



New Space – new dynamics in space exploration

TAB-Fokus no. 29 regarding brief study no. 1

October 2020

Summary

- › New Space refers to dynamics of innovation in space exploration that are driven by the private sector. New business areas are emerging due to an easier access to and use of space.
- › Around the world, there are different approaches to encourage the development of New Space companies. In this context, national space agencies play a central role.
- › The German space and New Space ecosystem is considered an innovation driver and technology developer for European space exploration. In international comparison, however, its competitiveness is less pronounced.
- › A lack of venture capital, unclear regulatory framework conditions and insufficient transfer of technologies and data to non-space industries hinder growth in the space industry through New Space players.
- › New financing instruments, a national space law as well as the consideration of the specific dynamics and requirements of space companies in political strategies might strengthen the New Space sector and the space industry in Germany.

What is involved

New Space refers to a commercialisation of space exploration that is increasingly driven by private-sector companies. Private-sector players are creating a momentum of innovation in space exploration by developing new technologies and business models. Even if New Space points to completely new developments, no clear line can be drawn between »Old Space« and »New Space«. Long-established companies are just as active as start-ups in the areas assigned to New Space. On the one hand, New Space companies operate in the established business areas of the traditional space industry, e. g. communications, navigation and earth observation. On the other hand, however, they are opening up completely new fields of activity – such as space tourism, space services including the removal of space debris, space mining and manufacturing – or are even aiming at developing new

space habitats. These developments are driven by innovations, particularly in the fields of miniaturisation, 3D printing, robotics and artificial intelligence (AI), which result i. a. in constantly declining costs for space transportation and enable new applications.

Prospering space market

Between 2005 and 2017, the global market of space-based economy has constantly grown at an average rate of 6.7 % p. a. Whereas companies in the space industry had a turnover of approx. 175 billion USD in 2005, this value increased to a total of 366 billion USD by the end of 2019. In the next 20 years, the market is expected to show a continued growth at an average rate of 5 % p. a.

In the space industry, a distinction is made between upstream and downstream sectors. The upstream sector includes those activities that are intended to launch objects into orbit and to operate them there (e. g. satellite manufacturing, launcher systems, spacecraft). The downstream sector essentially comprises the commercial use of products and services on Earth in the areas of satellite-based communications, navigation and earth observation. Upstream and downstream developments mutually stimulate each other and boost the dynamics of New Space markets.

Numerous new applications are enabled and become economically viable thanks to New Space activities, as e. g. rocket launches are becoming cheaper or small and affordable satellites (or satellite constellations) are being used. Increasingly, novel business models as well as products and services are emerging that have an impact not only within space exploration but also in non-space industries.

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Current market potential lies primarily in the application of microsatellites, launcher systems and services in the areas of communications, navigation and earth observation, which are already largely implemented today, but – thanks to New Space – can still experience significant impetus and offer further development potential.

Trends, drivers and barriers

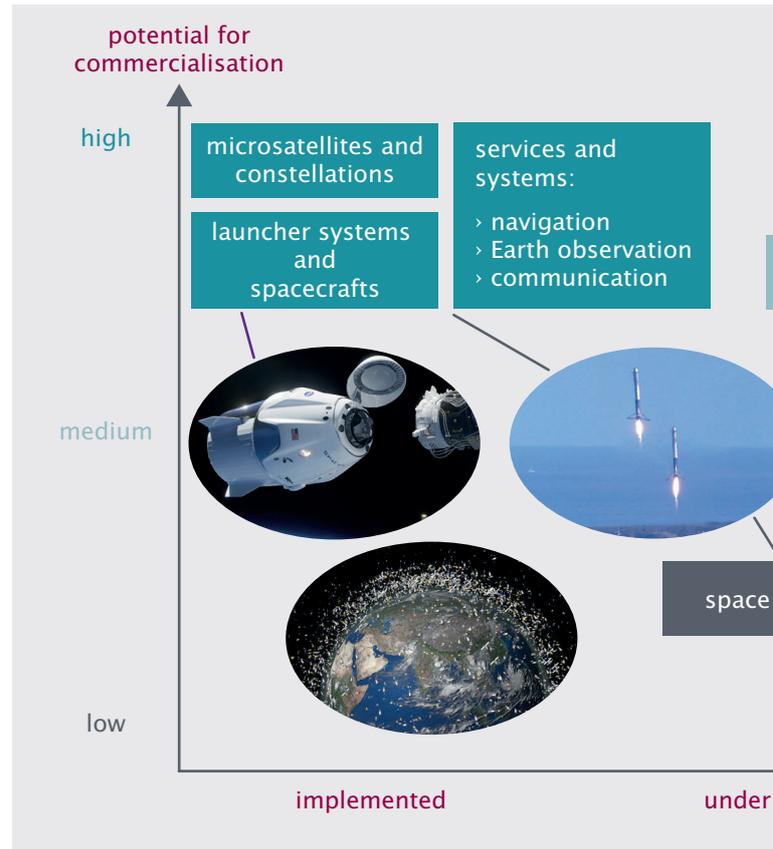
In the economic sphere, the most important factors are the creation of New Space start-ups, the availability of financial resources, the still untapped innovation potential of small or medium-sized enterprises (SMEs), and the development of business models based on space data and technologies in non-space industries.

With regard to technology, innovations such as miniaturisation or series production offer the opportunity to reduce costs and thus make space exploration more and more affordable.

The creation of a secure legal framework, clarification of liability and insurance issues as well as binding rules to prevent space debris are important prerequisites for space exploration. Finally, the role of space agencies is also crucial, as particularly the US National Aeronautics and Space Administration (NASA) pushes the commercialisation of new products and services by entering into public-private collaborations with companies. This leads to a dominance of US companies in the New Space sector.

Strengths and weaknesses, risks and opportunities

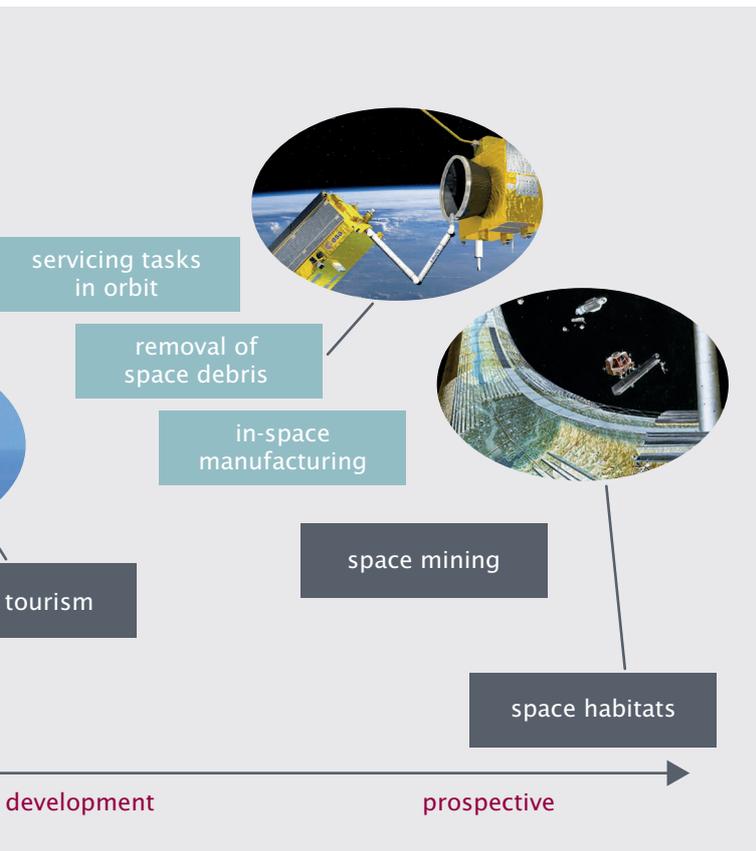
The German aerospace industry is considered an important innovation driver and technology developer for European



space exploration. In recent years, the space ecosystem – consisting of all players within the industry – has changed in Germany as well. Thus, in addition to established suppliers and manufacturers, start-ups are increasingly developing innovative solutions for various issues.

The overall picture shows that Germany’s space and New Space players with their high-performance space research and development are diverse and absolutely able to keep up with other countries in the field of technical components and their manufacturing. In Germany as well, the creation

Strengths	Weaknesses
<ul style="list-style-type: none"> > A diverse landscape of players and start-up scene are the basis of a well-developed New Space ecosystem in Germany. > High-performance space research and development are well connected at the international level > and in some research areas, they are even playing a leading role worldwide (sensors, radar, miniaturisation). > The system for early-phase funding of start-ups is well developed. > Three of nine ESA centres are located in Germany. > Four space-related cluster initiatives support the networking of science, economy and politics. 	<ul style="list-style-type: none"> > The lack of availability of venture capital – especially for start-ups and SMEs – is a brake on growth. > Compared to other countries, Germany’s spending on space programs as a percentage of GDP is rather low. > Small and medium-sized enterprises tend to benefit rather indirectly from the funding system. > The German space strategy of 2010 is no longer up to date. > Despite the population’s positive attitude toward space activities, the manifold potentials of space exploration and New Space are hardly tapped.



of new companies can be observed, and numerous funding measures are available especially for the early start-up phase. As the space market is growing substantially, it also promises lucrative market opportunities for German companies.

However, the potentially promising development opportunities face various barriers to innovation, such as a lack of venture capital (especially in the growth phase of start-ups), a funding system with no easy access for smaller players and legal uncertainties. Altogether, Germany invests rather little in space exploration compared to other countries, which

leads to a poorer starting position in competition. Furthermore, a crucial obstacle to overcome is the development of business models based on space data and technologies into other industries to tap the promising potential for applications – particularly in the downstream sector.

Options for action

Three main options of action emerge from the analysis, namely concerning legal certainty, with regard to measures encouraging innovation, and in terms of supporting New Space as an innovative industry.

The adaptation of the existing legal framework, i. e. space law that has been applicable so far, is currently made by shaping a national space law taking into account licensing procedures, issues of liability, access to and the exploitation of space assets as well as how to manage space debris. With regard to the constantly growing amounts of data generated during earth observation missions by a multitude of players, the question arises as to how data protection can be ensured by international agreements and how an unlawful exploitation of data relevant for competition – especially concerning companies – can be prevented.

In view of measures encouraging innovation, politics would have to examine whether financing instruments specifically adapted to New Space, such as e. g. a German space innovation fund established by the German Kreditanstalt für Wiederaufbau (KfW), would be desirable for improving access to funding or whether the funding and support of high-tech start-ups and innovative SMEs shall be further developed across the different areas involved. With regard to the shortage of skilled labour, it could also be examined whether there is a need for more space-specific programs for attracting new talent and securing the next generation of scientists, or

Opportunities

- > Global and national space markets are constantly growing both in the upstream and downstream sectors.
- > Applications of earth observation data offer particular growth potential – market leadership could also be achieved here.
- > New fields of activity and business models are emerging in the area of space services, such as e. g. the removal of space debris.
- > The positive development of the supplier industry is achieved by taking advantage of the strengths in mechanical and plant engineering.
- > Germany can further expand its strong positioning by becoming a facilitator between space nations.

Risks

- > Substantial market shares remain outside Germany and Europe because established or new US companies dominate the market.
- > Global competition is increasing, and US subsidy policies are promoting the market dominance of US companies.
- > Application potentials for non-space companies are only slowly emerging.
- > Cost savings are not realised by using standardised components.
- > International agreement on space law and data protection issues is delayed or of only limited success.

whether this issue should preferably be addressed in general within the framework of training measures encouraging innovation.

Without a target group-specific orientation of the funding instruments, German SMEs in the field of space exploration will continue to benefit primarily rather indirectly from space funding by being involved in projects as subcontractors or suppliers of larger players. It would be conceivable to focus future funding programs more strongly, for example by means of a quota for start-ups and SMEs or support measures adapted exclusively to start-ups or SMEs, in order to exploit the innovative strength of the space industry even more effectively.

Moreover, it could also be examined whether – as is common in the USA – competition between commercial providers for contracts with specified capability requirements (high level requirement) would also be appropriate for Europe or Germany. Due to the current dynamics in the New Space market, it would make sense for Germany – also within the framework of the commitment of the European Space Agency (ESA) – to enter into ambitious public-private partnerships in order to contribute to the growth of the space sector and at the same time strengthen the social and economic effects of space activities.

With regard to the relatively low level of government funding compared to other countries, it would have to be examined whether the amount invested should be (substantially) increased in view of the expected economic potential of space-related products and services. In order to ensure that German companies remain competitive in the growing space market, measures would have to be taken to increase competitiveness.

Access to space, which has become less expensive in recent years, offers significant economic opportunities for a wide range of industries. In order to take advantage of these opportunities – especially the use of downstream products and services in non-space sectors – the space industry is challenged to develop and offer suitable applications and business models for the non-space industries. For this, the

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use of space technologies should be anchored more firmly in the German government's industrial strategy and in other strategic measures to accompany the future space strategy, so that the connection to New Space is taken into consideration more strongly.

Germany's strong role in European space exploration and also its involvement in international projects such as the International Space Station (ISS) and the creation of the European Service Module (EMS) for the USA's future crewed spacecraft can be used as a good starting point for follow-up projects.

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