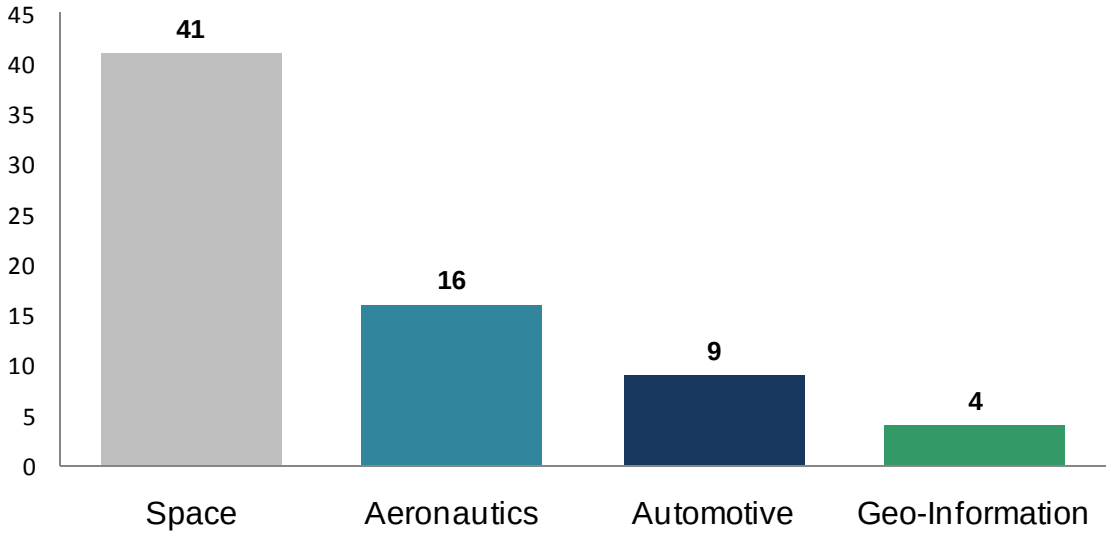

Fig. 5: Primary Industries of the Surveyed Organisations in Austria's Space Industry and Research (n=70)

2. What does a competence atlas look like for the space industry and research in Austria?

- There are companies and/or research institutes in the space sector present in nearly every Province, except for Burgenland.
- The geographical focal points of the space industry and space research are in Vienna and Styria.
- Vienna has the largest space travel turnover (45.9 M€) and at 291, the largest number of space sector employees.
- Research institutions are more prominent in Styria whilst companies predominate in Vienna.
- In proportion to the number of organisations (15), at 238 persons, there is a very large number of employees in the space industry and research sector.

There are organisations active in the space sector in every Austrian Province except for Burgenland (Fig. 6). The geographical focal points of the space industry and space research are in Vienna and Styria. Most of the companies (15) and research institutions (12) are located in Vienna. In Styria, there are 5 companies and 10 research institutions. As such, the focus in Styria is clearly on research whereas in Vienna, it is found on industry.

With 44.4 M€ - or 62% - companies headquartered in Vienna have the lion's share of the turnover of Austria's space industry which totals 71.2M€. The turnover and/or budget of the research institutes in Vienna is, at 1.5 M€, relatively small compared to the total of 11.3 M€ recorded in Styria. In Vienna, 291 persons are employed in the space sector compared to 238 persons in Styria (Total for Austria: 647). Taking a closer look at this indicator, one can clearly see here too that the focus in Styria is on research: 69% of employees in Styria work in research institutions.

The Provinces with the next largest space communities are Upper Austria with 9, Lower Austria with 8 and Salzburg with 7 organisations. Whereas only companies can be found in Upper Austria, there are 2 research institutes in Lower Austria and 3 in Salzburg. Furthermore, there are 5 organisations in Tirol, 2 in Carinthia and 1 in Vorarlberg.

By turnover, Tirol, with 39 M€, is the Province with the third-largest community, followed by Lower Austria (28 M€), Salzburg (25M€) and Upper Austria (24M€). In Carinthia, turnover amounts to around 2M€ and in Vorarlberg this figure is around 1M€(Fig. 6).

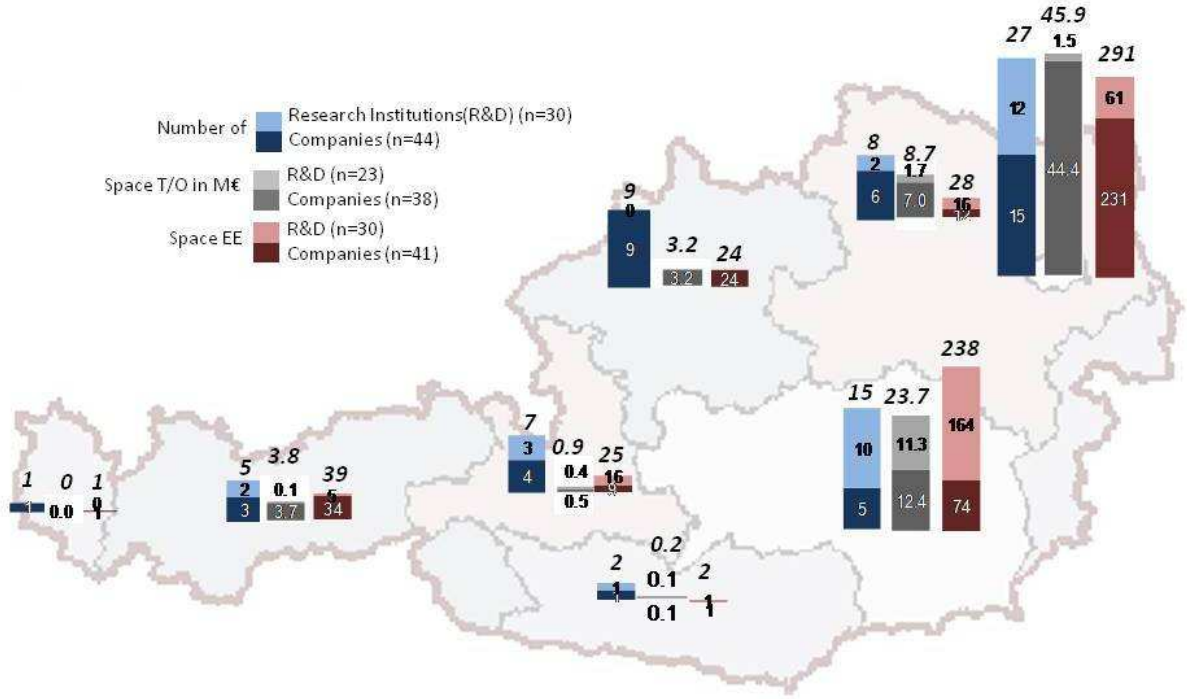

Fig. 6: Competence Map of the Space Industry and Research in Austria

The following table (Tab. 3) shows the geographical distributions of the organisations with a detailed breakdown. In Vienna, the concentrations lie in the satellite-based services segments (segment 5), spacecraft (segment 1) and the ground segment (segment 3). In Styria, organisations are mainly active in the areas of satellite-based services (segment 5) and instruments and payloads (segment 4).

	Number of Comp./Res. Inst.	Spaceflight Turnover M€ Comp./Res. Inst. (n=39/23)	Number of Employees/Res. Inst. (n=41/30)	Space R&D Employees Comp./Res. Inst. (n=41/30)	Segment Focus[4]
B	0/0	0 / 0	0 / 0	0 / 0	-
C	1/1	0.1 / 0.1	1 / 1	1 / 1	
LA	6/2	7.0 / 1.7	12 / 16	3 / 13	5, 1, 2
UA	9/0	3.2 / 0.0	24 / 0	19 / 0	1, 5
S	4/3	0.5 / 0.4	9 / 16	3 / 16	5
ST	5/10	12.4 / 11.3	74 / 164	26 / 156	5, 4
T	3/2	3.7 / 0.1	34 / 5	18 / 5	5
V	1/0	0 / 0	1 / 0	0 / 0	
V	15/12	44.4 / 1.5	231 / 61	157 / 60	5, 1, 3
Total	***44/30***	***71.2 / 15.1***	***385 / 262***	***225 / 251***	

Tab. 3: Austria's Space Industry and Research by Province

Table (Tab. 3) illustrates that in all the Provinces, with the exception of Upper Austria, satellite-based services (segment 5) is the segment in which the largest number of organisations are active. The following section goes into the division of the organisations by segment in greater detail.

[4] Segment 1: Spacecraft, Segment 2: Launchers & Manned Spaceflight, Segment 3: Ground Segment, Segment 4: Instruments & Payloads, Segment 5: Satellite-based Services

3. What does the sectorial distribution look like for the companies and research institutions active in the space sector?

- 49% of the organisations are research institutions, 46% service providers, 31% manufacturing operations and 23% software manufacturers (multiple mentions).
- Of the 86.3 M€ in total volume, 14.4 M€ is attributed to research institutions, 20.5 M€ to service providers, 44.3 M€ to manufacturing companies and 7.1 M€ to software manufacturers.

Nearly half (49%, 36 mentions) of the organisations categorise themselves under research institutions and a similar percentage (46%) of them consider themselves as service providers. 23 organisations (31%) are manufacturing companies and 17 (23%) software manufacturers. Multiple answers were possible for this question and the relatively high percentages indicate that many organisation are active in more than one sector. (Fig. 7: Sectorial Distribution of Austria's Space Industry and Research (n=74)**)**

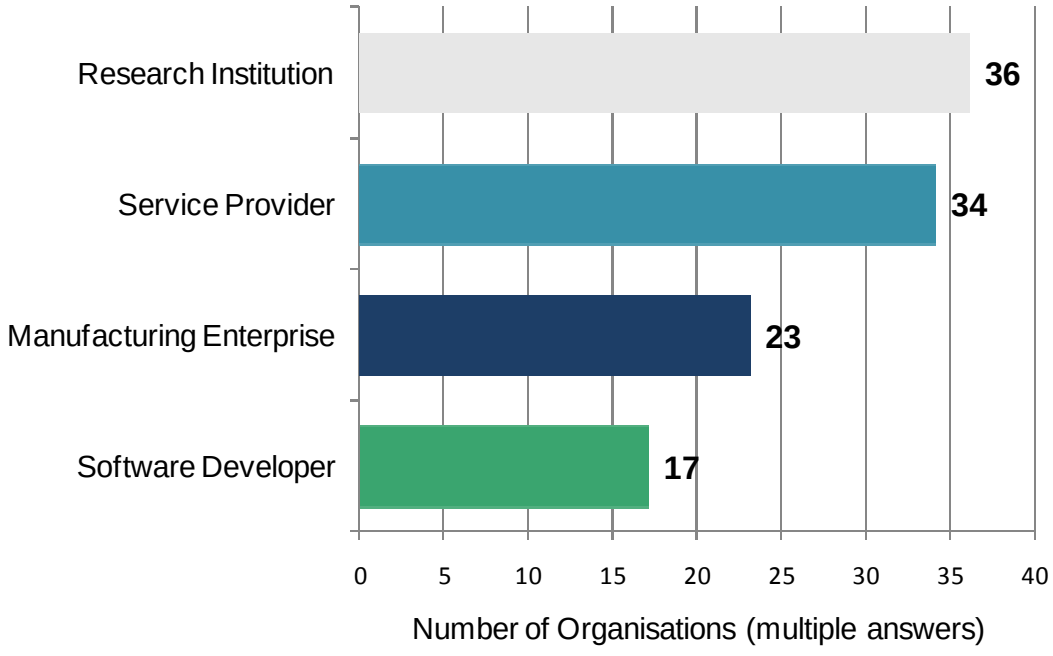

Fig. 7: Sectorial Distribution of Austria's Space Industry and Research (n=74)

Of the 86.3 M€ in total volume, 14.4 M€ is attributed to research institutions, 20.5 M€ to service providers, 44.3 M€ to manufacturing companies and 7.1 M€ to software manufacturers. In terms of employees, the largest percentage goes to research institutions and manufacturing companies. 112 persons are employed with service providers and 51 with software manufacturers. With the exception of the manufacturing companies, where spacecraft and launchers & manned spaceflight (segments 1 and 2) dominate, in the other sectors, satellite-based services (segment 5) have the greatest number of employees.

	Number of Organisations (Companies/Research Institutions)	Spaceflight Turnover in M€ (n=62)	Spaceflight Employees (n=71)	Spaceflight Employees - R&D (n=71)	Segment Focus
Research Institution	36 (6/30)	14.4	249	238	5
Service Provider	34 (31/3)	20.5	112	60	5
Manufacturing Company	23 (22/1)	44.3	235	135	1, 2
Software Manufacturer	17 (15/2)	7.1	51	43	5
Total		***86.3***	***647***	***476***	

Tab. 4: Austrian Space Industry and Research by Company Type[5]

When organisations listed more than one sector, service was often included. The combination "manufacturing company - service provider" came up 14 times, "software manufacturer - service provider" 12 times and "research institution - service provider" came up 8 times.

Of the 36 research institutions, 26 are exclusively research institutions; of the 34 service providers, 10 are exclusively service provider and one-third (8 of 23) of the manufacturing companies are exclusively manufacturing companies. Only two of the 17 software manufacturers concentrate just on software.

[5] "Number of Organisations" contains multiple answers, average values were calculated for each company for the purpose of computing turnover and employee figures.

4. To what extent are the surveyed companies and research institutions active in the space sector?

- For round one fifth (21%) or 13 organisations, spaceflight represents their core business. All these companies and research institutions are SME's or small research institutions.
- The majority of the companies and research institutions, i.e. 59% fall under the category of "also active in space travel." They generate less than 25% of their turnover in the space sector.

The graph below (Fig. 8: Austrian Space Industry and Research by Extent of Space Activity (n=61)) illustrates the different extent of the involvement of Austrian organisations in the space sector. Of the 61 organisations for which the available data were sufficient to evaluate this question, spaceflight represented the core business for 13. That corresponds to 21%. All these organisations are SME's or small research institutions. "Core business" here means that the turnover generated in the spaceflight sector accounts for 75% or more of total turnover. Eleven of these 13 organisations are active in segment 5 (satellite-based service), five in segment 6 (space science), and four each in segment 1 (spacecraft), segment 4 (instruments and payloads) and segment 7 (space science). In addition, segment 3 (two organisations) and segment 2 (two organisation) are also covered.

For nine organisations (15%), spaceflight is their primary activity (50%-75% of turnover) and for three organisations (5%), space travel is one field of activity amongst several (25%-50% of turnover). The majority of the companies and research institutions, i.e. 35 (59%) however fall under the category of "also active in spaceflight." They generate less than 25% of their turnover in the space segment. (Fig. 8, Tab. 5)

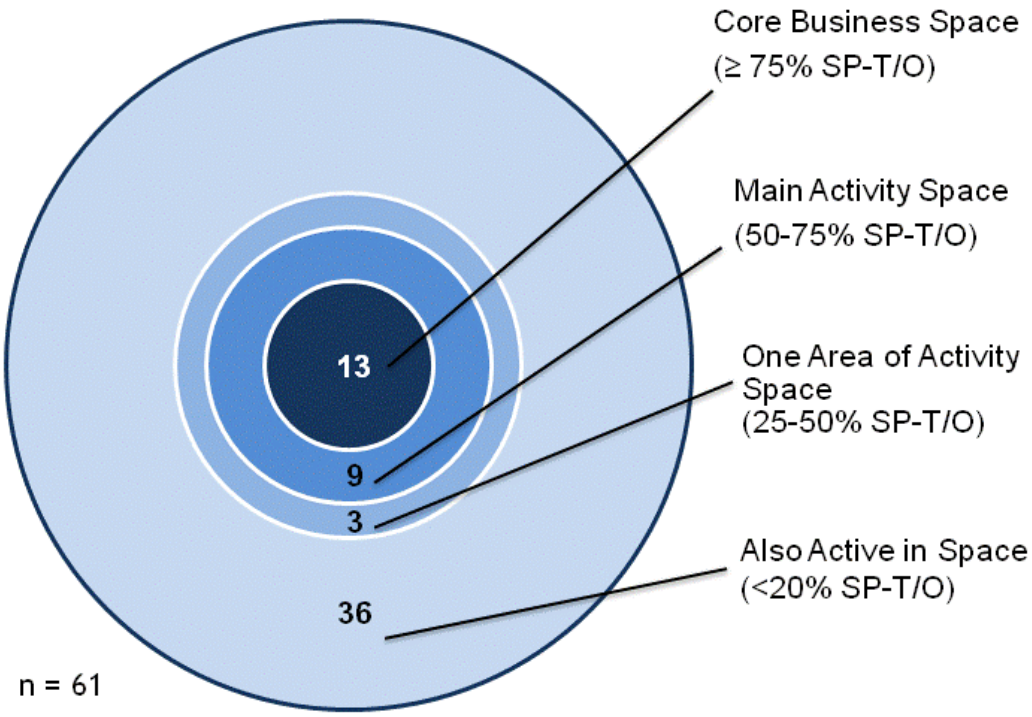

Fig. 8: Austrian Space Industry and Research by Extent of Space Activity (n=61)

Of the 13 organisations with spaceflight as their core business, eight are companies and five research institutes. These organisations generate a turnover of 41.8 M€ and employ 313 persons in the field of space. Accordingly, this 21% of the organisations (n=13) accounts for 48% of the turnover and 50% of the employees in the space sector. The nine organisations with spaceflight as their main activity generate 4.7 M€ and employ 69 persons. The three organisations, for which spaceflight is a field of activity, produce 1.9 M€ in turnover and employ 27 persons. Besides those with spaceflight as their core business, those organisations which concern themselves marginally with spaceflight have the largest share of turnover and employee figures: they generate 37.9 M€ and employ 215 employees.

As already mentioned, all organisations in the category of "Core Business" are SME's or small research institutions, i.e. each organisation has - in total, not pertaining to spaceflight - fewer than 250 employees and less than 50 M€ in annual turnover. In terms of the organisations for which less than 25% of their turnover comes from spaceflight, 27 of 36 are SME's (75%).

	Number (Comp./ Res. Inst.)	SF Turnover in M€	≥ 1M€ SF Turnover	SF Employ-ees	SF Employ-ees - R&D	SME's	Austrospace Members
Core Business is SF	13 (8/5)	41.8	5	313	235	13	4
Main Activity is SF	9 (3/6)	4.7	2	69	64	9	3
Field of Activity is SF	3 (1/2)	1.9	1	27	27	3	0
Also active in SF	36 (25/11)	37.9	8	214	132	27	2
Total	***61***	***86.3***	***16***	***623***	***458***	***52***	***9***

Tab. 5: Austrian Organisations and their Spaceflight Involvement (n=61)

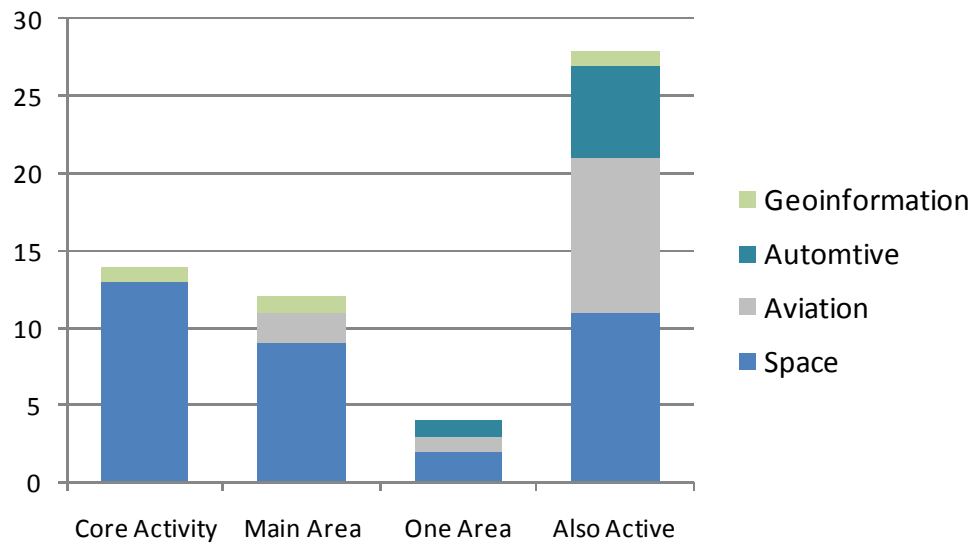

Fig. 9: Main Sectors of the Austrian Space Industry and Research Organisations and their Spaceflight Involvement (n=61, Multiple Mentions)

Not surprisingly, only very few respondents for whom spaceflight is the main field of activity mention other sectors in which they operate. Geoinformation and aviation are the only sectors mentioned. A considerable percentage of the other organisations - especially those "also active in spaceflight" - also operate in the fields of aviation and the automotive industry.

2.2 Competences

5. What competences do the companies and research institutions in Austria's space industry and research possess?

Focuses of Austrian competence, and thus important fields of research, traditionally lie in the field of spacecraft and launch systems, specifically in the following competence areas:

- Mechanics - lightweight construction (incl. development focuses such as structural and thermal analyses),
- Components for space transport systems (low temperature fuel lines for Ariane 5)
- System components for temperature regulation
- Material research and development (incl. special topics e.g. tribology, both in the area of metal materials and to an increasing extent in that of thermostable composite materials),
- Thermal insulation,
- Cryogen technology,
- Propulsion systems and rocket fuels,
- Engine positioning mechanisms,
- Ground support equipment for satellite testing,
- Development and operation of nanosatellites for scientific use (e.g. onboard software, optical instrumentation)
- Hardware and software for signal processing on board satellites,

Furthermore, Austria has established itself in the instruments and payloads segment with outstanding competences in:

- Control electronics (with a particular focus on digital signal processing),
- Embedded systems,
- Sensor systems,
- Satellite communication,

- Simulations and innovative information technologies for satellite control and monitoring.

In addition, over the last few years, companies and research institutions involved in satellite-based applications have been successful, particularly in the areas of:

- Remote sensing/earth observation (data transmission, automated information extraction, settlement, consumption and environmental monitoring, disaster management)
- Navigation (multisensor systems and filtering techniques, software for GNSS reception, application software and services)
- Communications (satellite-based voice and data communications)

2.3 Segments

The segments (S) of the space industry and research are analysed in greater detail below. These include:

S1. Spacecraft -
S2. Launchers & Manned Flights: -
S3. Ground Segment -
S4. Instruments and Payloads: -
S5. Satellite-based Applications -
S6. Space Science -
S7. Other -

This analysis was performed according to the number of organisations, the number of employees and the turnover figures for each segment.

6. What is the structure of the individual segments?

- Ranked by number of organisations, segment 5 (satellite-based applications) is the largest, followed by segment 1 (spacecraft) and segment 4 (instruments and payloads).
- In terms of employees as well, segment 5 (satellite-based applications) is the largest (175 EMP), segment 1 (spacecraft) is the second-largest (106 EMP) and segment 3 (ground segment, 95 EMP) is the third-largest.
- Based on total turnover volume, segment 1 (18.5 M€) is the largest, followed by segment 2 (18.1 M€) and segment 5 (16.7 M€).

Ranked by number of organisations (Fig. 11), segment 5 (satellite-based applications) is the largest, followed by segment 1 (spacecraft) and segment 4 (instruments and payloads). In terms of employees (EMP) as well, segment 5 is the largest (175 EMP), segment 1 is the second-largest (106 EMP) and segment 3 (ground segment, 95 EMP) is the third-largest (Tab. 6, Fig. 12). The largest turnover is generated in segment 1 (spacecraft, 18.5 M€), launchers and manned spaceflight (S2) account for the second-largest (18.1 M€) and satellite-based applications (S5) come in at third place with 16.7 M€. This is illustrated by the following figures:

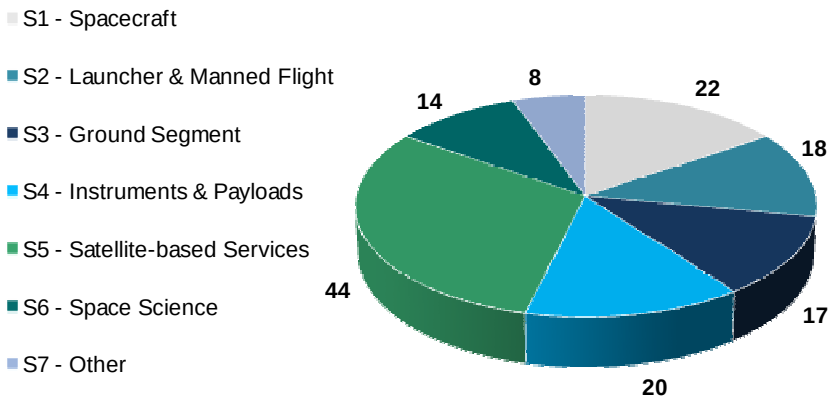

Fig. 10: Segments by Number of Organisations (Multiple Mentions, n=74)

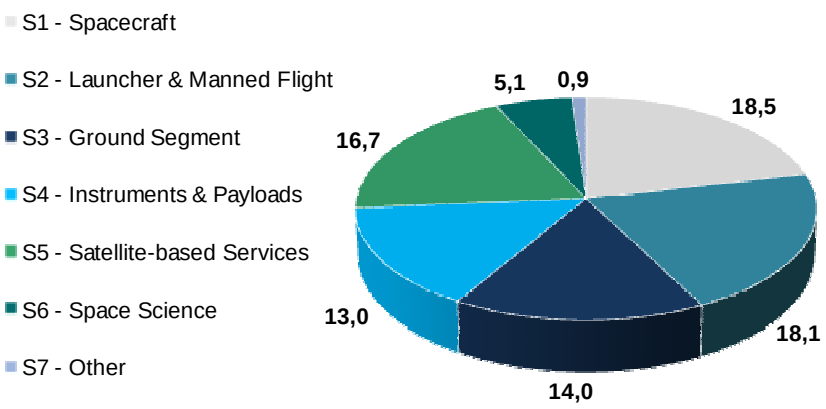

Fig. 11: Segments by Spaceflight Turnover

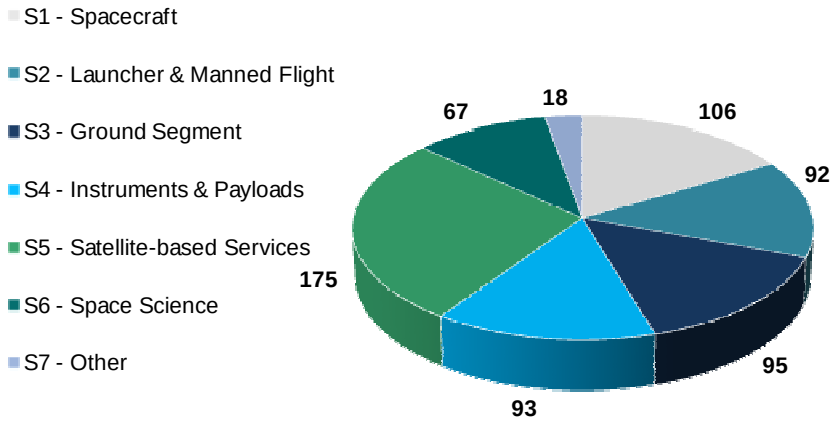

Fig. 12: Segments by Spaceflight Employees

The segment in which the majority of Austrian organisations operate is satellite-based services with 44 mentions (Fig. 10). This means that 60% of all companies and research institutes work in this field.

The second-largest segment is the spacecraft segment with 22 mentions or 30% and the third-largest, with 20 mentions (27%) is the instruments and payloads segment. The other

fields include launchers and manned spaceflight (18 mentions), the ground segment (17 mentions), space science (14 mentions) and "other" (8 mentions).

The aforementioned percentages and figures clearly show that many organisations operate in more than one field: 49% mentioned one segment and 51% more than one segment. In the latter group (n=38), there were 16 organisations operating in two, 14 organisations in three, seven organisations in four and one organisation in five segments.

With 14 organisations, there is a relatively large number of organisations operating in both segments 1 and 2. This means that 64% of the organisations in segment 1 (n=22) are also active in segment 2 and 78% percent of organisations active in segment 2 (n=18) also operate in segment 1.

Vienna is the only Province in which all segments are represented. Besides Vienna, Upper Austria is also represented in segment 1. Companies headquartered in Styria are also highly involved in segments 3, 4 and 6. Organisations based in Salzburg are also highly involved in segment 5.

	S 1	S 2	S 3	S 4	S 5	S 6	S 7
Number of Organisations* (Companies/Research Institutions)	22 (15/7)	18 (14/4)	17 (11/6)	20 (8/12)	44 (25/19)	14 (4/10)	8 (5/3)
Spaceflight Turnover in M€ **	18.5	18.1	14.0	13.0	16.7	5.1	0.9
Spaceflight Employees ***	106	92	95	93	175	67	18
Spaceflight Employees - R&D***	74	48	69	74	135	62	13
Strong Provinces	V, UA	V	V, ST	V, ST	V, ST, S	V, ST	V

* Multiple Answers

** n=62

*** n=71

Tab. 6: Austrian Space Industry and Research by Market Segment

With the exception of the ground segment (S3), more than three fourths of the organisations in all segments are SME's or small research units. In segments 7 (n=5), 6 (n=4) and 4 (n=8), the percentage of SME's/small research institutions is 100%. In segment 5

(n=25), 76% of the companies are SME's, in segment 1 (n=15) the percentage is 73% and in segment 2 (n=14), 79%. Segment 3 has the smallest percentage of SME's at 55%. Based on the data available, with the exception of segment 3, it is not possible to make any assertions about differences in company structure in the segments.

	S 1	S 2	S 3	S 4	S 5	S 6	S 7
Number of Companies	15	14	11	8	25	4	5
Number of SME's	11	11	6	8	19	4	5
Percentage of SME's	73%	79%	55%	100%	76%	100%	100%

Tab. 7: Percentage of SME's by Segments

Due to the great importance for Austria of the satellite-based applications segment, this field will now be discussed in greater detail below.(Fig. 13).

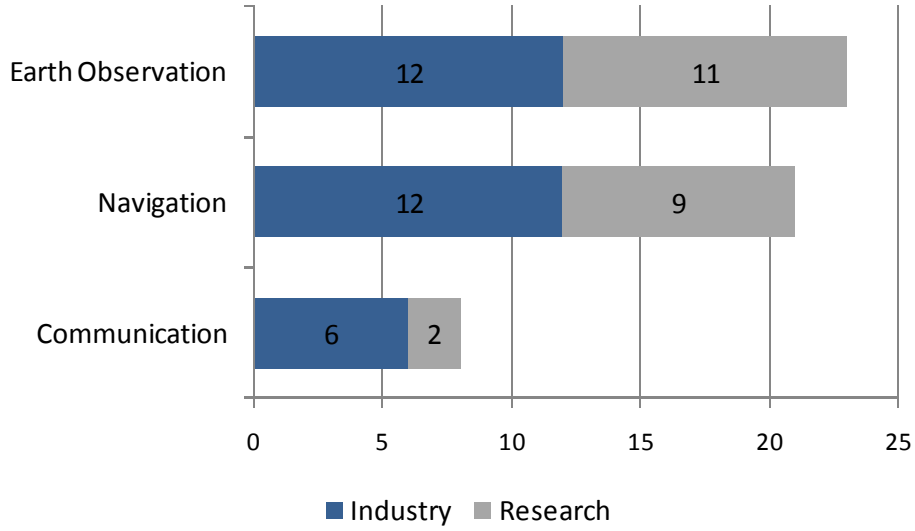

Fig. 13: Austrian Space Industry and Research in the Satellite-based Applications Segment (number of organisations, n=44)

Around half of the organisations active in the satellite-based applications segment deal - with remote sensing (23) whilst industry and research with 12 and 11 organisations, - respectively, are roughly equal. The field of application of satellite-based positioning and -

navigation is, with 21 organisations, nearly as strong although the ratio of industry to research there is 3:2. The field of satellite-based communication is dealt with by 28% (8) organisations with a clear predominance by industry (6 companies).

The majority of research institutions, service providers and software companies are found in segment 5 "Satellite-based Applications," whereas the manufacturing companies primarily concern themselves with spacecraft (segment 2) and launchers (segment 2).

2.4 Clients and Supply Relationships

This section presents the client and supply relationships of the Austrian companies in the space sector. In addition to principal clients, this section also goes into the topic of certifications and supply relationships. Given the topic at hand, only companies were included in this portion of the study, no research institutes.

7. Who are the principal clients of the Austrian space industry?

- The space industry is export-oriented, with nearly half of the companies (47%, n=33) exporting between 80% and 100% of their products.
- Europe is by far the largest export market for the Austrian space industry with a share of 54% based on the number of mentions.
- Asia (17%) and North America (15%) are also relevant markets.
- The most important clients for the Austrian space industry are the ESA (15 mentions) and EADS Astrium (10 mentions; n=32).

Austria's space industry is very strongly export-oriented. The export rate ranges between 80% and 100% in nearly half of the companies (47%). In 9% of the enterprises, this rate is between 60% and 80% and in 10% between 40% and 60%. In approximately one third (34%), export does not play a major role; in these companies the export rate is under 40% (n=33, Fig. 14).

Austrian space companies export first and foremost to European countries (Fig. 15). 54% of the companies list the destinations of their exports as Europe, 17% Asia, 15% North America, 9% South America and 4% Africa. Australia was not listed by any of the companies (n=32).

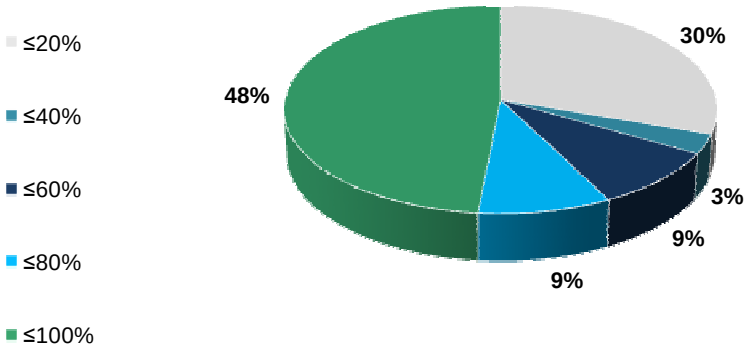

Fig. 14: Austrian Space Research: Distribution of the Companies by Export Rate (n=33)

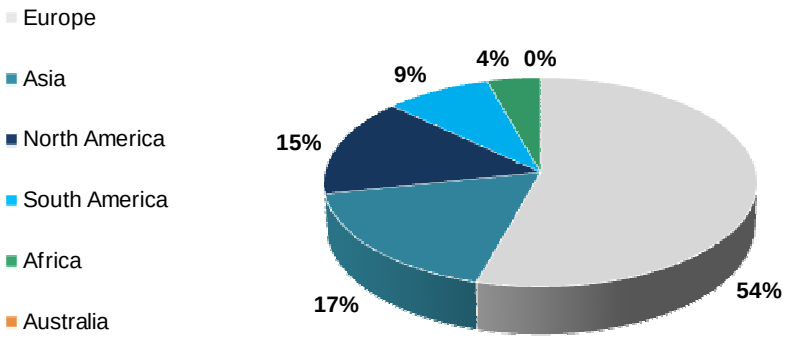

Fig. 15: Export Markets of the Austrian Space Industry (n=32)

Reference Clients:

In accordance with the primary export markets, the most important purchasers are also found in Europe. The European Space Agency ESA is the most important client and was named by 15 Austrian companies. Astrium, a wholly owned subsidiary of the European Aeronautic Defence and Space Company (EADS), is the second most important client with 10 mentions. NASA was listed by four companies as a reference client, as was the RUAG. Three companies each mentioned the German Aerospace Centre (Deutsches Zentrum für Luft- und Raumfahrt, DLR), the Thales Group and MT Aerospace.

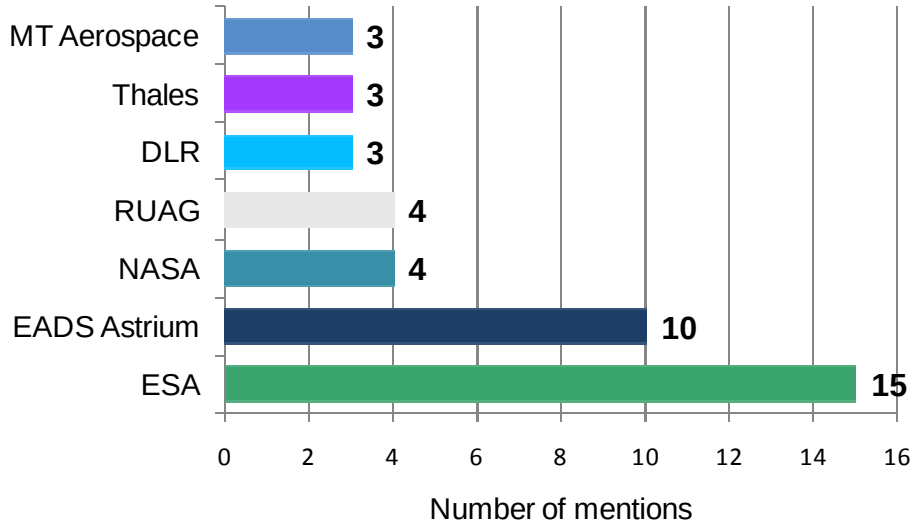

Fig. 16: Principal Clients of the Austrian Space Industry (n=32)

Other clients not shown on the above graph which were only listed once or twice include the French Space Agency CNES, Siemens and NATO.

8. What certifications do the Austrian companies hold?

- A total of 41 companies answered this question.
- The most frequently held certification of Austrian companies is EN ISO 9001 (14 mentions).
- The second most frequently listed certification is Standard EN9100 (5 mentions).

In addition to the general quality management certification (EN ISO 9001), companies operating in the space sector most frequently have EN 9100 certification which offers the framework for quality management systems in the aerospace sector.

In addition, ESA certifications, including ones in the field of spaceworthy soldering (n=3) and EASA (European Aviation Safety Agency) certifications (n=2). These certifications exceed the general standards as established in EN ISO 9001 and specifically pertain to aerospace requirements.

Various other ISO certifications, e.g. ISO 14001 (Environmental Management) and ISO 17025 (General Requirements for the Competence of Testing and Calibration Laboratories), which are not directly related to spaceflight, were named by five companies.

Depending on the business fields of the companies (besides spaceflight), certifications are also held in the fields of automobile construction (e.g. ISO 26262 - "Road Vehicles - Functional Safety") and software (e.g. IEC 61508 – "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems"[6]).

9. How are the supply relationships of the Austrian companies in the space industry characterised?

- Only 12 of 42 companies answered the question about principal suppliers.
- Amongst the suppliers, e.g. data suppliers, there is a concentration in the field of satellite-based applications.

The supplier landscape is very heterogeneous in nature and few companies were named more than once. EADS Astrium was the only organisation listed three times, Johanneum Research and Terma, an internationally active company headquartered in Denmark which operates in the fields of aerospace, defence and security applications, were each mentioned twice.[7]

In accordance with the focuses in the Austrian space community, companies active in the segment of satellite-based services also predominate amongst suppliers. These include, amongst others, data suppliers, such as Eurimage. In addition, material manufacturers (metal, plastics, carbon fibres) were also listed.

[6] http://www.iec.ch/functionalsafety -

[7] "Terma's Business Areas cover: Aerostructures, Integrated Defense and Security Systems, Radar Systems, Space (Mission-critical products, software, and services for space applications.)". - http://www.terma.com/ -

2.5 Value Chain

In this chapter, coverage of the value chain (from applied research to development, production and distribution to logistics) and product hierarchy levels (from raw materials and tools to complete systems) is analysed. For each segment, inferences can be made regarding vertical manufacturing integration and the position of Austrian organisations in the value chain.

10. How is the value chain covered?

- The product range of the Austrian space industry and research is quite heterogeneous.
- 22 organisations offer products and/or services in segment 1, 18 in segment 2, 17 in segment 3, 20 in segment 4 and 46 in segment 5.
- For five organisations, applied research enjoys the greatest coverage in segment 1 (spacecraft).
- Eleven organisations are active in development in each of the following segments: spacecraft and launchers & manned spaceflight.
- 17 organisations offer software. In this regard, the segment of satellite-based applications has the greatest coverage, followed by the ground segment with 7 software products.

In this section, coverage of the value chain and the product hierarchy is analysed. The organisations were asked to classify their primary products under the individual elements of the value chain and product hierarchy. Here, the product hierarchy is presented using the following levels: system, subsystem, devices/modules, assemblies /components, parts, raw materials/semi-finished products/ surfaces and tools/equipment. The value chain runs the gamut from applied research to development, manufacturing and distribution all the way to logistics.

Each box in the table represents a primary product or service of an organisation. At the edges of the tables, the number of companies is indicated in the respective column or row. In addition to the manufacturing companies and service providers, the research topics handled in the applicable segments are also presented. In the satellite-based applications segment, instead of product hierarchy levels, the subgroups satellite communication, navigation and earth observation are used. The topic of software is handled separately.

Segment 1: Spacecraft

- 22 organisations, of which 12 manufacturing companies and 12 service providers, are active in segment 1.
- All the elements of the value chain are covered.
- Eleven companies are engaged in development and eleven in production.
- Seven companies perform activities at the assemblies/components level.

Manufacturing Companies

Except for the system area, all levels of the product hierarchy are covered. The majority of the organisations are active in the subsystem and assemblies/components areas.

In terms of horizontal integration (value chain), development (11 companies), manufacturing (5 companies) and distribution (10 companies) have the greatest coverage. There are six products for which the entire value chain is covered. These are: electrical ground support equipment, components for payload fairing, GPS receivers for high-precision positioning of satellites, release and positioning mechanism and multi-layer insulation systems. (Tab. 8)

Service Providers

The 12 service providers in the spacecraft segment deal with a broad array of topics ranging from materials to sensor systems all the way to data communication technologies. The focuses here are found primarily in research and development as well as in engineering. (Tab. 9)

Research Institutions

Austrian research institutions deal with numerous topics in this segment. These include materials research and development (high temperature composites and coatings, lightweight construction, tribology, thermal insulation) as well as studying radiation effects, risk assessment, computational physics, MEMS actuators, energy harvesting and onboard data reduction/data compression. The TUGSAT-1 nanosatellite, created by TU Graz (Institute for Communication Networks and Satellite Communication) in collaboration with the University of Vienna and the Technical University of Vienna, also falls into this category.

		Value Chain				
		Applied Research	*Development*	*Manufacturing*	*Distribution*	*Logistics*
	# Org	*(5)*	*(11)*	*(11)*	*(10)*	*(5)*
Product Hierarchy	*System (0)*					
	Subsystem (5)	Electrical Ground Support Equipment Cryogenic Tank Systems Components for Payload Fairings GPS Receivers for High-Precision Positioning of Satellites Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems) Multi-Layer Insulation Systems Communication Hardware Communication Hardware (Switches, Nodes)				
	Devices/Modules (2)	GPS Receivers for High-Precision Positioning of Satellites Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems) Mechanical Ground Equipment for Construction, Testing and Transport of Satellites Communication Hardware (Switches, Nodes) Communication Hardware (Switches, Nodes)				
	Assemblies/Components (7)	Air Ducts Fuel Lines Exhaust Pipes Hydraulic Pipes Coaxial Cables and Connectors up to 65 GHz Mechanical Components Thermal Louvres Mechanisms Composite High Pressure Accumulators for Gases Composite Tubes and Rods Composite Structural Components Components for Payload Fairings Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems) Multi-Layer Insulation Systems				
	Parts (3)		Connecting Cables Mechanical Components Man Hole Cover Man Hole Flange			
	Materials/ Semi-Finished Products/ Surfaces (2)		Air Ducts Fuel Lines Exhaust Pipes Hydraulic Pipes Components for Payload Fairings			
	Tools/Equipment (2)		Construction of Clean Rooms Construction of Laminar Flows (Clean Room Ventilation) Mechanical Components			

Tab. 8: Spacecraft - Manufacturing Companies

Consulting/Planning/ Concept Design	*Research and Development*	*Engineering*	*Manufacturing*	*Quality Assurance and Certification*	*Product Support/ Logistics*	*Other Services*
	Composites					
	Nanomaterials					
	Ceramic Fibres (Hot Structures and Joining)					
	Fibre-Reinforced Composites					
	Lightweight Structures					
	Lightweight Construction					
	Development of Cryogenic Tank Systems			Development of Cryogenic Tank Systems		
	2 Phase Thermal Systems for Heat Transport					
	Thermal Management of Instruments					
		Kinematic Positioning				
	Docking Sensor					
	Rangefinders for Formation Flights					
	Finding Solutions for Complex Technical Problems in SF Science (LISA, GAIA, XEUS,...)					
	Mechanisms			Mechanisms		
	High Pressure Accumulators					
		Components for Rockets				
	Onboard Data Reduction/Compression					
	Communication Protocols and Data Communication Technology			Communication Protocols and Data Communication Technology		
		Clean Room				
Clean Room Planning		Clean Room Planning		Clean Room Measurements		

Tab. 9: Spacecraft - Service Providers

Segment 2: Launchers & Manned Flights

- 18 organisations are active in this segment.
- Eleven companies are engaged in development and eleven in production.
- With eight organisations, the assemblies/components product level has the greatest coverage.

Manufacturing Companies

Ranked by product hierarchy, assemblies and components have the greatest coverage, followed by the subsystem level, where five companies are represented. In terms of assemblies/components, the companies listed 15 products. (Tab. 10)

The value chain is fully covered. Some products go through the entire process from applied research to development, production, distribution and logistics. These products are: components for payload fairings, release and positioning mechanisms, components for fuelling and mechanical components and assemblies for rockets.

Service Providers

Eight service provisions companies are active in the launchers and manned spaceflight sector. Topics dealt with by these companies include lightweight structures, fibre-reinforced composites and composites, nanomaterials and fibre-reinforced ceramics. There also are service providers in fields of propulsion systems (cryogenic tank systems, fuel lines), calculations and analysis (e.g. structural analysis) testing procedures and measurements. In addition, there are also other topics, e.g. clean room (planning), which are listed in Tab. 11 .

Research Institutions

Some of the areas dealt with in segment 2 (spacecraft), overlap with segment 2 (launchers & manned spaceflight). So, for example, radiation effects, risk assessment, computational physics, miniaturised sensors and energy harvesting represent topics which are relevant in both segments. In addition, topics relating to propulsion systems, e.g. laser ignition systems for engines, are also studied.

		Value Chain				
		Applied Research	*Development*	*Manufacturing*	*Distribution*	*Logistics*
	# Org	*(4)*	*(11)*	*(11)*	*(10)*	*(5)*
Product Hierarchy	*System*					
	Subsystem (5)		ARIANE 5 Fuel Lines			
			Cryogenic Tank Systems			
			Components for Payload Fairings			
			Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)			
			Communication Hardware (Switches, Nodes)		Communication Hardware (Switches, Nodes)	
				Fuel Tank Depression Valve		Fuel Tank Depression Valve
	Devices/Modules (2)		Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)			
			Mechanical Ground Equipment Construction, Testing and Transport of Satellites			
			Communication Hardware (Switches, Nodes)		Communication Hardware (Switches, Nodes)	
	Assemblies/Components (8)		Air Ducts			
			Fuel Lines			
			Exhaust Pipes			
			Hydraulic Pipes			
			Coaxial Cables and Connectors up to 65 GHz			
			Mechanical Components			
			Composite High Pressure Accumulators for Gases			
			Composite Tubes and Rods			
			Composite Structural Components			
			Components for Payload Fairings			
			Components for Fueling			
			Various Mechanical Components & Assemblies for Rockets			
			Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)			
			Carbon Fibre Stringers			
				Component Manufacturing (Fuel Pumps)		Component Manufacturing (Fuel Pumps)
	Parts (2)		Mechanical Components (CNC)			
			Special Purpose Steel Components			
	Materials/ Semi-Finished Products/ Surfaces (3)		Air Ducts			
			Fuel Lines			
			Exhaust Pipes			
			Hydraulic Pipes			
			Components for Payload Fairings			
			Carbon Fibre Stringers			
	Tools/Equipment (3)		Construction of Clean Rooms			
			Construction of Laminar Flows (Clean Room Ventilation)			
			Components for Mechanical Components			
			Components for Carbon Fibre Stringers			

Tab. 10: Launchers & Manned Flights - Manufacturing Companies

Consulting/Planning/ Concept Design	*Research and Development*	*Engineering*	*Quality Assurance and Certification*	*Product Support/ Logistics*	*Other Services*
Lightweight Structures					
Fibre-Reinforced Composites					
	Composites				
	Nanomaterials				
	Fibre-Reinforced Ceramics (Hot Structures and Joining)				
High Pressure Accumulators					
		Assembly Mounting			
	Development of Cryogenic Tank Systems				
	Fuel Lines				
	2 Phase Thermal Systems for Heat Transport				
	Thermal Management of Instruments				
	Structural Analysis, Layout				
	Calculation Tools				
	Cross Checks				
		Valve Inspections			
		Power Stroke Measurements			
		Manufacturing of Components			
		3D Measurements			
		Surface Roughness Measurements and Hardness Tests			
	Finding Solutions for Complex Technical Problems in SF Science (LISA, GAIA, XEUS,...)				
	Communication Protocols and Data Communication Technology				
		Clean Room			
Clean Room Planning		Clean Room Planning	Clean Room Measurements		

Tab. 11: Launchers & Manned Flights - Service Providers

Segment 3: Ground Segment

- 17 organisations, of which eight are manufacturing companies, five software companies, ten service providers and seven research institutions.
- Three companies are active on the subsystem level.
- The most strongly represented element in the value chain is product development.

Manufacturing Companies

Two companies are active at the subsystem level. In addition to VSAT systems, the ground stations for MOST and CoRoT fall into this category. On the subsystem level, three companies offer products whereas there are two suppliers for assemblies/components. With regard to horizontal integration, the development segment has the greatest coverage, followed by manufacturing with five and distribution, also with five companies. There are some products which pass through the entire value chain. These are: carrier system monitoring, easy line-up, interference localisation systems and components for payload fairings.

Service Providers

Service providers in this segment deal with topics such as mission control, ground station infrastructure, carrier monitoring systems, interference localisation systems and EO ground data systems. In addition, services related to precision and reference-point networks, flow simulations and meteorology are also offered.

Research Institutions

Research in the ground segment is carried out on satellite terminal and monitoring systems, measuring devices for microwave propagation, mechanical ground equipment, carrier monitoring systems, ground segment systems and in the field of basic algorithms and processing chains for radar and lidar systems.

		Value Chain				
		Applied Research	*Development*	*Manufacturing*	*Distribution*	*Logistics*
	# Org	*(3)*	*(7)*	*(5)*	*(5)*	*(4)*
Product Hierarchy	*System (2)*		VSAT Systems Ground Stations for MOST and CoRoT		VSAT Systems	
	Subsystem (3)		Carrier Monitoring System; Easy Line-up Interference Localisation System Ground Segment Systems Mission Control Ground Station Infrastructure EO Ground Data Systems Voice Conferencing Systems for the Preparation and Execution of Manned and Unmanned Missions Components for Payload Fairings		Ground Segment Systems Mission Control Ground Station Infrastructure EO Ground Data Systems	
	Devices/Modules (0)					
	Assemblies/Components (2)		Components for Payload Fairings Components for Ground Stations		Components for Ground Stations	
	Parts (0)					
	Materials/ Semi-Finished Products/ Surfaces (1)		Components for Fairings			
	Tools/Equipment (1)		Transport Containers for Satellites			

Tab. 12: Ground Segment - Manufacturing Companies

Consulting/Planning/Concept Design	*Research and Development*	*Engineering*	*Quality Assurance and Certification*	*Product Support/ Logistics*	*Other Services*
Mission Control		Mission Control		Mission Control	
Ground Stations for MOST and CoRoT					
Ground Segment Systems		Ground Segment Systems		Ground Segment Systems	
Ground Station Infrastructure		Ground Station Infrastructure		Ground Station Infrastructure	
Carrier Monitoring Systems		Carrier Monitoring Systems		Carrier Monitoring Systems	
VSAT Systems	Transmission Protocols for VSAT			Transmission Protocols for VSAT	
Easy Line-up (Support of Earth Station Antenna Alignment)		Easy Line-up (Support of Earth Station Antenna Alignment)		Easy Line-up (Support of Earth Station Antenna Alignment)	
Interference Localisation System		Interference Localisation System		Interference Localisation System	
					Provision of Infrastructure for Geoinformation
		Reference Stations			
EO Ground Data Systems		EO Ground Data Systems		EO Ground Data Systems	
	Voice Conferencing Systems for the Preparation and Execution of Manned and Unmanned Missions				
Precision and Reference Point Networks		Precision and Reference Point Networks			
		Assembly Mounting			
Flow Simulations					
Meteorology					

Tab. 13: Ground Segment -Service Providers

Segment 4: Instruments and Payloads

- 20 organisations are active in this segment.
- The areas of development and distribution have the greatest coverage, by six organisations each.
- In terms of product hierarchy, assemblies/components were most often listen (four companies).

Manufacturing Companies

In the instruments and payloads segment there are eight products which pass through the entire value chain from applied research to logistics. These are components for payload fairings, GPS receivers for high-precision positioning of satellites, release and positioning mechanisms, multi-layer insulation systems, determination of parameters of the human autonomic nervous system, multi-layer insulation systems, continuous bloodless blood pressure measuring equipment and stroke volume measurement.

In terms of vertical integration (product hierarchy), only the system level is not covered.

Service Providers

In this sector services for VSAT systems, 2 phase thermal systems for heat transport, thermal management of instruments, assembly mounting, materials (composites, nanomaterials, fibre-reinforced ceramics) and clean room planning are offered.

Research Institutions

Research in the instruments and payloads segment focuses on technologies based on miniaturised sensors such as docking sensors, rangefinders for formation flights, laser scanners for selecting a safe place to land and thermoelectric energy harvesters.

		Value Chain				
		Applied Research	*Development*	*Manufacturing*	*Distribution*	*Logistics*
	# Org	*(3)*	*(6)*	*(5)*	*(6)*	*(3)*
Product Hierarchy	*System (0)*					
	Subsystem (2)	Components for Payload Fairings				
		GPS Receivers for High-Precision Positioning of Satellites				
		Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)				
		Multi-Layer Insulation Systems				
	Devices/Modules (2)	Continuous Bloodless Blood Pressure Measurement Equipment				
		Continuous Bloodless Stroke Volume Measurement				
		Determination of Parameters of the Human Autonomic Nervous System				
		GPS Receivers for High-Precision Positioning of Satellites				
		Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)				
			Mechanical Ground Equipment Construction, Testing and Transport of Satellites			
	Assemblies/Components (4)		Coaxial Cables and Connectors up to 65 GHz			
		Components for Payload Fairings				
		Release and Positioning Mechanisms (e.g. for Antennas and Electric Propulsion Systems)				
		Multi-Layer Insulation Systems				
	Parts (1)		Connection Lines			
	Materials/ Semi-Finished Products/ Surfaces (1)	Components for Payload Fairings				
	Tools/Equipment (2)		Construction of Clean Rooms			
			Construction of Laminar Flows (Clean Room Ventilation)			

Tab. 14: Instruments and Payloads - Manufacturing Companies

Consulting/Planning/Concept Design	*Research and Development*	*Engineering*	*Manufacturing*	*Quality Assurance and Certification*	*Product Support/ Logistics*	*Other Services*
VSAT Systems	Transmission Protocols for VSAT				Transmission Protocols for VSAT	Communication Technologies
	2 Phase Thermal Systems for Heat Transport					
	Thermal Management of Instruments					
	Finding Solutions for Complex Technical Problems e.g. for SF Science Programmes (LISA, GAIA, XEUS,...)					
		Assembly Mounting				
	Composites					
	Nanomaterials					
	Fibre-Reinforced Ceramics (Hot Structures and Joining)					
Clean Room Planning		Clean Room Planning		Clean Room Measurements		

Tab. 15: Instruments and Payloads - Service Providers

Segment 5: Satellite-based Applications

- There are 44 organisations active in this segment, of which 13 software companies, 19 service provision companies and 23 research institutions.

Manufacturing Companies

Three companies are active on the system level in the satellite-based applications segment. Their products are from the areas of navigation, cartography and applications in the areas of infrastructure, spatial planning and forestry.

Service Providers

Services can be divided into the areas of navigation, earth observation and satellite - communication. (Tab. 17) -
The **navigation services** include data systems and infrastructure, GPS applications and GIS. - Hybrid measuring systems, an information and sensor platform for traffic information, - continuous situation awareness in the security sector and satellite navigation devices are - also supplied by Austrian companies. -
Earth observation includes provision of operational services from EO data, processing and - evaluation & interpretation of remote sensing data. Spatial data infrastructure - architecture and engineering as well as feasibility studies are other services offered in this - segment. -
VPN (virtual private networks), VoIP and IP TV as well as transmission protocols for VSAT - fall under the heading of **Satellite communication.**

Research Institutions

Concentrations include environmental monitoring, land coverage and land use, hydrology, remote sensing of the atmosphere, new applications of GNSS, development of GEOSS, interoperability (ISO, OGC, ...), Galileo and processing lines for RS data. Other areas include precision farming, hydrography and real-time interpolation.

		Value Chain				
		Applied Research	*Development*	*Manufacturing*	*Distribution*	*Logistics*
# Org		*(2)*	*(6)*	*(5)*	*(6)*	*(2)*
Product Hierarchy	*System (3)*		Route Documentation Geographically-Dependent Data Collection Mobile GPS Applications GIS Data Collection Digital Cartography Town, Spatial and Regional Planning Applications Forestry Sector Applications Forestry Sector Infrastructure			
	Subsystem (1)		EO Ground Data Systems		EO Ground Data Systems	
	Devices/Modules (0)					
	Assemblies/Components (2)		Coaxial Cables and Connectors up to 65 GHz Mechanical Components			
	Parts (2)		Mechanical Components Connecting Cables			
	Materials/ Semi-Finished Products/ Surfaces (0)					
	Tools/Equipment (1)		Mechanical Components			

Tab. 16: Products (Satellite-Based Applications)

	Consulting/Planning/Concept Design	***Research and Development***	***Engineering***	***Quality Assurance and Certification***	***Product Support/ Logistics***	***Other Services***
Navigation	GNSS Data Infrastructure and Test Bench for Attitute and Orbit Command Systems AOCS		GNSS Data Infrastructure and Test Bench for Attitute and Orbit Command Systems AOCS	GNSS Data Infrastructure and Test Bench for Attitute and Orbit Command Systems AOCS		System Operation and Engineering
	Mission-Specific Data Systems and Applications		Mission-Specific Data Systems and Applications	Mission-Specific Data Systems and Applications		
	Flight Dynamics Systems (FDS) und Mission Analysis and Global Navigation Satellite Systems (GNSS)		Flight Dynamics Systems (FDS) und Mission Analysis and Global Navigation Satellite Systems (GNSS)	Flight Dynamics Systems (FDS) und Mission Analysis and Global Navigation Satellite Systems (GNSS)		
			Correction Data for Satellite Systems			Provision of Infrastructure for Geoinformation
	Route Documentation					Consulting for GNSS Feasibility Studies
	Geographically-Dependent Data Collection					
	Mobile GPS Applications					
	GIS Data Collection					
	Special Developments for GNSS Services					
			Fleet Management			
			Electronic Logbook			
			Tracking & Tracing			
			Surveying			
	Precision Navigation Services		Precision Navigation Services			
	Hybrid Measurement Systems (GNSS)		Hybrid Measurement Systems (GNSS)			
	Information and Sensor Platform for Traffic Information					
	CSA (Continuous Situation Awareness Portal) in the Security Sector					
	SatNav Devices for Mobile GIS Applications		SatNav Devices for Mobile GIS Applications		SatNav Devices for Mobile GIS Applications	

	Consulting/Planning/Concept Design	*Research and Development*	*Engineering*	*Quality Assurance and Certification*	*Product Support/ Logistics*	*Other Services*
Earth Observation	Services for Satellite Data Analysis and Product Derivation from EO Data				Services for Satellite Data Analysis and Product Derivation from EO Data	
	Development and Provision of Operational Services for Products from EO Data				Development and Provision of Operational Services for Products from EO Data	
	Processing, Evaluation and Interpretation of Remote Sensing Data				Processing, Evaluation and Interpretation of Remote Sensing Data	Data Procurement and Customer-Specific Data Preparation
	Development of Applications for Remote Sensing Data				Development of Applications for Remote Sensing Data	
	EO Online Access Technologies (Visualisation and Transmission)			EO Online Access Technologies (Visualisation and Transmission)		Standardisation Support, Reference Implementations
	Spatial Data Infrastructure Architecture and Engineering (relevant for INSPIRE, GMES, GEOSS)			Spatial Data Infrastructure Architecture and Engineering (relevant for INSPIRE, GMES, GEOSS)		
	Relief Presentation from Satellite Images		Relief Presentation from Satellite Images			
	EO in Town, Spatial and Regional Planning			EO in Town, Spatial and Regional Planning		
	EO in the Forestry Sector			EO in the Forestry Sector		
	EO in Infrastructure			EO in Infrastructure		
	EO Ground Data Systems		EO Ground Data Systems		EO Ground Data Systems	
		Analysis of Ground Cover Data			Analysis of Ground Cover Data	
		Air Quality Analysis via EO			Air Quality Analysis via EO	
		Fire Monitoring via EO			Fire Monitoring via EO	
	Satellite Images and Specific Evaluations and Derived Products		Satellite Images and Specific Evaluations and Derived Products		Satellite Images and Specific Evaluations and Derived Products	

	Consulting/Planning/Concept Design	***Research and Development***	***Engineering***	***Quality Assurance and Certification***	***Product Support/ Logistics***	***Other Services***
	Feasibility Studies and Expert Reports (EO)		Feasibility Studies and Expert Reports (EO)			SW--Support, -Maintenance
Satellite Communication	All Satellite-Based Services: Data, VPN, VoIP, IP-TV				All Satellite-Based Services: Data, VPN, VoIP, IP-TV	Communication Technologies
		Transmission Protocols for VSAT			Transmission Protocols for VSAT	
		Satellite Communication for Air Traffic Control				
	Satellite Communication Infrastructure (Product Development and Consulting)					

Tab. 17: Segment 5 - Services

Segment 6: Space Science

- 14 organisations are active in this segment, of which 11 research institutions.

The technology-related topics in the field of spaceflight research dealt with in Austria are listed below.

- Materials Development, Material Testing Programmes, Developing of Testing Methods
- Computational Physics

- Solar System Exploration
- Meteorite Research
- Precision Photometry of Stars to Study Stellar Structure (Asteroseismology) or Search for Exoplanets, Star Activity and Star Rotation (Surface Imaging), Infrared Astronomy, X-Ray Astronomy, Mineralogy
- Concepts and Software for Photogrammetry on Explorer Missions
- Hardware and Software for Space Missions
- Space Plasma Physics, Plasma Surface Interaction
- Solar Observation, Space Weather, Interplanetary Observations
- Scenario-Based Exploration
- Pulse Frequency Spectra (Asteroseismology)
- Laser Physics
- Chemical Processes under Space-like Conditions, Analytical Cosmochemistry

- Microgravity Experiments
- Earth's Gravitational Field, Static and Variable-Time Gravitational Fields of the Earth, Mass Transport
- Earth System Research from Space, in particular Gravitational Field Determination
- Development of a Multifunctional Training and Diagnostic Device for Use in Zero-Gravity
- Quantum Cryptography
- Magnetometer based on a Quantum Interference Effect

- Radiation Effects, Dosimetry
- Risk Assessment
- Determination of Parameters of the Human Autonomic Nervous System
- Miniaturised Sensors (e.g. Pressure, Acceleration, Radar), Signal Processing

Structural aspects of space science in Austria are discussed in (Section 2.6) .

Segment 7: Other

- 8 organisations are active in segment 7 ("Other").
- Market Studies, Training, Programme and Science Management fall into this Segment.

Eight organisations responded that they are active outside of segments 1-6. These organisations deal with:

- Training for Systems Engineering
- Project Management (Project Setup, Project Recovery, Coaching)
- Knowledge Management
- ORBIT Programme System
- Scientific Studies based on Solar Observation Data and Interplanetary Observations (Sun-Earth)
- Market Studies on Space Technologies

Software

- 17 organisations offer software for the space sector.
- In this regard, the segment of satellite-based applications has the greatest coverage (21 mentions), followed by the ground segment with 7 software products.

In total, there are 17 organisations which offer software in the space industry.

Communication protocols and data communication technology and software for programming and control of communication hardware are found in the spacecraft segment and the launchers and manned spaceflight segment. In addition, there is flight software for onboard data reduction/compression and software for flow control actuators.

The following software falls under segment 3 (ground segment): carrier monitoring systems, easy line-up, interference localization systems, ground segment systems (mission control; ground station infrastructure), EO ground data systems, voice conferencing systems for the preparation and execution of manned and unmanned missions and control software (ground stations for the MOST and CoRoT projects).

Software for continuous bloodless stroke volume determination, determination of parameters of the human autonomic nervous system and prototypes for navigation and transport optimisation fall under the segment of instruments and payloads (segment 4).

Software for satellite-based services (segment 5) includes 14 software products in the area of GNSS, six software products for EO and one software product for satellite communication. These are listed after Tab. 18 .

Spacecraft	Launchers & Manned Flights:	Ground Segment	Instruments and Payloads:	Satellite-based Services
Communication Protocols and Data Communication Technology		Carrier Monitoring Systems	Continuous Bloodless Stroke Volume Measurement	14 GNSS Software Products
Software for Programming and Control of Communication Hardware		Easy Line-up	Determination of Parameters of the Human Autonomic Nervous Systems	6 EO Software Products
Onboard Data Reduction/Compression (Flight Software)	Software for Flow Control Actuators	Interference Localisation Systems	Prototypes for Navigation and Transport Optimisation	1 Software Product in the Field of Satellite Communication
		Ground Segment Systems (Mission Control; Ground Station Infrastructure)		
		EO Ground Data Systems		
		Voice Conferencing Systems for the Preparation and Execution of Manned and Unmanned Missions		
		Control Software: Ground Stations for the MOST and CoRoT Projects		

Tab. 18: Software by Segments

Amongst other things, software for the following satellite-based services are found in segment 5:

- GNSS Data Infrastructure and Test Bench for Attitude and Orbit Command Systems AOCS
- Mission-Specific Data Systems and Applications
- Simulation Tools for Trajectory Determinations
- Flight Dynamics Systems (FDS) und Mission Analysis and Global Navigation Satellite Systems (GNSS)
- Information Systems for Coordination of Units
- Route Documentation
- Geographically-Dependent Data Collection
- Mobile GPS Applications
- Software for Mobile Devices (e.g. Windows Mobile)
- GIS Data Collection
- Fleet Management
- Tracking & Tracing
- Surveying
- Software Development for GNSS Receivers
- EO Online Access Technologies (Visualisation and Transmission)
- Spatial Data Infrastructure Architecture and Engineering (relevant for INSPIRE, GMES, GEOSS)
- EO Ground Data Systems
- Analysis of Ground Cover Data
- Air Quality Analysis via EO
- Fire Monitoring via EO
- Satellite Communication for Air Traffic Control

11. What perceived market entry barriers exist?

- With regard to market entry barriers, especially the large companies mentioned long investment cycles and long lead times with funding and procurement programmes.
- Both the financial and technological risks in the space sector were described as obstacles.
- In the case of ESA procurement programmes, the complex access structures were also perceived as a barrier.

The big players in the Austrian market mentioned long investment cycles, long lead times of funding and procurement programmes and the associated problem of return on investment (ROI) as barriers. Moreover, they indicated that the technological risk is considerable and that a great deal of cost and effort is required to qualify technologies, processes and products. Two small companies mentioned data privacy directives and pre-financing for prototypes and high investment costs associated with hiring/training of new employees. With regard to orders, they noted very long "lead times" from announcement to tendering to contract start and initial payment.

Smaller market participants (SME's) mentioned the complex access structures, e.g. in the ESA, but a large company did as well. For small organisations (9), it is not always easy to gain access to the European spaceflight market. The "lacking network" and "difficulty in cooperating with existing workgroups" as well as "poor marketing for SME's not considered spin-offs from universities" were mentioned by two companies.

Not least corporate risk is a concern for SME's. In ESA tenders, the relationship between expenditure and chance of success is unfavourable. "Without pre-arrangements", they perceive ESA tenders as unachievable. The award decision process is not comprehensible and involves a lot of marketing and lobbying efforts. High entry costs and the associated risk were named by one company as was expensive certification, and the costly, long and drawn out acquisition and very complex tendering process.
SME's mentioned their small company size and, this item was mentioned by three companies - the market concentration in a small number of large companies as market entry barriers. Moreover, they said that there are too few or no OEM's (Original Equipment

Manufacturer) and major suppliers, which makes it harder to enter the market. They mentioned that the sector's requirements are often at the system level, which represents an accordingly high need for knowledge, technology and expertise.

In Section 2.9 , some of the market entry barriers are revisited from the point of view of how value and competitiveness can be increased.

2.6 Research and Development

In this chapter the research and development activities (R&D) of the companies are studied based on the following indicators: number of employees, publications and patents. In addition, research topics which could potentially be pursued cooperatively are gone into.

12. How many space R&D employees are there?

- 74% (476 persons) of all persons employed in the space industry and research (n=646) work in research and development.
- A very strong concentration is noted in this area: five companies employ 52% of all R&D employees.

Of the 646 persons working in the space sector, 476 work in research and development. This corresponds to 74%. As expected, this relationship can be seen amongst the research institutions to an even greater extent. 96% of the jobs in the research institutions fall under the heading research & development, but even in the companies, at 59% this percentage is relatively high and reflects the technology and research-intensive character of the space sector.

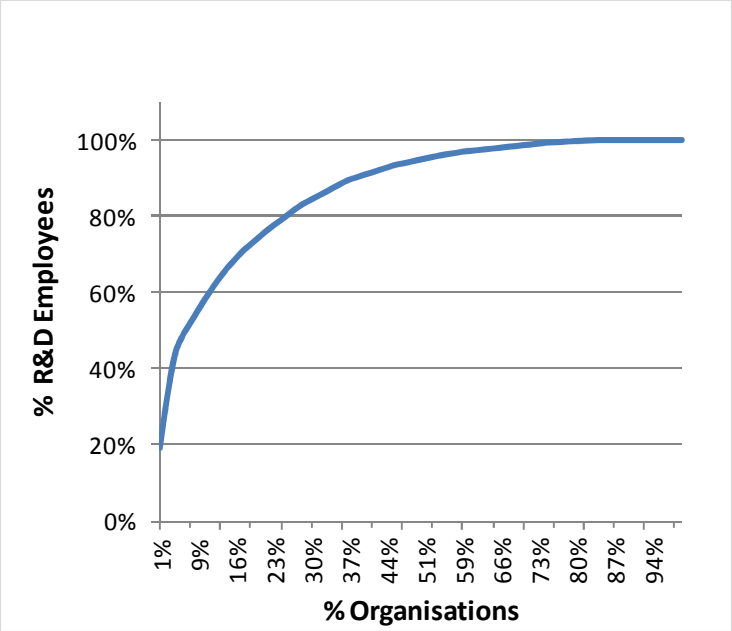

Fig. 17: Distribution of R&D Employees of Organisations in the Austrian Space Industry and Research (n=70)

From the graph above (Fig. 17), it is clear that there is a significant concentration in terms of the distribution of the F&D employees. The five largest employers in this area or 7% of the organisations employ more than half of all R&D personnel. 20% of the organisations, i.e. 14 organisations, employ around three fourths (74%) of all employees in research and development.

13. How many publications and patents are there?

- The number of publications by Austrian space companies and research institutes is 1037 per year (2009; n=49).
- 17 patents were obtained in 2009.

In 2009, 1037 publications were released by Austrian organisations in the space sector. The vast majority, i.e. 94% or 975 of these publications come from research institutes. Companies are responsible for 62 publications. In total, organisations obtained 17 patents in 2009. The majority of these were obtained by companies (14 patents, 82%) with three institutes holding patents (17%).

The Atom Institute of the Technical University of Vienna, the Space Research Institute of the Austrian Academy of Sciences and the Centre for Geoinformatics of the University of Salzburg (Z_GIS) are the most prolific with more than 80 publications each. The following institutes recorded 20 or more publications in the space sector:

- Institute for Photogrammetry and Remote Sensing (TU Vienna)
- Institute for Astronomy (University Vienna)
- DIGITAL - Remote Sensing and Geoinformation Research Group (Johanneum Research Ges.m.b.H)
- IGAM - Institute for Geophysics, Astrophysics and Meterology (Institute of Physics, Karl Franzens University, Graz)
- Institute for Communication Networks and Satellite Communication (TU Graz)
- DIGITAL - Space Technology and Acoustics Research Group (Johanneum Research Ges.m.b.H)
- Research Studio Austria Research Society, Studio iSPACE

The following section deals with the topics covered.

14. What topics are dealt with in publications?

- 33 organisations responded to the question as to what topics are dealt with in their publications.
- Proportionately speaking, satellite-based applications are most significantly represented in terms of publications. (n=14)

In terms of publications, there is a clear focus in the area of satellite-based applications. Within this sector, a broad spectrum of topics are dealt with. The fields of remote sensing (e.g. remote sensing of the atmosphere, GMES, environmental monitoring, disaster management, atmosphere and climate research), satellite navigation (e.g. applications for inland navigation) and satellite communication should be mentioned.

In the field of propulsion, two organisations list publications (laser ignition, slush hydrogen). With regard to materials, there are publications on composites as well as forming of tubes and profiles.

In addition there are (n=7) a number of other topics receiving attention and ranging from chip design to space experiments (ISS Miller Urey Experiment).

2.7 Cooperative Partnerships

This section deals with the question of cooperative relationships in the Austrian space industry and research. The following issues are discussed:

- What existing cooperative partnerships are there?
- With which countries/institutions do cooperative partnerships or does an interest in cooperation exist?
- In which areas is there a heightened interest in medium-term cooperation?
- What impediments to cooperation are there?
- What are the most import topics for the future?

15. What existing cooperative partnerships are?

- 56 organisations gave an answer to this question.
- 76% (56 out of 74) of the organisation in the Austrian space industry and research cooperate with other organisations.
- Research organisations (78%) cooperate roughly as often as companies (76%) with other organisations.
- Cooperative partners are mainly universities (they are involved on 40% of these cooperative ventures) as well as national and interventional research institutions and space organisations (DLR, ESA, NASA).

In total, nearly eight out of ten (77%) Austrian space organisations collaborate with other companies or research institutions. As such a majority of the research institutions (78%) and companies (76%) work together with other organisations (Tab. 19).

	Number of Cooperative Partnerships	Cooperative Partnerships (%)	Number of Organisations
Companies	31	76%	41
Research	25	78%	32
Total	56	77%	74

Tab. 19: Degree of Cooperation in the Austrian Space Industry and Research

Cooperative relationships exist more frequently in the area of research & development than in manufacturing, training and certification (Tab. 20). The forerunners here are large organisations generating more than 1 M€ in annual turnover in the space industry and research sector. 85% of these organisations cooperate with others in the area of research and development. This figure is almost just as large amongst organisations generating more than 75% of their turnover in the space sector (85%).

An interesting aspect to note is that small companies (less than 1 M€ in turnover in the space industry or research) cooperate to a lesser degree with other organisations than is the case with large companies. This is particularly evident in the areas of production (10% vs. 46% cooperation), training (15% - 38%) and certification (8% - 46%).

Cooperative relationships amongst large companies (spaceflight turnover >1 M€) in the fields of manufacturing (46%), training (38%) and certification (46%) are the most common. Cooperative research ventures are, at 85%, just as common as amongst organisations having spaceflight as their main field of activity.

	R&D		Manufacturing		Training		Certification	
Companies (41)	27	66%	8	20%	8	20%	6	15%
Research Institutions (32)	23	72%	5	16%	5	16%	5	16%
Spaceflight T/O ≤1 M€ (52)	34	65%	5	10%	8	15%	4	8%
Spaceflight T/O >1 M€ (13)	11	85%	6	46%	5	38%	6	46%
Manufacturing Companies (22)	14	64%	7	32%	4	18%	4	18%
Core (SF T/O ≥75%) (13)	11	85%	5	38%	5	38%	4	31%

Tab. 20: Existing Cooperative Partnerships of the Austrian Space Industry and Research by Company Size, Sector and Type of Spaceflight Involvement

The Austrian companies and research institutions cooperate with a broad range of partners. In research and development, universities are the most common partners. Of 48 R&D cooperative partnerships, at least one university is involved in 19 of them. Cooperative partnerships with the German Aerospace Centre (DLR) are also very common (13 mentions). The Austrian Institute for Technology (AIT) and the EAS were named by 9 organisations each.

As expected, in manufacturing, nearly all cooperative partners are companies, in training: universities, and in certification: space organisations like the ESA or testing and certification institutions such as TÜV.

16. With which countries/institutions do cooperative partnerships or does an interest in cooperation exist?

- In 45% of the organisations (n=40), there is an interest in (increased) bilateral cooperation with Germany and 18% of the surveyed organisations would welcome an intensification of bilateral relationships with the US and France.
- The vast majority of the organisations surveyed (83%, 39 out 47) express a heightened interest in cooperating with the European Space Agency. 38% of the organisations are interested in cooperating with NASA.

- 17% or 8 organisations would like to collaborate or expand their collaboration with the United Nations.

In terms bilateral cooperation, Germany is named by 45% of the companies as a desired partner (n=40). The US (18%) and France (18%) are tied at second place with Russia (15%) and China (10%) in third and fourth place, respectively. India, Italy (three mentions each), Africa (2 mentions) and "developing countries" (2 mentions) were also named. In addition to Germany, other neighbouring countries were also named (Slovenia, Hungary, one mention each).

The interest in cooperation with the ESA is present amongst nearly all research institutes (90%) and most of the companies (78%) also view this as desirable. 50% of the institutes and 30% of the companies would like to collaborate with NASA. The United Nations (19% of the companies, 15% of the institutes) and JAXA (7% of the companies, 5% of the institutes) were also listed.

17. In which areas is there a heightened interest in medium-term cooperation?

- 56% (n=41) of the companies and 69% of the research institutions (n=32) are interested in future cooperation in research & development. With regard to manufacturing, training and certification, the interest in cooperation is lower amongst the organisations.
- The topics in which interest in cooperating exists are quite diverse. One focus is on satellite-based applications and another on materials and propulsion systems.

A relatively small percentage of the organisations are interested in increased cooperation in the area of certification, i.e. only 12% of the companies and 6% of the Institutes (Tab. 21). In research & development, the interest in cooperation amongst the research institutions is higher than amongst the companies (69%-56%).

Major institutions (spaceflight turnover > 1 M€) and ones listing spaceflight as their core business (SF turnover makes up more than 75% of total), have the greatest interest in intensified cooperation in research and development in the future (Tab. 21).

	R&D		Manufacturing		Training		Certification	
Companies (41)	23	56%	13	32%	7	17%	5	12%
Research Institutions (32)	22	69%	6	19%	2	6%	2	6%
SF Turnover ≤1 M€ (43)	30	57%	12	23%	6	11%	5	9%
SF Turnover >1 M€ (13)	8	62%	3	23%	2	15%	1	8%
Manufacturing Companies (22)	11	50%	8	36%	4	18%	3	14%
Core (SF Turnover ≥75%) (13)	9	69%	3	23%	2	15%	0	0%

Tab. 21: Interest by the Austrian Space Industry and Research in Future Cooperative Partnerships

Interest in cooperation exists by Austrian companies and research institutes in the following topics:

- **Satellite-based Applications** (Remote Sensing, Navigation, Communication, Security and Defence) -
- **Materials**
- **Satellite and Instrument Construction**
- **Propulsion Technology**
- **Software**
- **Medical Applications**

In accordance with the alignment of the Austrian space industry and research, there is a great deal of interest in cooperation in the domain of **satellite-based applications.** The sectors mentioned were environmental monitoring, geoinformation systems (GIS), image processing and measuring (e.g. image information mining technologies, photogrammetry) and products and services using sensing data, e.g. decision support systems including remote sensing data. There is also interest in cooperation in the field of navigation as well (mobile devices for routing and navigation, location-based services) and satellite communication.

In the **materials segment**, organisations indicated an interest in cooperating in lightweight construction, shielding materials, nanomaterials fibre-reinforced ceramics (hot structure), polymer composite technologies, thermal insulation and tribology.

There is also interest in cooperation in **propulsion technology** (e.g. laser ignition systems). Concretely speaking, valve development, fuel regulators, cryogen technology and laser ignition.

Six organisations expressed a desire to cooperate in **satellite and instrument construction.** The organisations mentioned development of small satellites/earth observation satellites and their applications, triaxial stabilised nanosatellites and development of instruments for space research.

In addition to these focus areas, radiation research (radiation effects on biological systems and solid objects, radiation protection radiations for spaceflight) as well as medical applications were mentioned.

18. What impediments to cooperation are there?

- 31 organisations answered this question.
- Financing is at the top of the list of impediments to cooperation.
- The absence of a network and/or a lack of willingness to cooperate and competitive thinking are the second most frequent mention.

With regard to the question as to what impediments to cooperation exist, approximately one fourth of the answers (8 answers; n=31) have to do with financing. Mentioned here are "long-term financing of joint research projects," "costs for initiating research" and the "high pre-financing costs" that are necessary as well as the "rigid procurement structures of large companies." Also mentioned are the "relatively long lead times associated with funding programmes" and the "absence of long-term programmes to develop level 2+ processing chains." One research institute listed that space is "almost exclusively financed with public funds (ESA), which creates strong competition, even within a country.

A second topic mentioned was the lacking willingness to cooperate/the prevailing competitive thinking in companies and research institutes. "Dealing with advanced and complex technologies" requires "well organised task sharing and sharing of results and profit," which is contradictory to the extremely competitive thinking. Other organisations simply mentioned "lacking willingness to cooperation," self-interests" and "distrust" as impediments to cooperation. Overall, they consider it very laborious to gain access to a network.

These two topics were indicated by both small and large companies.

Some of the SME's (n=5) made it clear in their answers that the lacking size represents an obstacle in gaining access to ESA procurement. Other obstacles mentioned include: **"not** well known," "lack of staff" and "young age of the company and thus short list of references."

2.8 Technology Transfer

19. What space technologies have to potential to be used in other industries?

- One concentration in terms of technologies used outside of the space industry is on satellite-based application (remote sensing, satellite navigation).
- Highly resilient materials, composites and hydrogen technologies also have potential outside of the space industry.

Companies see potential especially in the area of satellite-based application such as remote sensing and satellite navigation, but also in materials (lightweight construction, composites, surfaces) as well as in hydrogen technologies. The identified potential is viewed somewhat differently by the research institutes. Here, the focuses are on high resilience materials (coatings, composites), detector systems for radiation measurement, risk models, shielding materials and high-resolution and hyperspectral satellite remote sensing.

Space technologies with application potential in other industries are, from the survey participants' point of view:

Satellite-based Applications

- Data visualisation: Remote sensing data as a standard for visualisation in numerous fields
- Synergetic utilisation of earth observation with models for environmental monitoring
- Satellite-based remote sensing for disaster management, conflict monitoring, early warning, development policy interventions -
- Geographical information technology, geo-information systems -
- Interactive navigation with linked data transfer -
- Digital image processing -

Materials

- New materials: "designer materials" and fibre-reinforced composites made from new polymers, ceramic precursors or hybrids. High temperature lightweight construction components
- Extremely lightweight construction -
- Shielding materials for radiation -
- Coatings -
- Fibre-reinforced composite manufacturing and processing technologies -
- Computation software for material characteristics -

Propulsion Engineering

- Hydrogen technology -
- High pressure accumulators for hydrogen vehicles -
- Cryogenic technologies -

Manned Spaceflight

- Inspiring topics like manned spaceflight and associated technologies -
- Monitoring of astronauts, stress determination -

Other

- Standard-compliant information technologies developed from the ground segment

- Onboard data reduction
- Laser technology, precision clocks
- Detector systems for radiation measurement
- Risk models

20. What organisations are already engaging in technology transfer?

- Overall, technologies from 43% of the organisations are used outside of the space industry and research segment.
- The most important sectors here are surveying, the aerospace sector, the automotive industry, medical technology, plant engineering and security and the environment.
- With regard to transferred technologies, the number one type mentioned is satellite-based applications, followed by propulsion technologies and developments in the field of new materials.

Austrian space technologies are used in very different fields. The main sectors to be mentioned here are surveying, the aviation sector, the automotive industry, medical technology, plant engineering and security and environment.

The technologies used therein often come from the segment of satellite based-technologies, such as remote sensing, satellite navigation, satellite communication and image processing/analysis and data visualisation. In the area of propulsion technologies, transfers have already taken place in hydrogen technology and laser ignition for engines. Other transfers include ones in the area of new materials, thermal insulation, magnetometers, measurement methods and simulation procedures.

	Technology Transfers		Organisations
	n=	%	
Companies	16	36%	44
Research Institutions	16	53%	30
≤1 million	21	39%	54
>1 million	7	54%	13
Core SF	10	77%	13
Total	**32**	**43%**	**74**

Tab. 22: Number of Technology Transfers carried out

Technologies from 43% of the organisations are used outside of the space industry. This percentage is, at 53%, higher amongst research institutes than amongst companies, of which 36% list that products developed for space are being used in other industries. At 54%, technology transfers are more likely in large organisations than small ones (39%) and most likely, at 77%, in organisations generating more than 75% of their turnover in the space industry and space research.

Technology Transfers carried out:

Satellite-based Applications

- Digital Image Processing, Data Visualisation
- GNSS Applications
- Automated Image Analysis Processes
- Laser Scanners for Surveying
- Land Coverage and Land Use for Public Administration
- Satellite-based Earth Observation in Water Management and Hydrology
- Aerial Surveying, Traffic Management Systems, Maintenance Logistics
- Snow and Ice Monitoring for Water Management and Geotechnical Planning (Mass Movements)

- Satellite Communication Systems were used in terrestrial broadband networks and communications systems for aircraft (flight platform).
- Near-Real-Rime METOP ASCAT Soil Moisture Service Operated by EUMETSAT
- Compressed Sensing
- Special Precipitation Measurement Device ("Distrometer") for Terrestrial Broadband Applications and Flight Platforms

Propulsion

- Laser Ignition for Engines
- Hydrogen Technology

Medicine

- Sensitive Magnetometers also usable in Medical Technology
- Thermal Insulation (Magnetic Resonance Imaging)
- Shielding
- Research Results in the Area of Human Factors and Physiology
- Measurement Methods

Information Technology

- Development of Software Programmes for the File Administration and Application in the Web Service Activities. Computer Programmes to Analysis Safety Issues of Nuclear Reactors.
- Calculation Tools
- Standard-Compliant Information Technologies Developed from the Earth Observation Ground Segment
- Flow Simulations for Comfort Studies/ Microclimate Assessments in Urban Settings

2.9 Value Creation and Competitiveness

21. How can Austrian value creation and competitiveness be increased from the organisations' point of view?

- According to the organisations, funding measures are needed in the fields of pure research, research and development overall, in young companies and new technologies. In particular, more regular and better endowed ASAP calls as well as intensive participation in ESA programmes were mentioned.
- Increased international networking and visibility of Austrian organisations was also listed as a measure to increase added value.
- Improvement of training and further education and competence bundling and niche concentration are also viewed as important.

Both companies and research institutions see promotion of research and development as centrally important in increasing Austrian value and competitiveness in the space sector. More regular and better endowed ASAP calls are listed as is an expansion of promotional measures in the areas of pure research, research & development and for start-ups. One suggestion is to create financial incentives for companies so that they direct more funds to research. In addition to the ASAP programme, ESA programmes are also mentioned. Here a desire for bigger budgets is expressed and "appropriate support" asked for. One company wishes to receive "financial support for further development of prototypes, developed in research projects, to make them ready for market, e.g. through favourable venture capital options." One company pointed out that it is important, "to establish suitable framework conditions in the area of research & development, such as risk minimisation through guarantees, subsidies for research and development and export activities" in order to increase added value and competitiveness.

In addition to the financing and research funding, the area of "cooperation and networking" was another topic discussed. The international networking and visibility of Austrian organisations should be advanced. Increased cooperation between industry companies and research institutions and pooling of competences from both areas are desired. Networking amongst R&D institutions is also mentioned, as is the desire for improved "communication among application developers and technology developers." Other measures to increase

added value and competitiveness listed include intensified involvement with the ESA and their technology programmes as well as "other European research institutions." One university institute stated that "better lobbying" with the ESA is needed. Although qualification is reportedly good in many areas, competing in ESA calls for tenders is very difficult since the organisation is not a "primary contractor." Development of bilateral cooperative partnerships is viewed as desirable.

According to three companies, improvement of space-specific tertiary education is necessary to increase added value and competitiveness. One company mentions the need for support for new, innovative companies.

Pooling of competences and niche focuses are also desirable. One research institution indicated that these should be areas which are not extremely cost-intensive "in order to be able to implement certain initiatives to the greatest extent possible." One company mentioned the development of telematics systems and telematics services as desirable goal and another indicated increased use of remote sensing data and methods in the public sector.

3 Outlook

The Austrian space industry and research is quite heterogeneous, both in terms of its structure and topics dealt with it. Despite a relatively large number of organisations which do not include space as their core business, there are few overlaps with aviation. Only nine companies operating in the space sector are also represented in the Aeronautics Competence Atlas published by the Federal Ministry for Transport, Innovation and Technology (www.aeronautics.at).

The results of this study were incorporated into the BMVIT's strategic paper, "Weltraum – Zukunftsraum. Space Vision 2020: Die österreichische Weltraumstrategie" (Outer Space - Future Space. Space Vision 2020: The Austrian Space Strategy). As such, this report should also be viewed in the context of far reaching efforts by Austrian (research promotion) policy in the space sector.

As a next step, BMVIT plans to publish a competence atlas for the Austrian space industry and research, which will be done in the form of a webpage and brochure. This study provides the foundation for greater coverage of the sector. This competence atlas should thus contribute significantly to the international networking and visibility of the Austrian space industry and research.

The national funding programme, which may serve, not least as a stepping stone to the international arena, is of major relevance for the Austrian space industry and research. This way, for example, topics in the field of earth observation and navigation, for which particular demands are made due to the topography here in Austria, can be better researched and applied.

In addition, in the summer of 2011, the ESA's National Technology Transfer Initiative, NTTI for short, will begin for Austria. The goal of this initiative is to strengthen the Austrian business community by facilitating the transfer of space technology to fields outside of the space industry and research.

4 Appendix

4.1 List of Organisations

Below, the organisations which took part in the survey are listed:

Industry

Name	Website
3D Systems Engineering AT GmbH	www.3DSE.at
ANDRITZ AG	www.andritz.com
ATOS ORIGIN Information Technology	www.atosorigin.com
AW Software und Technologie GmbH	www.awst.at/en/index.html
Federal Office for Metrology and Surveying	www.bev.gv.at
Cleanroom Technology Austria Gmbh	www.crta.at, www.reinraum.at
CNSystems Medizintechnik AG	www.cnsystems.at
COMMUNICATION & NAVIGATION	www.c-n.at
creative BITS OG	www.creativeBITS.com
Crosat Telekommunikation GmbH	www.crosat.at
DI Peter Stix Zivilgeometer	www.hauerstix.at
ELB-FORM GmbH	www.formgroup.eu
ENVEO Environmental Earth Observation IT GmbH	www.enveo.at
eoVision GmbH	www.eovision.at
EOX IT Services GmbH	www.eox.at
Fleischmann Consult ZT Gmbh.	www.fleischmann-consult.com
Frequentis AG	www.frequentis.com
GeoMatica OG	www.geomatica.at
GeoVille Gmbh	www.geoville.com
GFÖLLNER Fahrzeugbau und Containertechnik	www.gfoellner.at
HUBER+SUHNER GmbH	www.hubersuhner.at
Ing. Ernst Kurri Ges.m.b.H.	www.kurri.com
Ingenieurbüro Schmechtig Ziviltechniker für Vermessungswesen	www.schmechtig.info
INTALES GmbH	www.intales.com
KOWE CNC Metallverarbeitung GmbH	www.kowe-cnc.com
LIQUIFER Systems Group	www.liquifer.com
MAGNA STEYR Fahrzeugtechnik AG & Co KG	www.space.magnasteyr.com
MCE Maschinen- und Apparatebau GmbH & Co KG	www.mce-map.bilfinger.com
Peak Technology GmbH	www.peaktechnology.at

Pichler & Strobl GmbH	www.pichler-strobl.at
PRISMA solutions EDV Dienstleistungen GmbH	www.prisma-solutions.at
Raumfahrt Technologie Beratung Wien - Ingenieurbüro für Technische Physik	www.rtbv.at
RISC Software GmbH	www.risc-software.at
RUAG Space GmbH	www.ruag.com/space
Secar Technologie GmbH	www.secar.at
Siemens AG Österreich - Space Business	www.siemens.at/space
SISTEMA GmbH	www.sistema.at
TeleConsult Austria GmbH	www.teleconsult-austria.at
Test -Fuchs GmbH	www.test-fuchs.com
Transfercenter für Kunststofftechnik GmbH	www.tckt.at
TTTech Computertechnik AG	www.tttech.com
Umweltdata GmbH	www.umweltdata.at
via donau - Österreichische Wasserstraßen-Gesellschaft mbH	www.via-donau.org
Weatherpark GmbH Meteorologische Forschung und Dienstleistungen Ingenieurbüro für Meteorologie	www.weatherpark.com

Research

Name	**Website**
Aerospace & Advanced Composites GmbH früher AAC Bereich der AIT [formerly a division of AIT]	www.aac-research.at
AIT Austrian Institute of Technology - Safety & Security Department	www.ait.ac.at
alpS - Zentrum für Naturgefahren und Risikomanagement GmbH	www.alp-s.at
Carinthian Tech Research AG	www.ctr.at
Joanneum Research Forschungsgesellschaft mbH, DIGITAL, Forschungsgruppe Fernerkundung und Geoinformation	www.joanneum.at/digital/fer
Joanneum Research Forschungsgesellschaft mbH, DIGITAL, Forschungsgruppe Fernerkundung und Geoinformation	www.joanneum.at/digital/spa
Karl Franzens University, Graz, Institute of Physics, Institute for Geophysics, Astrophysics and Meterology (IGAM)	www.uni-graz.at/igam
Karl Franzens University, Graz, Wegener Centre for Climate and Global Change	www.wegcenter.at
Austrian Academy of Sciences, Institute for Space Research	www.iwf.oeaw.ac.at

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Research Studio Austria Research Society, Studio iSPACE	http://ispace.researchstudio.at/home_de.html
RIEGL Research Forschungsgesellschaft mbH	www.riegl.com
Salzburg Research	www.salzburgresearch.at
Technical University of Graz, Institute for Experimental Physics	http://iep.tugraz.at
Technical University of Graz, Institute for Remote Sension and Photogrammetry	www.geoimaging.tugraz.at
Technical University of Graz, Institute for Communication Networks and Satellite Communication	www.tugraz.at/iks
Technical University of Graz, Institute for Navigation	www.inas.tugraz.at
Technical University of Graz, Institute for Theoretical Geodesy and Satellite Geodesy	www.itsg.tugraz.at
Technische University of Vienna, Atom Institute	www.ati.ac.at
Technical University of Vienna, Institute for Geodesy and Geophysics, RG Higher Geodesy	http://mars.hg.tuwien.ac.at
Technical University of Vienna, Institute of Construction Sciences and Technical Logistics, Machine Design and Rehabilitation Engineering Division	www.ikl.tuwien.ac.at/mel
Technical University of Vienna, Institute of Photogrammetry and Remote Sensing	www.ipf.tuwien.ac.at
Technical University of Vienna, Photonics Institute	www.tuwien.ac.at/photonik
Technical University of Vienna, Institute of Sensor and Actuator Systems, Department of Microsystems Technology	www.ifwt.tuwien.ac.at
BOKU - University of Natural Resources and Life Sciences, Vienna, Remote Sensing and Land Information	www.rali.boku.ac.at/ivfl.html
BOKU - University of Natural Resources and Life Sciences, Vienna, Institute of Landscape Development, Recreation and Nature Conservation Planning	http://www.rali.boku.ac.at/ilen.html
University of Innsbruck, Institute of Ion Physics and Applied Physics	www.uibk.ac.at/ionen-angewandte-physik
University of Innsbruck, Institute of Meteorology and Geophysics	http://imgi.uibk.ac.at/
University of Vienna, Department of Lithosphere Research	http://lithosphere.univie.ac.at
University of Vienna, Institute of Astronomy	http://astro.univie.ac.at
University of Salzburg, Centre for Geoinformatics Z_GIS	www.zgis.at

4.2 Questionnaire

Dear Sir or Madam,

The purpose of the Ö-SPACE study is to collect data on the Austrian space industry and research. The objectives are to create a database of market participants, analyse the value chains in the various segments and identify potential for cooperation. For this reason, research institutions and companies are deliberately being surveyed with a identical questionnaire.

In order to obtain a complete, valid and reliable set of data, we need the support of every organisation. As such, we request that please fill out this questionnaire for your organisation and if possible that you return it to **jb@brimatech.at** by **9 July 2010**. The questionnaire will take up 10-15 minutes of your time.

The contents of the questionnaire will only be used for internal project evaluation. Your information will not be disclosed to third parties. Subsequently, we plan to publish the company profiles (this corresponds to questions 1-13) in a competence catalogue, after consultation with the companies.

This survey is being conducted by BRIMATECH Services GmbH. If you would like to contact us, please direct your enquiries to:
Mag. Johanna Berndorfer, jb@brimatech.at.

Survey Questionnaire on the Austrian Space Industry and Research

1. *Name of Organisation/Institute:* _____

2. *Address:* _____
3. *Postcode:* _____
4. *City:* _____
5. *Website:* _____

6. *Year founded (for Companies):* _____
7. *Active in the space sector since:* _____

who

	Contacts:	Contact 1	Contact 2	Contact 3
8.	*Name:*			
9.	*Position:*			
10.	*Tel:*			
11.	*E-mail:*			

12. Sector:
In what sector(s) (space, automotive, aviation, etc.) are do you primarily operate? _____

13. Segments:
We have divided the Austrian space sector into 7 segments. In which segment/s would you classify your organisation with regard to space? (Multiple answers possible)

_____ 1. Spacecraft: (space vehicles, stations and probes, satellites)
(structure, materials and manufacturing techniques, equipment, electronics, avionics, propulsion, basic systems, engineering)

_____ 2. Launchers & Manned Flights:
(structure, materials and manufacturing techniques, equipment, electronics, avionics, propulsion, basic systems, engineering)

_____ 3. Ground Segment
(ground stations, reference stations, telescopes, launch equipment, engineering)

_____ 4. Instruments and payloads
(for remote sensing (lidar, optical sensors, radar, radiometers, etc.), for navigation, for telecommunications, for security and defence, for space research (robots for missions, etc.), engineering

_____ 5. Satellite-based Applications
(earth observation, navigation, telecommunications, security & defence, end user equipment, engineering)

_____ 6. Space Science
(pure research for space technology, exploration, microgravity, simulation, other experimental research)

_____ 7. Other, i.e. _____

14. Special Competences:
What space-relevant competences does your organisation have?

15. Products/Services/Research Topics in the Space Area:
What products and/or services does you as a company offer in the space sector?
What research topics do you deal with as a research institution in the space sector?

16. *Are you a: (multiple choices possible)*

____ Manufacturing company
____ Software Manufacturer
____ Service Provider
____ Distributor
____ Research Institution

If you answered manufacturing company, distributor and research institution, please go on to question 18.

17. *In which field does your service provision company operate:*
(multiple answers possible)

____ Research and Development
____ Engineering
____ Quality Assurance and Certification
____ Product Support (technical assistance, maintenance, spare parts, documentation, training)
____ Consulting/Planning/Concept Design
____ Other services, i.e. _____

18. *Please list 3 or 4 of your chief products/services/research fields in the space sector. Please provide a generic product name in each instance, no organisation-specific product names.*

Chief products/services/research fields:	A	B	C	D

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19. *In which of the 7 segments do these products/services/research fields belong?*
(please check off as appropriate)

1. Spacecraft: (space vehicles, stations and probes, satellites) (structure, materials and manufacturing techniques, equipment, electronics, avionics, propulsion, basic systems, engineering)				
2. Launchers & Manned Flights: (structure, materials and manufacturing techniques, equipment, electronics, avionics, propulsion, basic systems, engineering)				
3. Ground Segment (ground stations, reference stations, telescopes, launch equipment, engineering)				
4. Instruments and payloads (for remote sensing (lidar, optical sensors, radar, radiometers, etc.), for navigation, for telecommunications, for security and defence, for space research (robots for missions, etc.), engineering				
5. Satellite-based Applications (earth observation, navigation, telecommunications, security & defence, end user equipment, engineering)				
6. Space Science (pure research for space technology, exploration, microgravity, simulation, other experimental research)				
7. Other				

20. *To which level of the product hierarchy would you assign these products/services/research fields? (please check off as appropriate)*

1. System				
2. Subsystem/Aggregates				
3. Devices/Modules				

4. Assemblies/Components				
5. Parts				
6. Materials/Semi-Finished Products/Surfaces				
7. Tools/Equipment				

If you answered service provider, research institutions and distributions, please go on to question 22.

21. *Which elements of the value chain do these product pass through in your company? (please check off as appropriate)*

1. Pure Research				
2. Applied Research				
3. Development				
4. Manufacturing				
5. Distribution				
6. Logistics (= Product Support)				

22. Total Employees (full-time equivalent) in 2009*:*
How many employees did your company/institute have in 2009 (full-time equivalent)?

_____ (estimate if possible)

23. Space Employees (full-time equivalent):
How many of them worked in the space area? _____ (estimate if possible)

24. R&D Space Employees (full-time equivalent):
How many of them worked in the research & development? _____ (estimate if possible)

25. Total Turnover for 2009:
Please state your total turnover for 2009:

_____ in Euros (estimate if possible)

26. Space Turnover for 2009
How much of this is attributed to space? _____ in Euros (estimate if possible)

27. Standards and Certifications:
What standards and certifications does your company have/do you have for your products? _____

28. Number of Scientific Publications per Year:
On average, how many scientific publications do you produce each year? (alternatively, in 2009) _____ (estimate if possible)

29. Number of Patents Granted per Year
On average, how many patents were granted to you per year (alternatively, in 2009) _____ (estimate if possible)

30. Topics:
What topics are dealt with therein? _____

Research institutions, please go on to question 33.

31. Export Rate in the Space Sector:
How high is your export rate in the space sector? _____ %

32. Export Markets in %:
To what markets do you primarily export? Please estimate the percentage shares for North/South America, etc.
North America: ____ South America: ____ Europe: ____ Asia: ____ Africa: ____ Australia: ____

33. Reference Clients in the Space Sector:
Please list some reference clients in the space sector:
(Sponsors, in case of research institutions) _____

34. Suppliers in the Space Sector:
This study also aims to present the networking of the Austrian industry and research landscape in order, amongst other things, to create better framework conditions for cooperation. Therefore, we would like to ask you to name your primary suppliers. _____

35. Increasing Added Value/Competition:
How could Austrian added value/competitiveness be increased? What intra-company, intra-industry or public measures should be urgently instituted in order to increase Austrian added value and competitiveness in the space sector?

36. Market Entry Barriers:
What factor make it difficult to enter the space industry/the market?

37. Cooperation in the Space Sector:
With what companies or research institutions to you cooperate in the space sector?

R&D
Manufacturing
Training
Certification

38. Interest in Cooperation:
With which institutions (ESA, NASA, UN, …) is there a heightened interest in cooperation?

39. *With what countries would a bilateral cooperative partnership be particularly appealing and should be set into motion by the public sector?*

40. Interest in Cooperation, Topics: *In what space-relevant areas do you have a strong interest in cooperation in the medium-term? Please list relevant topic areas?*

R&D
Manufacturing
Training
Certification

41. Impediments to Cooperation:
What, in your opinion, impedes such cooperative relationships?

42. Technology Transfer:
What space technologies have, in your opinion, great potential for use in other industries?

43. *What space technologies developed by you have been/are being used in other industries?*

44. Comments:

Thank You!

Please send the completed questionnaire to Ms. Mag. Johanna Berndorfer jb@brimatech.at