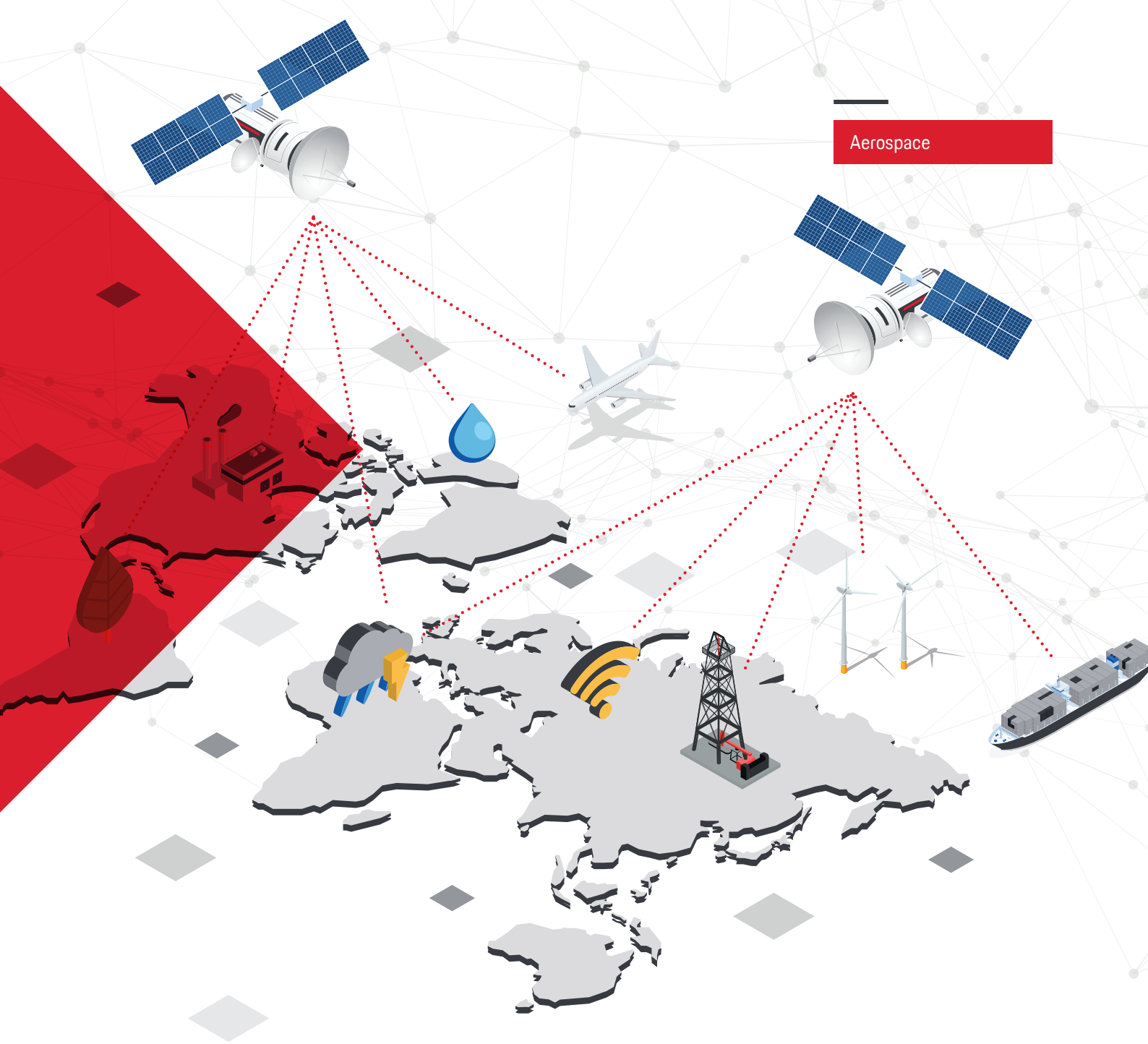


Aerospace

The Race to Space

How to achieve profitable growth in an accelerating space economy

Porsche Consulting

Strategic Vision. Smart Implementation.

INSIGHTS

//01

Space services are becoming an indispensable part of daily life, growing into a one-trillion-dollar commercial business.

//02

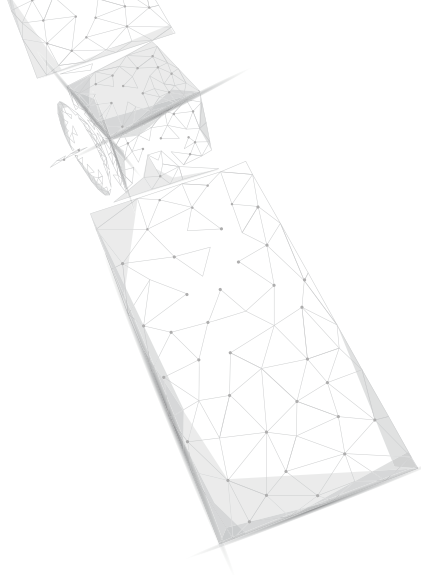
A dramatic shift in market economics regarding the cost and capabilities of space ventures provides the basis for the success of countless new space businesses.

//03

Space services must target relevant revenue pools while limiting system costs to not run out of money before coming to market and while competing with deep-pocketed challengers like Amazon.

//04

New Space is disrupting the decades-old status quo with new business models, value chains and competitive landscapes, requiring incumbents and newcomers alike to strategically position themselves in this growing market.



From in-flight Wi-Fi and car navigation to zooming in to vacation destinations—space applications already play an essential role in everyday life. "New Space"* companies are promising to further boost the impact and overall business outlook by transforming a once highly conservative industry.

Commercial space businesses stand at the early stages of monitoring every place on Earth and providing gapless global broadband connectivity—service segments with high revenue and strong profitability expectations. Due to the attractive growth prospects in this race to space, many companies aim at becoming service providers. What is crucial for new entrants and experienced incumbents to achieve profit and withstand competition? To this end, the study investigates three core questions:

01 | Is the (New) Space market attractive for newcomers, incumbents, and investors due to outsized revenue opportunities or is it just a fading hype?

02 | What are success factors for turning space services into commercial successes?

03 | What are the most promising corporate strategies to position a company in the space value chain to set it up for sustained growth?

These questions will be answered in the following three chapters and provide a guideline for (space) companies to navigate through the disruptive environment with all its challenges and chances ahead. New Space is bringing the most profound changes to the industry since its inception in the 1960s. It will alter the status quo towards new business models, value chains, and competitive landscapes. Incumbents but also newcomers must be prepared to transform their business to stay ahead in the race to space.

* New Space describes the commercialization of space with a shift from institutional to private actors since the mid-2000s.

CONTENT

01

New Space: vanishing hype or a real business opportunity?

For decades, space industry developments were largely driven by the competition between the superpowers USA and USSR during the cold war. At the height of the space race (1965-66), NASA received over 5 percent of the total U.S. federal budget.[1] Once the USSR disintegrated, expenditures on space were deprioritized and the NASA budget fell to below 1 percent of the federal budget.[2]

With the retirement of the space shuttle program in 2009, the US and the Western world even lost the ability to send humans into space. The space industry was facing mediocre growth opportunities: it neither captured the attention of the public nor of investors. Starting in the mid-2000s a remarkable turnaround occurred, driven by the private sector and frequently termed the "New Space" era. Since the 1990s, satellite space technologies have enabled several commercial applications like satellite TV and navigation, which have sustained a small industry. However, since 2010 the space economy has expanded significantly and the development has even accelerated over the last few years, driven by favorable economics of reduced costs, higher capabilities, and an influx of capital. By 2021, the number of orbital launches surpassed the record of 1967. In the 2010s, the number of active satellites increased from 1,000 to 4,000 and the global space economy grew from $277B to $371B.[3,4] It is projected to become a one-trillion-dollar industry by 2030.[5]

In the decade from 2013 to 2022, investors poured over $260B into space start-ups.[6] Some have recently gone public with billion-dollar valuations and promises of hockey-stick growth rates. However, lofty promises and expectations are often reliable indicators for industry hypes that create bubbles—especially in a nascent industry where business models are still unproven. Hence, prudence from investors, industry leaders, and spectators is reasonable. Looking into the future, the space industry today is at a crossroads: either the novel business models take off and the market goes mainstream or profitability remains elusive, forcing players out and the market returns to its niche existence. In short, boom or bust? The answer to this question is relevant for the industry as a whole and its financial backers.

// **Incumbents** must assess whether they need to take these developments seriously, which would require them to transform their business models.

// **Newcomers** must understand whether the market really offers untapped and significant revenue pools that they can seize and that makes their efforts worthwhile.

// **Financial backers** like space agencies, venture funds, or shareholders need to know whether their money will generate sufficient returns in the future.

The following sections try to answer this question from several perspectives. Starting with a look inside the space economy with its main revenue pools and industry players to investigate whether New Space has already left its mark in the numbers.

1.1 The current space economy and its industry

In 2020, the space economy reached a market size of $371B, driven by three legacy revenue pools that have dominated the market since the 1990s: around $100B (27 percent) comes from government spending through agencies like NASA and ESA. This includes programs on human spaceflight and science but also projects for space infrastructure like navigation systems (e.g., GPS, Galileo) and Earth observation (e.g., the Copernicus program). The remaining $271B constitute the commercial space value chain of which $117B comes from satellite communication services of which $88.4B is satellite television. It is a market where growth has slowed significantly and might soon decline due to streaming over the Internet. Ground equipment adds another $135B market that is dominated by sales of navigation devices worth $103,4B. All other applications, such as Earth observation or maritime and aviation connectivity, are rather a niche with market sizes of a few billion dollars.

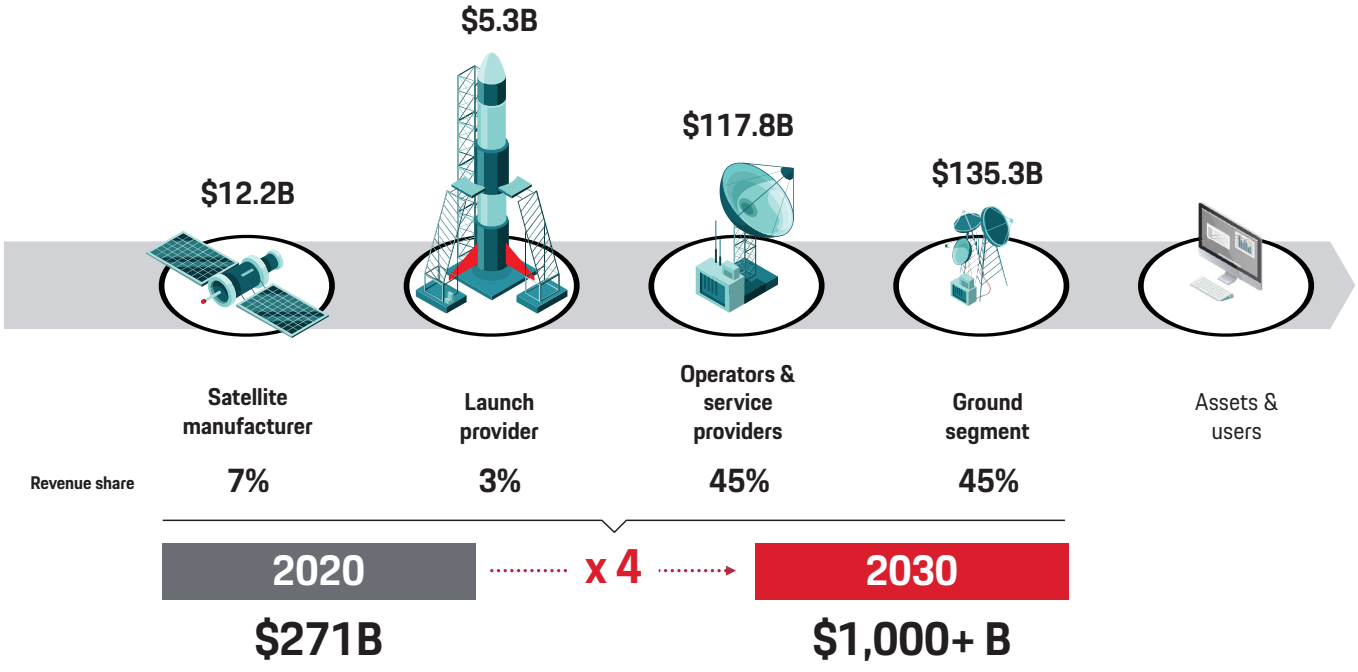


Fig. 1. The commercial space value chain (excl. government spending) with its four core segments is growing strongly and will reach a combined value of over $1 trillion by 2030.

Like the space economy, a deep dive into each element of the value chain reveals only little impact of the New Space era. Satellite manufacturers build the satellites and command 7 percent of commercial revenues. The market is dominated by established military-industrial conglomerates like Northrop-Grumman, Airbus, and Thales. Launch providers design, build, and operate orbital launchers that cost up to $50 million or more per launcher. Except for SpaceX, most heavy launchers are built by incumbents like ArianeGroup in Europe or ULA in the US. Satellite service providers, such as traditional satcom TV services like Canal+ and Sky, deliver communication and entertainment offerings to households. Operators manage the satellite network in the background and ground equipment manufacturers add the necessary terrestrial infrastructure. This segment includes antenna providers like Intellian, ground station network providers like KSAT, and consumer equipment providers like Panasonic.

Looking at the bare numbers of the space economy and its value chain sketches a picture of little change—indeed, the situation is very similar to the one a decade ago. The market is divided into three legacy revenue pools: government spending, satellite TV, and navigation devices. The value chain is controlled by incumbents with hardware provided by large industrial conglomerates. All market segments are still highly fragmented with few players really known outside of the space industry. Except for SpaceX, there seems to be almost no trace of the much-hyped New Space era. However, this picture of "business as usual" belies a profound shift in business models and industry players over the last few years. Hundreds of start-ups with yet little revenue and spread all over the planet have injected a dynamic and speed that is currently upending the entire industry. The next section therefore shifts the perspective from top-down to bottom-up to assess why this disruption is occurring now and if it can last.

1.2 Drivers of New Space

In January 2021, a SpaceX Falcon 9 rocket lifted off from Cape Canaveral, Florida. It was a remarkable mission, which can be seen as the culmination of several trends that have catalyzed the development of the New Space age since the mid-2000s. The first stage booster of the Falcon 9 successfully flew its fifth overall mission and landed safely on the SpaceX drone ship off the coast of Florida. It was the first smallsat rideshare mission by SpaceX and carried 143 spacecraft on board, setting a record for the most satellites ever deployed in a single mission. It can be seen as a truly global mission, as it carried satellites for 26 customers from 12 different countries. Many of those customers were commercial New Space companies, some only a few years old. Most customer payloads were batches of satellites intended to operate in global constellations in low-Earth orbit. Among its payload, the mission also carried 36 satellites of Swarm Technologies of Palo Alto, California. Founded in 2016, the company brought the trend of satellite miniaturization to an extreme. At 11x11x2 centimeters, its SpaceBEE satellites are about the size of two smartphones and weigh only 400 grams. The mission was an industry milestone that highlighted the combined impact of five top trends on the industry: reduced launch costs due to reusability, hardware miniaturization, serial satellite production, a global and bold start-up ecosystem as well as significant venture funding that looks beyond immediate profits. Each trend will be looked at more closely in the following paragraphs.

Launch cost reduction and availability

Launch costs are a critical element in space industry. With costs per kilogram of payload lying in the range of $30,000 and more, launch costs used to be prohibitively expensive, making most business cases turn negative and impeding the development of new space applications. However, the reusability of rockets from SpaceX has enabled a reduction of launch costs to as little as $5,000 per kilo for rideshare missions, forcing other launch providers to match prices so as not to be squeezed out of the market. By being responsible for 31 of the 134 global launches in 2021, SpaceX already commands a market share of over 20 percent. Moreover, a lot of new launch capacity is coming online. In the past, launch capacity was severely constrained. Governmental entities often formed the largest customer and were prioritized over emerging commercial companies. Today, providers of smaller launchers like Rocket Lab offer up to one ton payload, filling the gap of orbiting smaller spacecraft. Thus, space companies have much cheaper, faster, and a greater variety of options for accessing space, significantly speeding up revenue generation and lowering setup costs for their prospective space services.

Satellite miniaturization and integration

Another essential driver is satellite miniaturization and integration. SpaceBEE satellites thereby offer an extreme example, underpinning a crucial development: satellites have shrunk significantly. Rather than filling entire rooms, satellites are now often the size of hand luggage. The average satellite weight has reduced by a factor of 10 from 2.5 tons in 2010 to 300 kg by 2021 (see Figure 2), significantly lowering the up-front expenses for setting up a space service. At the same time, capabilities have increased, like in smartphones, due to increased integration and miniaturization of electronical components, enabling new business models.

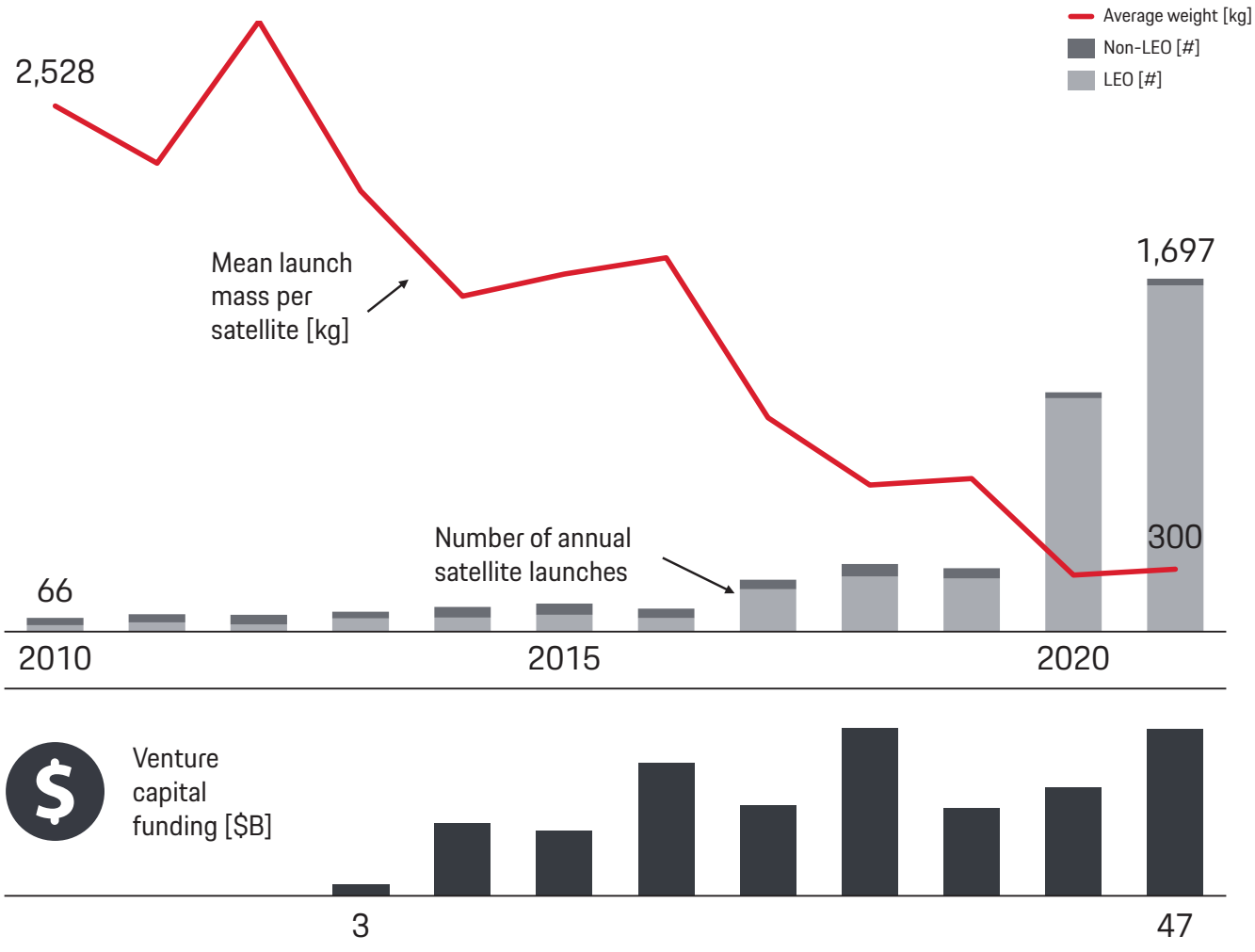


Fig. 2. Over the last 10 years, satellite miniaturization has driven mass reduction from tons to kilograms while constellation building has increased annual satellite launch numbers more than fiftyfold. In that period, venture capital (VC) funding for satellite space businesses has increased strongly.[7]

Constellation manufacturing

The trend to constellations is driven by the move from geosynchronous (GEO) to low-Earth orbit (LEO), bringing satellites much closer to Earth (from 36,000 km to 250–2,000 km).[8] Over 90 percent of satellites are now placed into LEO. This shift impacts quality but also quantity requirements. Being closer to Earth speeds up communication and observation becomes more detailed. To ensure continuous regional coverage through LEO satellites, it is necessary to set up a constellation of many satellites. The median size is in the range of 40 to 50 satellites, with some constellations going into the hundreds or even thousands.[9] Manufacturing at scale enables a streamlining and industrialization of production processes at a level previously unknown in the industry. In contrast to one-off productions, it is manageable if a few satellites out of hundreds fail in orbit as the constellation will still be operational. The use of off-the-shelf and standard components further reduces manufacturing costs. For the world's most prominent constellation, Starlink, it is reckoned that satellites cost less than $0.5 million apiece (at 260 kg). Even smaller satellites can cost as little as $100,000. This contrasts with large GEO communication satellites, which cost up to $150 million (at >5,000 kg). Mass production reduces costs of setting up a space service and lowers the entry barriers into the market for newcomers with limited financial firepower.

Funding of commercial companies

Space companies receive funding from space agencies' public-private partnerships and increasingly from global equity investors. In 2008, NASA began to extend partnerships with private enterprises. SpaceX, one of two beneficiaries, was awarded $1.6 billion for 12 Falcon 9 cargo missions, providing crucial funding to develop a launcher that only had its maiden flight in 2010.[10] Building on the success of private cargo and crew transports, NASA expanded its scope with contracts to several different private companies for designing a new space station and a new spacesuit.[11] Investors are bullish for the space industry with their global investment mounting to $260B.[12] Investment has risen steadily, with its latest peak of $47 billion invested in 2021. Next to their size the investments are noteworthy for their breadth. They are naturally skewed towards key spacefaring regions like the US (46 percent) and China (30 percent). However, funding also extends into less obvious corners of the planet like Singapore (5 percent), India (3 percent) or Indonesia (2 percent), highlighting that New Space is a truly global phenomenon, making its success independent from individual markets. New space companies can bank on support through local space agencies just as much as through a global venture capital industry for their business ideas.

Start-up culture

Besides cost, the space industry has additional high entry barriers in terms of regulation, safety and quality requirements, and certification. It requires a strong, risk-taking start-up culture with the mindset to challenge established norms with bold visions. Such a start-up ecosystem has formed over the 2010s. On the product side, they develop existing concepts several steps further, employ new production technologies like 3D printing, and are more focused on software. On the organizational side, they replace a rigid and conservative project management philosophy with an agile development process. Adopted from software development to sequentially build, test, and launch modules in sprints, the New Space industry employs the mantra of "build-launch-repeat" of fast, iterative learning. What sets the new start-ups apart in the space industry is the unusually large gap between their approach and the traditional way of working. Time-to-market for satellites was measured in years and significant project cost overruns were the norm. Hence, "normal" improvements by start-ups in the space industry have an outsized impact on the status quo.

The combination of these five trends has enabled the development of a dynamic, commercial ecosystem of companies that challenges incumbents, including mega-cap companies like Amazon extending their business into space and start-ups like Loft Orbital changing paradigms in the space value chain. They collectively try to turn the industry into a self-sustaining business outside the traditional pillars of the space economy. So far, they have been relatively successful when measured by the number of new companies started (hundreds), satellites launched (thousands), or funding attracted (billions). However, commercial success is not yet visible in the numbers. The $371 billion space economy is still dominated by legacy applications and players. However, it is evident that the New Space era is here to stay, as it builds on lasting trends that have evolved since the mid-2000s and will further strengthen in the future. Nevertheless, the key question for the industry and its financial backers is still open: is there real money to be earned with "new space" or is it a big value trap? To this end, the next section deep dives into financial performance of individual companies.

1.3 Financial company performance

In terms of financial analysis, three broad observations can be made. Most strikingly, making money in space is difficult. The biggest companies like Thales Alenia Space or Viasat earn a few billion dollars in annual revenues, making them the behemoths of the industry. Most established space companies report revenues of around $1 billion, with many lying significantly below that watermark, showing that the space industry is tiny compared to basically any other terrestrial counterpart like aviation or automotive. Although the economy stands at almost $400 billion, there are very few sizable players, highlighting a strong fragmentation in almost every aspect of the space value chain.

Moreover, it can be seen that services are much more lucrative than hardware. Hardware providers generally have margins of around 10 percent. Their business model is subject to revenue fluctuations as satellite demand can be erratic. Service providers are in a more comfortable position. Their margins easily exceed 20 percent and can reach lofty heights beyond 60 percent, which are largely sustained through the lucrative satellite television business. Also, cash flow is steady, as satellite spectrum is rented to customers on long-term contracts that guarantee predictable annual revenue streams. Nevertheless, players remain small, as satellite television is often a state-owned or -controlled buiness.

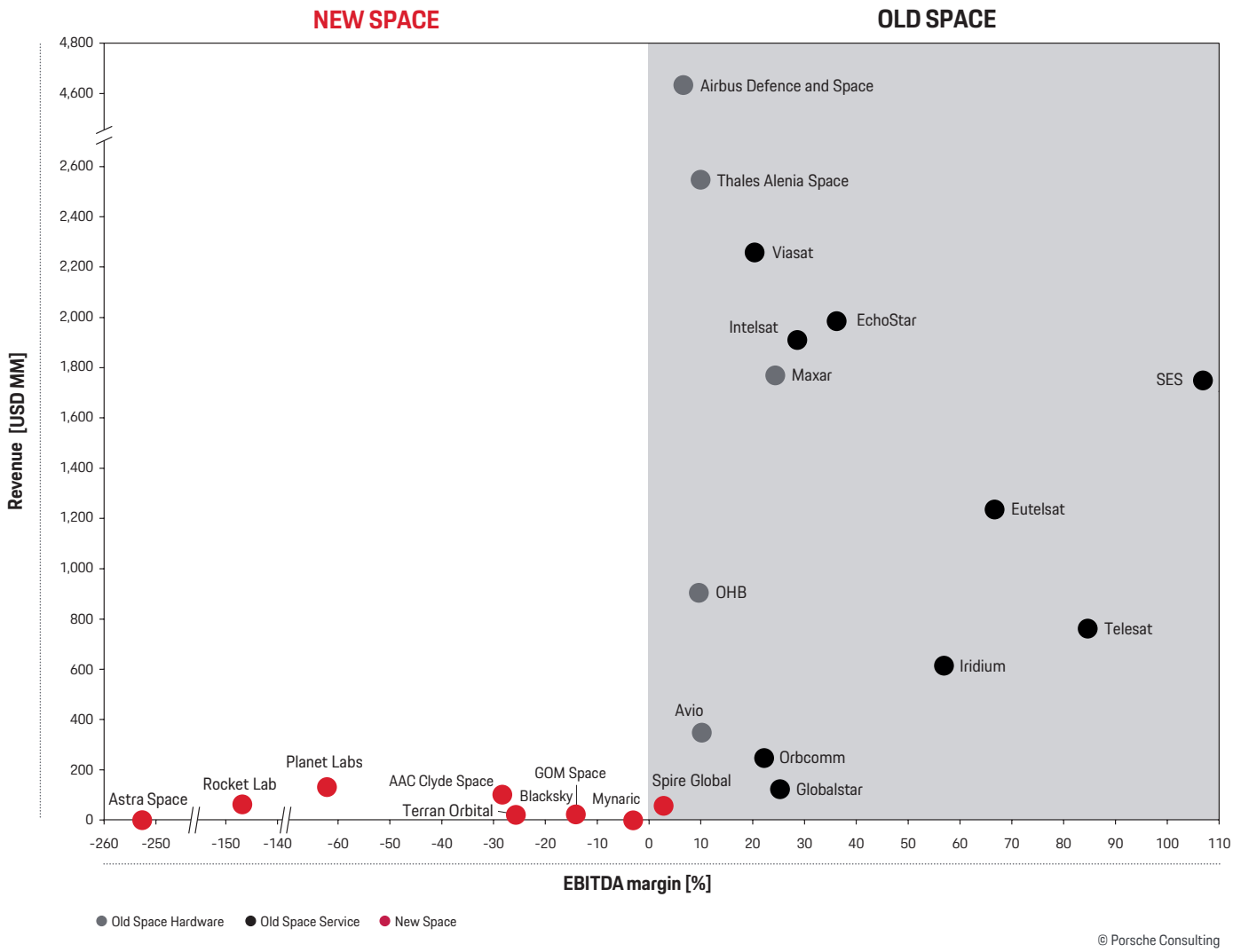


Fig. 3. Financial analysis shows individual financial performance of companies. Incumbents ("Old Space") achieve respectable margins but comparatively small revenues when compared to other industries. New Space companies are usually unprofitable with little revenue.[13]

Finally, most New Space companies do not (yet) earn money. On the contrary, they burn significant amounts of cash at negligible revenues. In some cases, like for Astra (US) in Q1/22 EBITDA losses surpassed revenues by a factor of 12 (revenues $4M, EBITDA loss $48M).[14] Most of those companies are young and have only recently started their services. Unlike in software, the building and scaling of a space business takes time. Five or more years may elapse between entering the market and the first revenues.

Most players in the industry are neither huge nor hugely profitable—except for a few Old Space representatives with a strong footprint in satellite television. Even on an individual company level, the market does not seem very attractive to newcomers, incumbents, or investors. So far, the outlines whether New Space is only hype or real growth opportunity show a mixed picture: it is a durable development built on lasting industry trends but at present it is not a commercial success, either at the macro or micro level. However, a deeper look into investor presentations provides encouragement: New Space companies promise outsized financial opportunities at sometimes eye-watering growth rates. The optimism is striking but warrants caution. To substantiate the claims of exponential growth, truly new "killer applications" like the $100 billion satellite television market would have to come online. Thus, the final chapter peeks into the future to assess whether such game-changing services and revenue pools really exist.

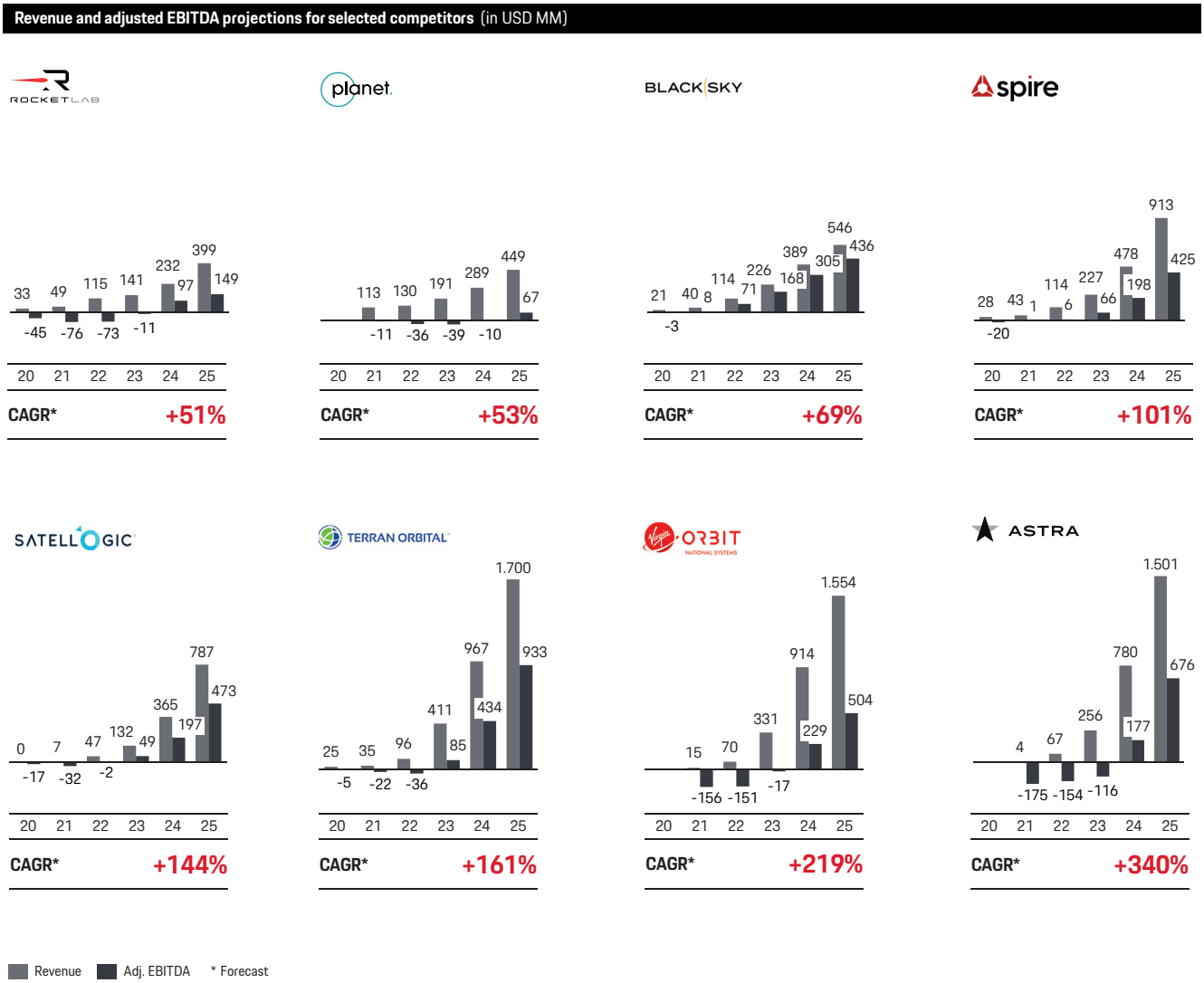


Fig. 4. Projections of New Space companies' financial performance promise strong future revenue growth over a short period of time.[15]

1.4 Market opportunity—hype or reality?

Over the past decades, the industry has been dominated by three pillars: government spending, satellite TV, and navigation devices. Looking towards the future, new applications would require a similar impact and magnitude to justify the hype around the New Space industry. What are the opportunities resulting from either global (high-speed) connectivity or frequent high-resolution images of every place on Earth? The following outlines delve into these two business propositions and explore whether there might be markets that can sustain the New Space ecosystem in the long term.

Connectivity is a global megatrend. Even in developed nations, coverage in rural areas is still patchy. For instance, the 130,000 cell towers in the US cover over 90 percent of the population with 4G networks but only 70 percent of the landmass.[16] Gaps are much greater in developing countries like Mexico. Telecom operators have little incentive to extend their networks into sparsely populated remote and rural areas due to high costs and limited returns. Starlink, on the other hand, covers the entire planet with a few thousand satellites—an arguably simpler infrastructure with a single service provider. There is certainly value in using space infrastructure for global connectivity applications but how big can the market be?

The potential total addressable market is huge. There are over 2 billion households globally. By 2050, global population will increase to 9.8 billion, of which 3.1 billion are expected to live in rural areas.[17] Satellite broadband is getting more competitive on cost and comparable in speed posing a viable option. Some nations might even leapfrog the setup of terrestrial infrastructure in remote areas in favor of satellite infrastructure. According to the COO of SpaceX, broadband is a trillion-dollar market opportunity for the company.[18] Indeed, it is forecasted that satellite broadband will replace satellite TV as the main pillar of the space economy in the 2030s.[19] This market size can sustain several players, which is why Amazon, OneWeb, and even the European Union with IRIS² are entering the market. This development will benefit the entire space value chain, as thousands of satellites must be built, launched, and operated.

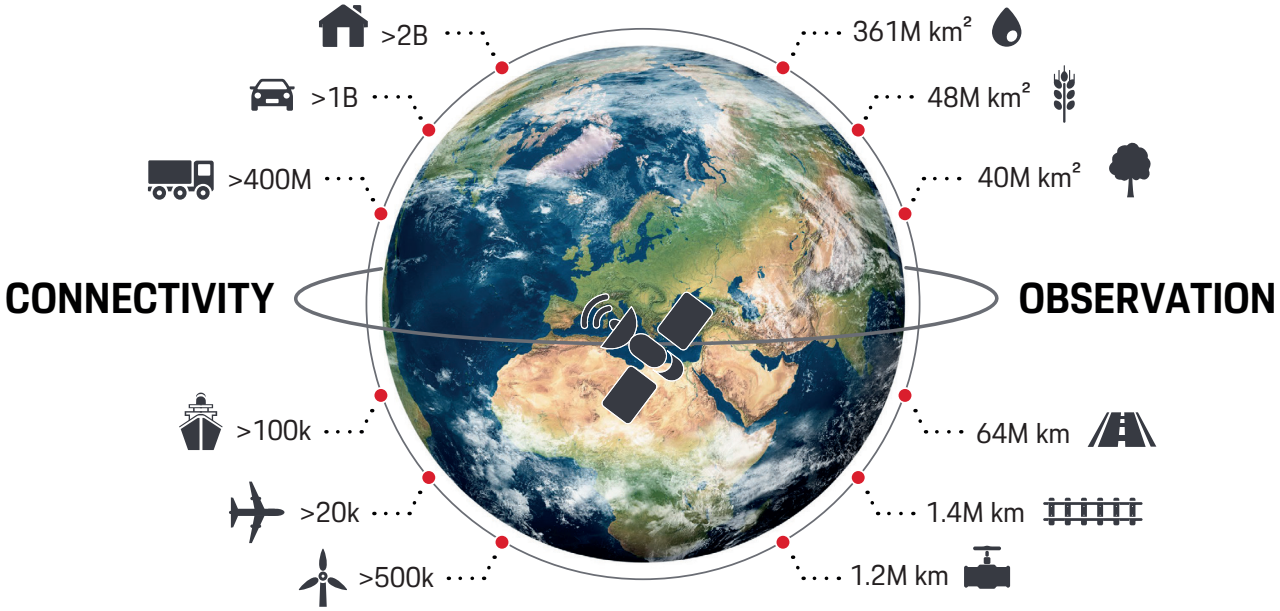


Fig. 5. Opportunities for New Space services are huge: there are a lot of assets in remote areas that could be connected to the Internet or monitored for such purposes as infrastructure degradation.[20]

Next to consumer broadband, the market for the Internet of Things (IoT) is no less exciting. In 2020, the IoT market size was estimated at $740B and expected to reach $4.4 trillion by 2029.[21] First, there are mobility assets with the biggest prize being connected ground transportation: There are over 1 billion cars, hundreds of millions of trucks and a lot of agricultural machinery – all of which become increasingly "smart". Moreover, there are a lot of additional assets in remote areas: shipping containers, wind parks, field irrigation systems, water pumps, environmental sensors, etc. All these assets must be connected to receive and transmit their data. Many start-ups are targeting these multi-billion markets. Studies find that by 2025 over 30 million devices will be connected via satellite creating a $6 billion market.[22]

The outlines indicate that connectivity is a promising opportunity going forward. The second big group of applications is Earth observation with an expected future revenue potential of more than $140B (see Figure 6), serving another megatrend: sustainability and climate protection. The future market for Earth observation will be driven by three main groups of services.

The 40 million square kilometers of global forests are exposed to ever more and bigger pests or wildfires which satellites can detect early on.[24] They can also reliably measure carbon emissions and other harmful gases from nations or even individual companies and sites. 361 million square kilometers or seventy percent of Earth is covered by oceans. Satellite imagery can help rescue missions, support marine vessel surveillance, and track illegal activities.

Another group of services focuses on agricultural and industrial applications as well as on the monitoring of critical infrastructure like the 1.2 million kilometers of global oil and gas pipelines. Satellite imagery can reliably and continuously identify leaks or sabotage.

Finally, there are applications open for the general public. Digital maps are already universally used for navigation and orientation. They rely on highly detailed and up-to-date satellite imagery. High-definition maps (3D maps) are widely required for autonomous driving because, unlike human drivers, autonomous cars cannot compensate for inaccuracies in maps and GPS signal delays.

The outlines show that there are significant market opportunities in connectivity and Earth observation for incumbents, newcomers, and investors alike. Adding in some of the more exotic business ideas like asteroid mining or space tourism, it can be concluded that the space hype is justified to a certain extent. Planned constellations indicate that over 50,000 active satellites could be in orbit by 2030, signifying a tenfold increase from 2022 levels. The production, launching, and operation of such volumes would drive very strong industry growth in all parts of the value chain. However, despite sensible business ideas around connectivity and Earth observation, commercial success is far from guaranteed. For all companies entering the New Space market, there is a significant risk that they will use up their cash before becoming self-sustaining, scalable businesses. To this end, the following chapter will outline success factors for bringing a new space application to market. It should serve as a rough guideline for companies that intend to build their own space service or are already putting their ideas into practice.

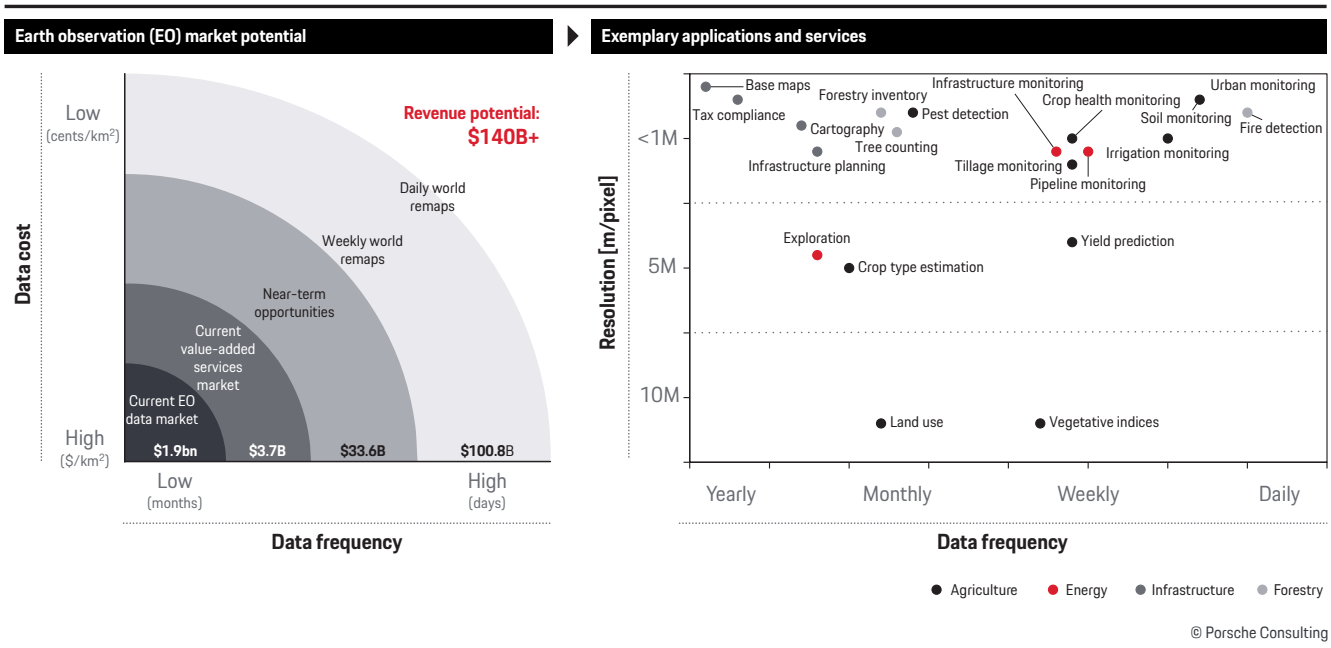


Fig. 6. The Earth observation market opportunities are huge: Most applications will only become viable in the next years when daily re-map resolutions drop below 1 m per pixel.[23]

02

Ready to launch? How to build a successful space service

The history of the space industry is littered with spectacular failures. Setting up a service is a formidable challenge. Satellites are expensive and regulation is complex, so that time to market is measured in years with frequent additional delays. Once satellites are in space, they are in an unforbidding environment.

A study of 1,000 CubeSat missions between 2000 and 2018 found that only 25 percent of those missions were declared full successes.[25] Some satellites simply do not work due to quality issues or fail early in their multi-year lifetime. Moreover, building a customer base comes with many difficulties as newcomers lack sizable sales channels into industry verticals. Space company bankruptcies of the past like OneWeb or Orbcomm were driven by outsized costs for setting up a service as well as limited (immediate) revenue potentials. However, the economics regarding costs and revenue potentials continue to change dramatically, making future success much more likely. Costs continue to strongly decrease in all aspects of the space value chain, further reducing entry barriers. More capable and powerful satellites meanwhile increase revenue pools by addressing larger customer bases. For any space service to be truly successful, both sides of the equation need to be optimized. The following 18 success factorsintend to give (space) companies a rough guideline how to increase the odds of success for their prospective services by focusing on the revenue potential as well as on the service costs.

18

success factors

Revenue potential ↗

The right market and business model

01 Find a market demand that (only) space can solve competitively
02 Build a scalable service in a relevant market
03 Build an "as a service" application

"Sticky" service design

04 Complement the space data
05 Differentiate through intelligent software
06 Use software-defined satellites

Go-to-market strategy

07 Prioritize time over quality
08 Limit the initial sales channel work
09 Put scale before profit

Service costs ↘

Hardware manufacturing

10 Limit the rocket science
11 Move from craftmanship to industrialization
12 Build, learn, repeat

Launch provision

13 Bus versus taxi—select the right partner(s)
14 Design for launch

Ground segment

15 Ground Station as a Service
16 Get ground equipment into customers' hands

Service provision

17 Be truly customer-centric
18 Manage the space infrastructure

Fig. 7. For designing a successful space service 18 principal success factors must be considered to maximize revenues and reduce costs.

2.1 Success factors to drive revenue potential

Looking on the revenue side of the equation, success factors to ensure commercial success fall into three broad topics. Firstly, the service (idea) must be allocated to the right market and translated into the right business model. That means the total addressable market (TAM) should be several billion dollars large. The back-of-the-envelope calculation in Figure 8 for a space broadband service showcases that serving two million or 0.1% of all households globally could cover the annual running costs of $2 billion, making the service sustainable over the long term.

Secondly, the service must be designed in such a way that it becomes "sticky" and retains customers once they have subscribed (lock-in effect). In general it requires creating a competitive value proposition along the value chain, leveraging network effects and designing a solution suite whose utility increases over time. The value of the service needs to be compounded through additional data sets and the automated extraction of truly actionable insights that customers can put to direct use in their daily operations. Third and finally, the initial go-to-market strategy must be aggressive to guarantee fast scaling of the service. To test and develop the target market, a service needs to focus on its core functionalities that drive its value proposition and be priced competitively.

The subsequent sections will deep dive into the nine success factors on the revenue side. They intend to give companies recommendations that should be considered when building a space service. The outlines are supplemented with examples from the industry to illustrate that many already follow those best practices.

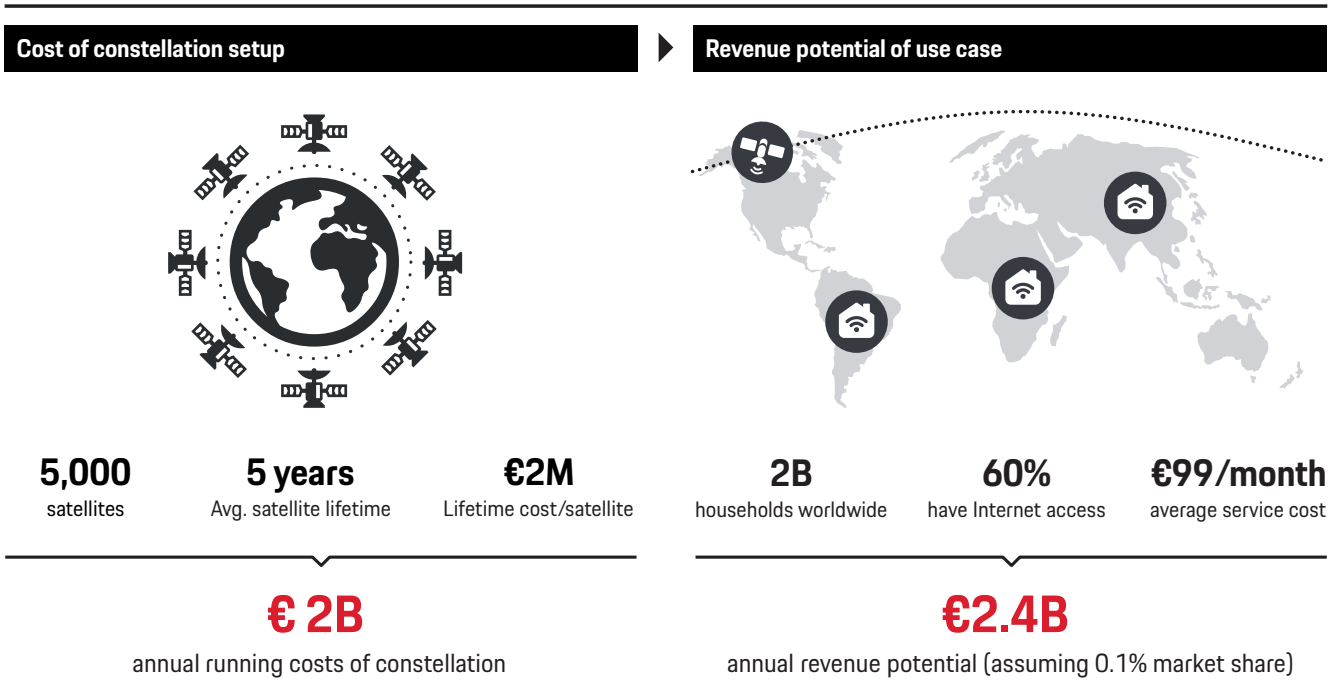


Fig. 8. A simplified business case for global broadband connectivity. It illustrates that a small share in a sufficiently large market can be enough for a positive space case business.[26]

The right market and business model

Find a market demand that (only) space can solve competitively

Space companies want to address Earth's problems through space technology. It is, however, critical to soberly assess whether space really has a competitive edge or if a terrestrial solution is superior. Even in the New Space era, deployment of connectivity infrastructure on the ground is significantly cheaper and faster for many applications and regions. For one-to-one connectivity use cases and for broader bandwidth requirements on the return link, satellite services lose their techno-commercial advantages. There is a simple mantra to follow here: Don't do space for space's sake.

Build a scalable service in a relevant market

Earlier outlines highlighted that the space industry is following several megatrends and rightly so. Going into the Internet of Things or broadband is sensible as those markets are already sizable and growth will be strong for decades. Nevertheless, many business models focus on (extreme) niche applications. For a niche service it is critical to clearly define a growth path beyond any initial application or target customer group and to be fully transparent and realistic about the total addressable market. For sustained success, it is important to offer flexible pricing and performance along the customer life-cycle journey. Space service quality should either improve over the lifetime at little to no additional cost or give customers flexibility in their contract durations.

Build an "as a service" application

Subscription-based business models are a universal trend across industries so that customers can exchange capital expenditures (CAPEX) for operating expenses (OPEX). Space is no exception: most businesses own their satellites to be able to offer access to their platform through subscription models. Three broad business models can be distinguished based on their service depth: (i) sell satellite capacity to customers to collect and/or deliver their own space data; (ii) collect and sell raw space data to customers; and (iii) enrich space data to sell actual insights or information. All three options are viable business models and their applicability depends on the target market and customers. Pricing power but also service design expenses increase from options 1 to 3.

“Sticky” service design

Complement the space data
To differentiate and maintain market clout it is paramount to complement space data with additional sources. The combination of data sources allows the generation of higher-
level information that adds more value for customers. In turn, it reduces the risk that a copycat with a lower price point is enough to draw away customers. Many of the newest services in the market already complement space data. For instance, Planet Labs enables clients to integrate use-case-relevant proprietary and third-party data, e.g., Automatic Identification System (AIS) data for maritime vessel location.

Differentiate through intelligent software
Any future-proof data service is built around algorithms that use machine learning or artificial intelligence. Satellites generate and transfer vast amounts of data. Algorithms help companies to sift through their data lakes to identify the exact information that their customers are looking for and for which they pay. For instance, Planet Labs’ web geo platform complements geospatial imaging with analytics capabilities to deliver decision support to customers. It is even feasible to integrate it into third-party applications through standard APIs and cloud-based technologies. Its areas of application include environmental monitoring, defense applications, and infrastructure observation.

Use software-defined satellites
In the past, satellites were designed for a specific purpose without the possibility of reconfiguration. This worked well for long-term customer contracts that ensured revenues independent from actual usage. An as-a-service business is based on usage that can fluctuate heavily. This requires high degrees of flexibility to actively steer beams into areas of high demand or interest and to continuously reallocate spectrum or capacity to different customers based on their current demand. This operational flexibility will be largely automatically controlled and coordinated between satellite networks through algorithms based on machine learning and artificial intelligence. In addition, satellites’ software will be continuously updated, much like a smartphone operating system, to improve data collection, data processing, operations optimization, or download capacity.

Go-to-market strategy

Prioritize time over quality
It is counterproductive to aim for the "perfect" service at launch. Setting up the initial service is time consuming and costly. It must also be considered that satellites in low-Earth orbit only live five years on average, meaning that a constellation must be replenished constantly. The chances of an initial business vastly improve if it focuses on a minimum viable product (MVP) that is based on a nimble constellation design and core functionalities. This way, the service can be tested and fine-tuned while the business can build the customer base. With subsequent satellite generations the service is then updated to higher quality. Starlink started with smaller satellites of 200 to 300 kg and now proposes a second generation that will weigh 1.2 tons but where each satellite has three times the capacity. In short, don't overengineer the initial service and focus on continous improvement of customer service, engagement and benefits.

Limit the initial sales channel work
Getting a service into the hands of end customers is difficult. An initial hurdle is to make the target customer group aware of the availability of the service. (New) Space companies largely lack sales channels. They also often create completely new markets. Hence, services lack a track record of value creation, increasing the need for sales work even further. There are two major ways to get around the problem. First, it is much easier to pitch applications like the Internet of Things to an "integrator" like manufacturers or distributors of the devices instead of their users. The second option is to secure a contract with an anchor customer to finance initial service rollout. A prominent example is SpaceX. NASA backed the company early on when it retired the Space Shuttle.

Put scale before profit
Paramount to the success of any new service is to gain momentum quickly and scale the business. Most platform companies initially offer their service at a discount to the actual cost. They place gaining market share over making profits. This ensures customer retention over the start-up period while the service scales into a relevant business. However, customer centricity does not end with low costs for the service. In addition, an as-a-service business is based on monthly or annual subscriptions that must be easy to set up and cancel. Switching to a different provider should be easy on paper but needs to be discouraged through a superior service experience and application ecosystem.

If space companies follow the nine success factors outlined above, it should greatly improve the odds for their space service to become a commercial success. With the revenue side covered, the following paragraphs focus on costs. Space services are still expensive, so means to control costs are critical to bridge the time until revenues are flowing.

2.2 Success factors for controlling service costs

Looking at the cost side of the business equation, two factors are key: time and money. Time-to-market needs to be kept short to limit time between major operating expenses and first revenues. A lot of space services fail because companies run out of money before the service gets to market. Therefore, it is critical to streamline the end-to-end process of setting up the infrastructure. On the cost side, as outlined earlier, expenses for setting up space infrastructure has reduced significantly. However, setting up the space infrastructure for a service is still capital intensive and there are continuous expenses for building and launching new hardware. Continuous cost control is key. Satellites make up around 50 percent of the infrastructure setup costs. However, there are several other important cost positions to optimize. In the upcoming sections, nine success factors to control costs and time-to-market are detailed. The structure follows the main roles along the space value chain that drive costs: hardware manufacturing (satellites and launchers), launch provision, ground segment, and service operation.

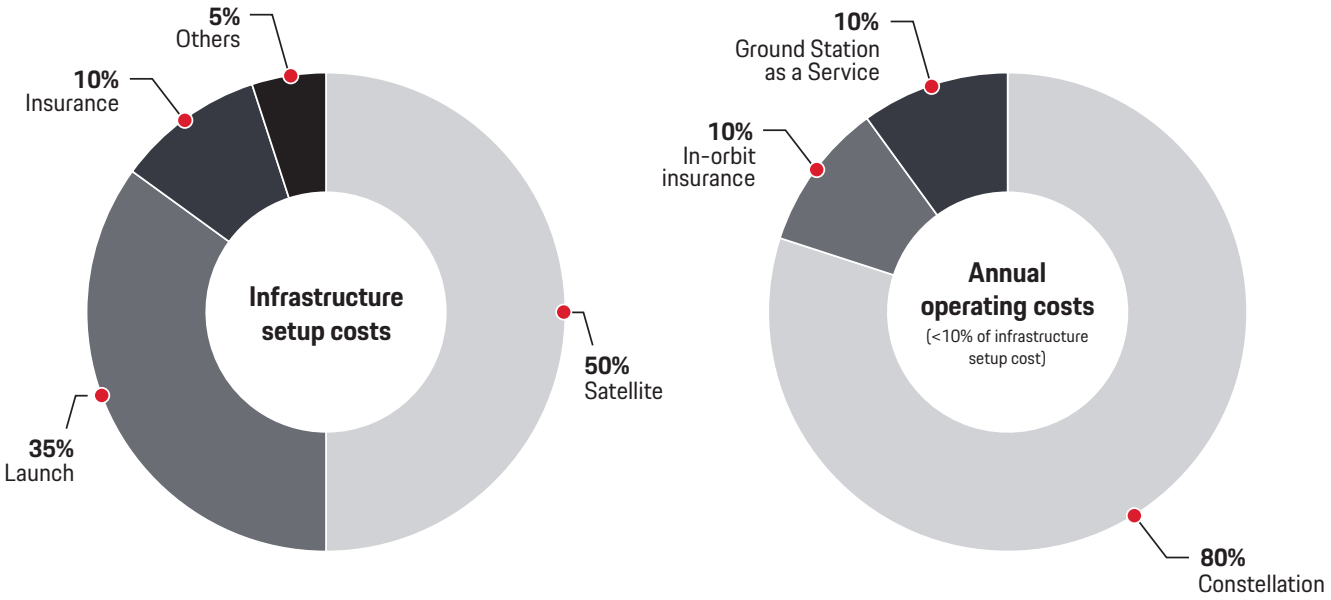


Fig. 9. Exemplary cost distribution for setup and operation of a space service. Satellites and launches are top cost drivers while annual operation expenses are less than 10 percent of infrastructure setup cost.

Hardware manufacturing

Limit the rocket science

Satellite design and engineering used to be a project environment where each new customer order launched the full development cycle, resulting in high non-recurring engineering costs that were spread over a few products. To be successful, the industry needs to change its mindset from project to product development. Foremost, this means standardization. Satellite design should build upon proven building blocks that can be reused for different customers and applications. Customization should be limited as much as possible to the payload. Additionally, engineering must use more off-the-shelf and highly integrated components from other industries instead of relying on designed-for-space parts. Engineering needs to follow design-for-manufacturing principles to make production efficient and reliable. That involves simple designs that avoid typical sources of errors. Finally, engineering needs to control costs of its design. Given certain production volumes, the in-house development of specific components or subsystems could make sense to cut out significant cost positions in the bill of material.

Move from craftmanship to industrialization

Production needs to shift its mindset from an artisanal workshop to an industrial assembly. Today space hardware spends most time waiting in production because of work preparation or feedback loops with quality or engineering. This contrast heavily with industrial production lines where every minute is optimized to contain as much value-add work as possible. First and foremost, manufacturers must build an industrial manufacturing system. It is key that the sequence of work steps is clearly defined and tacted so that the product progresses in predictable intervals. Individual processes need to become robust and efficient. Technology plays a key role here. 3D printing of complex components, especially in rocket manufacturing, is a promising technology. However, process design is critical as well. The hardware should be easily accessible for workers while important areas that are prone to damages are shielded during production.

Build, learn, repeat

Today, production is basically an iteration of component installation and a subsequent quality control routine. This effort needs to be streamlined to ensure on-time and on-cost equipment delivery while not compromising on quality. Three major actions can be taken. Firstly, a smart testing regime that limits quality control to strategic points along the process should be installed. Testing of a certain installation should be done as long as the area is still easy to access so that errors can be identified and corrected quickly. Secondly, a quality management system must be set up. To improve quality continuously, an organization needs to reliably identify, document, and learn from its mistakes. Thirdly, it is recommended to follow the New Space mantra of "build, learn, repeat." Products just as much as processes must evolve from their initial version. To ensure structured improvements, every product and process should build on a development road map that highlights the evolution path from current to target state, improving reliability while ensuring the optimization of future hardware generations. In addition to strict quality control during production, satellites are exposed to all kinds of tests after assembly. These tests should be done in-house if volumes permit the company to flexibly and timely test the new products.

Launch provision

Bus versus taxi—select the right partner(s)

Worldwide launch capacity is scarce and involves a significant amount of waiting time. Currently, the market is essentially divided into large rockets with payloads of several tons like SpaceX and micro launchers of less than one ton, such as Rocket Lab. Each option has its respective advantages, which strongly influence cost and time-to-market for a service. Large payloads are very economical in case of batch deliveries of heavier satellites. The main payload customers can determine the target orbit. Smaller payload customers have limited influence over launch time and orbit. Micro launchers address those shortcomings. They fly a small batch of satellites whenever a customer wants and directly to the target orbit, eliminating the need for any additional fuel or means of transportation. However, like a taxi compares to a bus, their price will remain higher on average than those for large rockets—especially until they master serial production and reusability.

Design for launch

It is fair to assume that launch cost will continue to drop. However, even at today's lower levels, it is still a significant portion of the overall system cost. Designing the satellite in accordance with launcher restrictions optimizes costs. The most important decision is the interface and deployment strategy with the launch vehicle. It is driven by the sizes of the constellation (the number of satellites) and the satellites (weight). There are two broad options: either a single satellite interfaces to the launcher or a batch of satellites share a single interface. A typical example for the first option is a ring structure with a central core inside the launcher fairing around which the satellites are attached. This option is well suited for constellations below 100 satellites and satellites below 100 kg. The second option can utilize a dispenser as done by Starlink. This is a mechanical structure that stacks a batch of satellites and connects them to the launcher through a single interface. Due to its scale and optimized space utilization, batch deployment through a dispenser significantly lowers launch segment costs.

Ground segment

Ground Station as a Service

Ground infrastructure is the gateway between space data and customers. It plays a key role, as it determines the time between data generation in space and data availability for customers on Earth. Two parameters are key: first, only a global footprint of ground stations ensures the ability to frequently contact satellites for data download. Second, computing capabilities and data storage need to be close to data sources, favoring edge computing and cloud providers. Traditionally, service providers build up their own ground segment as a complement to space infrastructure. Today, Ground Station as a Service (GSaaS) avoids those costs and essentially virtualizes the ground segment. It enables services to scale faster and rent ground infrastructure according to their needs (pay-as-you-go models). This way, time and capital are freed up to focus on the core value proposition of a service: satellite constellation, service development, and market penetration. After scaling the service to a global business, own ground segment infrastructure can be considered.

Get ground equipment into customers' hands

Whereas Earth observation services can be accessed through the Internet, satcom services require additional customer equipment. Connectivity through satellites of users or assets cannot be established without receiving and transmission hardware on the ground. For service providers, there are two important factors to consider: price and distribution channel. Current trend for service providers is to develop and build their own consumer equipment and sell it at a discount to make the service attractive. The other option is to partner with a specialized ground hardware provider. The second important factor is equipment distribution. Start-ups like Astrocast or Swarm Technologies market their equipment through their websites directly to customers. Other companies work with integrators to avoid building up their own distribution channels.

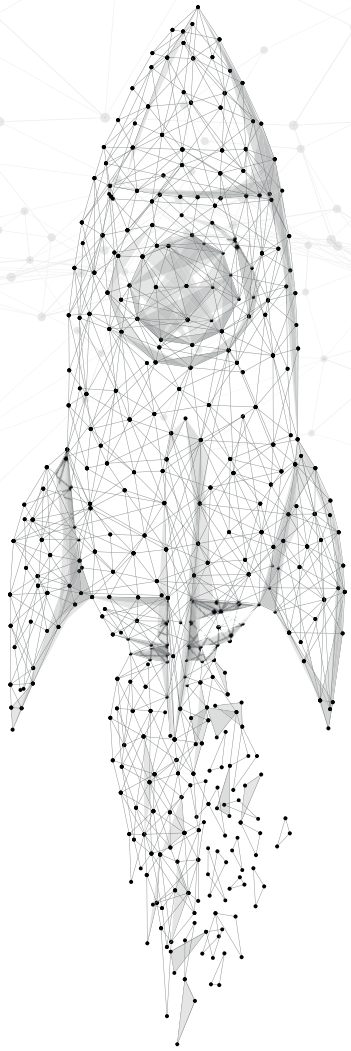
Service provision

Be truly customer-centric

When designing a space service, companies tend to focus their expenses on the hardware side to develop the space infrastructure. Most new space companies started out as hardware manufacturers that transformed over time into service businesses. With their roots and head count firmly placed in the hardware side of the business, other key functions are frequently underrepresented. However, from the customer perspective, an intuitive and informative front end is much more important than the space hardware that works in the background. In many space companies, the sales department serves primarily as an interface that redirects customer inquiries to technical staff. The department needs to be given significant weight to go into the field and capture customer needs that can be fed back into the organization to evolve into service ideas.

Manage the space infrastructure

A comparatively minor cost component for setting up a space service is the management of the constellation and its satellites during their useful life. This involves remote orbit control services for the launch and early orbit phase as well as routine operations. The latter includes orbit maintenance as satellites descend due to the gravitational pull of the Earth, collision avoidance, and deorbiting procedures. Setting up the mission control is usually considered a core competence of a service provider and is generally done in-house. The annual expenses for constellation operation are usually less than 10 percent of the infrastructure cost. In the future, this cost segment might expand with the possibility to buy on-orbit services like refueling, orbital modification, and active debris removal.



The nine success factors for controlling costs conclude the 18 top recommendations for building a space services. Their intention is to serve incumbents and newcomers in the space industry as a guideline on how to maximize their chances in the market by improving their position in terms of revenue potential and service costs. Recent bankruptcies are an important reminder that despite a focus on the right markets and favorable economics, a small hiccup in cost can still quickly lead to bankruptcy, as the industry is so capital intensive.

The hype around the New Space industry has led to a gold rush among all kinds of companies to vertically integrate and develop space services. The trend is understandable: services offer high margins and large revenue pools. At the same time the industry disruption is forcing virtually every space company to reconsider its strategic positioning in the value chain, so a move into services could be sensible. However, the default answer on corporate strategy should not be the emulation of a general industry trend but rather to chart an individualized path to growth. In addition, with many services coming to market there is a serious risk of cannibalization. To help space companies navigate the industry disruption and support the search for the right corporate strategy, the next chapter takes a close look into promising growth strategies for hardware and service providers.

03

Beyond the moonshot— How to become a successful space company

When searching for best-fit corporate strategies, a good starting point is the analysis of the most successful company in the industry: SpaceX. The company was recently valued at more than $100 billion, making it by far the most valuable space company.[27] Interestingly, in its valuation the rocket business was only responsible for about 10 percent. Most of the remaining value was Starlink. This difference highlights the revenue outlook for the respective markets. The question for incumbents and newcomers is whether SpaceX is a singular feat or if its success can be emulated?

Digging deeper into the evolution of the company highlights its strategic development. It started out by pursuing technological superiority to become market leader. Its rockets were the first to be reusable, driving down costs. At the same time, they are highly reliable. SpaceX has accumulated over 100 launches in sequence without failure—and counting. This further reduces costs because it lowers insurance, which can be 10 percent or more of the combined launch and satellite price. However, the rocket business was always going to be a limited market opportunity. In fact, Starlink is by far the best customer of SpaceX, showing that the launch market for weekly payload deliveries is still small. The COO of SpaceX stated that the total addressable market (TAM) for launch is maybe a six-billion-dollar opportunity whereas global broadband is one trillion. Moving first into satellite manufacturing and then into broadband services was a logical move to expand its TAM.[28] Today SpaceX is incredibly vertically integrated, building satellites, rockets, ground antennas, and offering a broadband subscription service. It has cut out virtually all middlemen along the value chain and fully controls its own ecosystem. Thus, once SpaceX had secured access to space, it developed all necessary components to move into satellite broadband. The company now even entertains the vision of using its Starship rocket for ultra-fast Earth-to-Earth travel between major cities.[29] It pursues extreme revenue growth and significant margin expansion to fund its long-term vision of reaching Mars.

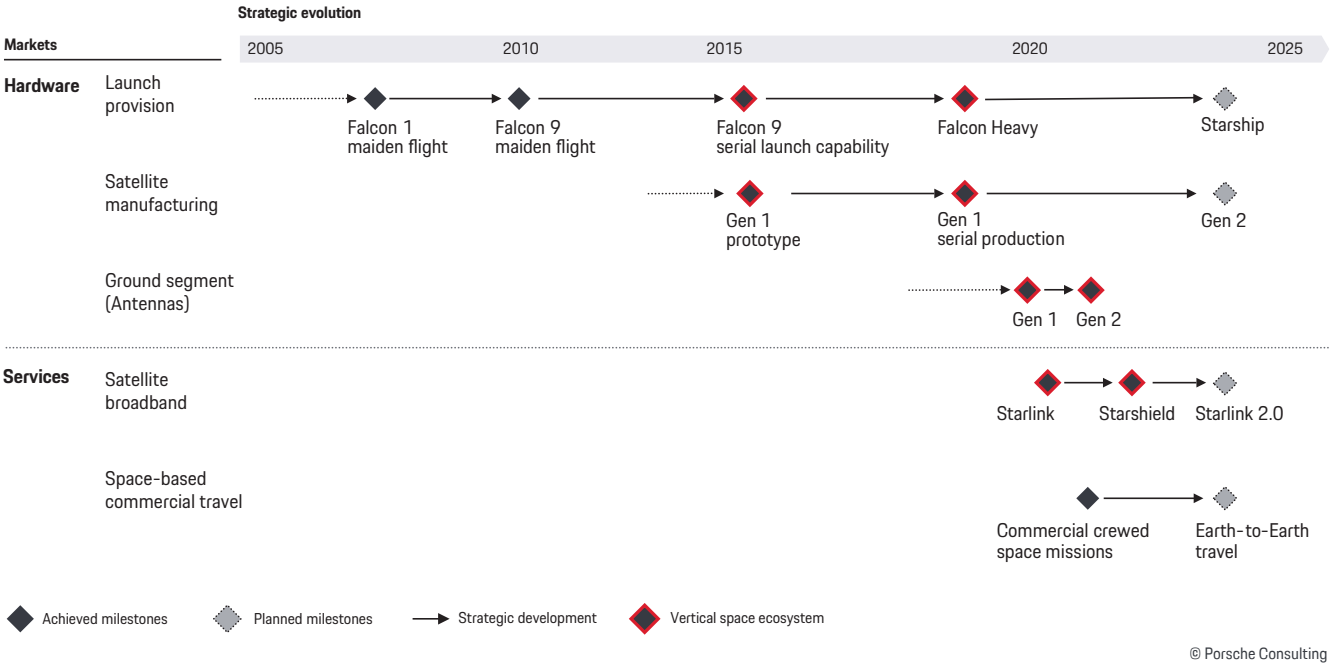


Fig. 10. SpaceX corporate strategy case study. It shows the targeted evolution from small total addressable market and margin potential in rockets and satellites to large service markets.

SpaceX success has not gone unnoticed in the industry. The entire industry is on the move. Established manufacturers like Thales, Airbus, and Boeing have established or bought subsidiaries to mass-produce smaller satellites. However, closer examination of the industry dynamism gives the impression that companies fear to be left out, rather than that they're following a structured and strategic development path. Active and conscious strategic positioning along the value chain is critical but following the trend of full vertical integration by default leaves out other promising options that might be more suitable to a specific company situation. To this end, the following two sections outline viable company strategies. The discussion starts out with opportunities for hardware providers before moving on to services. The intention is to give space companies a sketch of strategic options to support their positioning for profitable growth in a rapidly changing but highly attractive market.

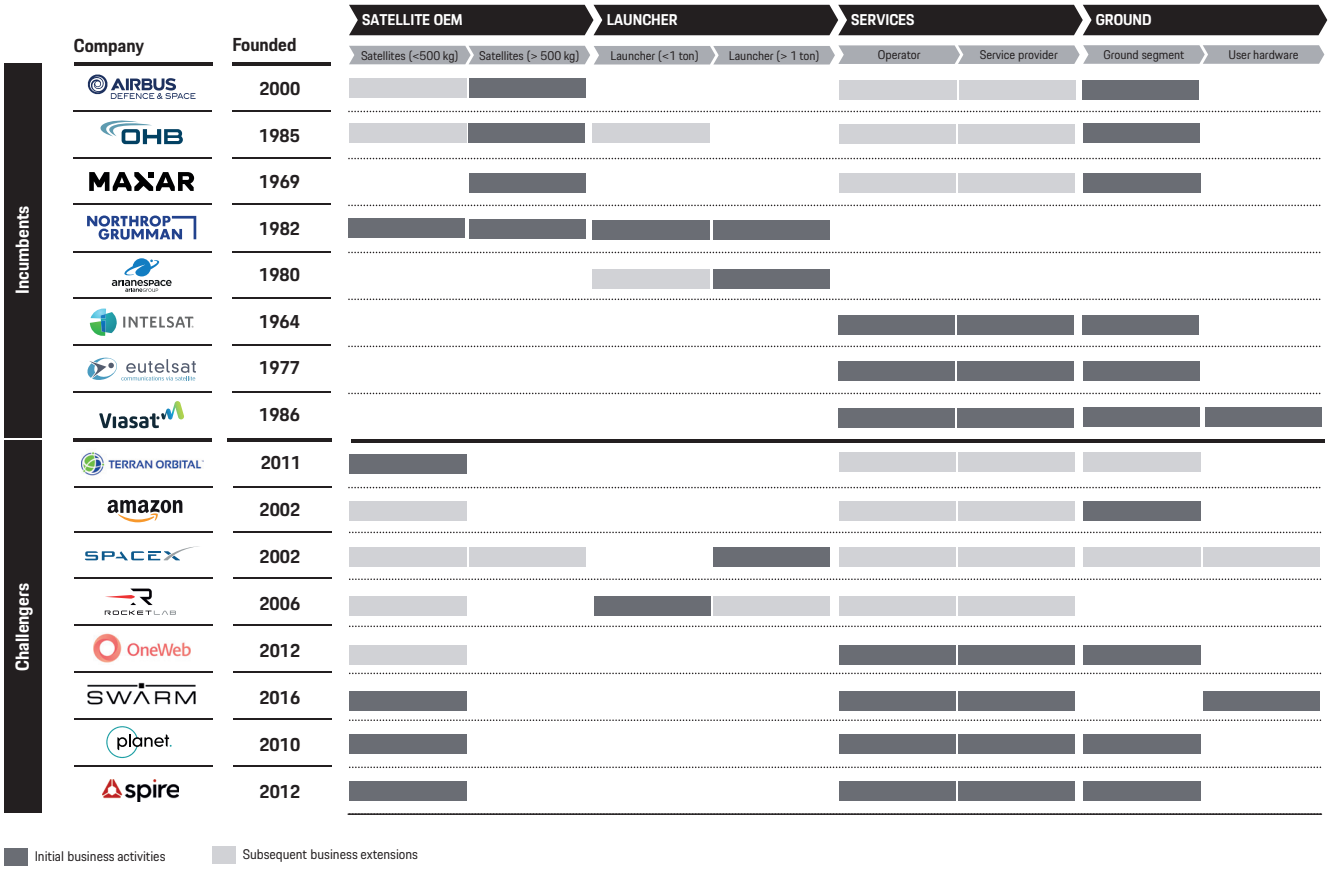


Fig. 11. Industry disruption has created market dynamics where incumbents and newcomers are increasingly covering hardware and service aspects of the space value chain.

3.1 Growth strategies for hardware providers

There are three common corporate strategies that can be pursued by space hardware providers. The aim is to maintain a competitive edge and to achieve profitable growth in the space economy. The subsequent paragraphs detail the strategies by outlining advantages and disadvantages, their primary impact on margins, and/or total addressable market as well as company examples.

Segment	Strategy		Improve margin	Expand TAM	Example company	Example focus
Hardware manufacturers	1. Lead the niche	(a) Technology leader	✓		TESAT-Spacecom	First mover into laser communication terminals
		(b) Manufacturing power house	✓		NanoAvionics	Has strong position in CubeSat market despite late start
	2. Extend the core	(a) Rescale		✓	Rocket Lab	Now develops Neutron rocket with 8t payload to LEO
		(b) Complementary hardware		✓		Sells satellite components like star trackers or reaction wheels
	3. Move into services		✓	✓	Terran Orbital	Company started with focus on hardware and is now building up its own Earth observation constellation
Service providers	1. Build or buy		✓		Telesat	Lightspeed is one of the few satcom constellations where the service provider does not build the satellites in-house
	2. Cut out all intermediaries		✓	✓	SpaceX	Ecosystem approach covering the full value chain that consolidates all revenues and margins in one company
	3. Expand services	(a) increase service depth	✓	✓	Spire Global	Sells enhanced data directly to verticals (e.g., weather, aviation)
		(b) increase service breadth	✓	✓	Planet Labs	Intends to establish a platform and app ecosystem

Fig. 12. Distinct corporate strategies are available for hardware manufacturers and service providers to improve their margins and/or to expand their total addressable market.

Lead the niche

The first strategy primarily focuses on margin expansion. Two options can be distinguished: first, a company can focus on key technologies that would make it an indispensable supplier to customers. Tesat-Spacecom became a technology leader for laser communication terminals by betting on the technology early on and bringing it to technical and industrial maturity. Technology leadership drives market leadership and gives pricing power. Marketing the competitive edge drives top-line growth. However, the total addressable market will remain limited. To keep growing, companies subsequently need to leverage economies of scale in manufacturing and procurement. Further growth can come from "as-a-service" revenue models.

The second option is to become a manufacturing powerhouse by combining cost and quality leadership. OneWeb and Starlink successfully manufacture at scale, but both produce almost exclusively for their own uses. Success for an independent contract manufacturer would require a combination of production industrialization and product standardization, offering a construction kit of different standard satellite bus sizes and modular subsystems. Cost-efficient, performant, and reliable spacecraft are a compelling value proposition for service providers to externalize production

Extend the core

Established satellite manufacturers like OHB and Airbus and launch providers like Arianespace are challenged by new entrants. To stabilize existing market positioning and capture further market share, businesses can extend their core and expand their TAM from adjacent market segments. Again, two strategies can be followed. Companies with strong positioning and expertise in rocket or satellite manufacturing could follow the "rescale" approach. This means to extend the portfolio with smaller or larger products within the home market. This allows broadening the target customer group while sticking to a core business. For instance, after successfully bringing the Electron with 300kg payload to market, Rocket Lab is now developing Neutron with 8t payload to target customers with larger satellites or for constellation deployment.

Another option to extend the company core is to pursue a complementary hardware strategy. At a satellite manufacturer this strategic approach could lead, for example, to internalizing development and manufacturing capabilities of satellite sub-systems. These include major cost drivers of space systems like solar panels, star trackers, or propulsion. Since these components would not be sourced from the supply chain and constellations drive production rates, high margins for the newly developed products can be expected. Further possibilities exist in developing complementary space equipment like orbit transfer vehicles or move into ground equipment.

Moving into services

The third strategic direction is to move into services like most of the industry is currently doing. The high-revenue space service segment promises decent EBITDA margins for both satcom and Earth observation services. SpaceX started as a launcher manufacturer in 2008 and further diversified the hardware business into satellite manufacturing in 2016. Compared to hardware manufacturing, where revenues are transaction-based one-offs, services guarantee recurring revenues over extended periods of time and higher EBITDA margins. However, despite this attractive value proposition, the strategy is not without perils. A rebranding of a hardware company is dangerous, as this could blur its established market perception. Also, satellite manufacturers that offer data services will start to directly compete with some of their potential customers. This could cannibalize their traditional business, as service providers would be reluctant to share their service idea and technical specifics. Moreover, vertical integration always diverts attention and capital. Developing a service will inevitably slow down the development of hardware. Moving into services should only be done after careful consideration and with some prerequisites fulfilled like a clear customer need, a robust business case and, ideally, an anchor customer.

The outlines illustrate that there are several other strategies outside of verticalization into services for hardware providers. In fact, there is a greater need for dedicated, innovative hardware companies than ever before. Serial contract manufacturers and technology leaders are crucial elements to further catalyze the industry development. After covering the hardware side of the value chain, the next paragraphs now investigate top-level strategies for service providers.

3.2 Growth strategies for service providers

Given that a service provider entered a relevant space market, revenue and margin potential should be given. To this end, Chapter 2 outlined success factors for bringing a lucrative but cost-optimized service to market. At this point, the strategic view is taken: What strategies should a service provider consider to ideally position itself along the space value chain?

Build or buy

Hardware is a top cost position when building a space service. To reduce these costs and improve profitability, service providers must decide whether to build their own hardware. The default answer seems to be "build it ourselves." A study found that only 57% of constellation developers have externalized production but over 90% of constellations require 250 satellites or less.[30] The question of build or buy should correlate to the constellation size: larger constellations of many satellites should favor in-house production whereas for smaller constellations production should be outsourced. Nevertheless, there are some good arguments for service providers to build their own spacecraft. In-house development of hardware and service allows for an integrated and iterative process that can significantly speed up the overall system design. Also, reliability and costs are not optimal when sourcing hardware from external providers. Many service providers assume that they can produce better quality and at similar cost levels. However, the advantages come at significant investments in terms of cleanrooms, machinery, test equipment, and personnel. It is proposed to follow a general rule of thumb regarding "build or buy": building the first-generation hardware to develop the service and market but subsequently externalizing production if the constellation size is 250 satellites or less. In future, large contract manufacturers will hopefully offer superior quality and price due to volume production, making externalization a more attractive option.

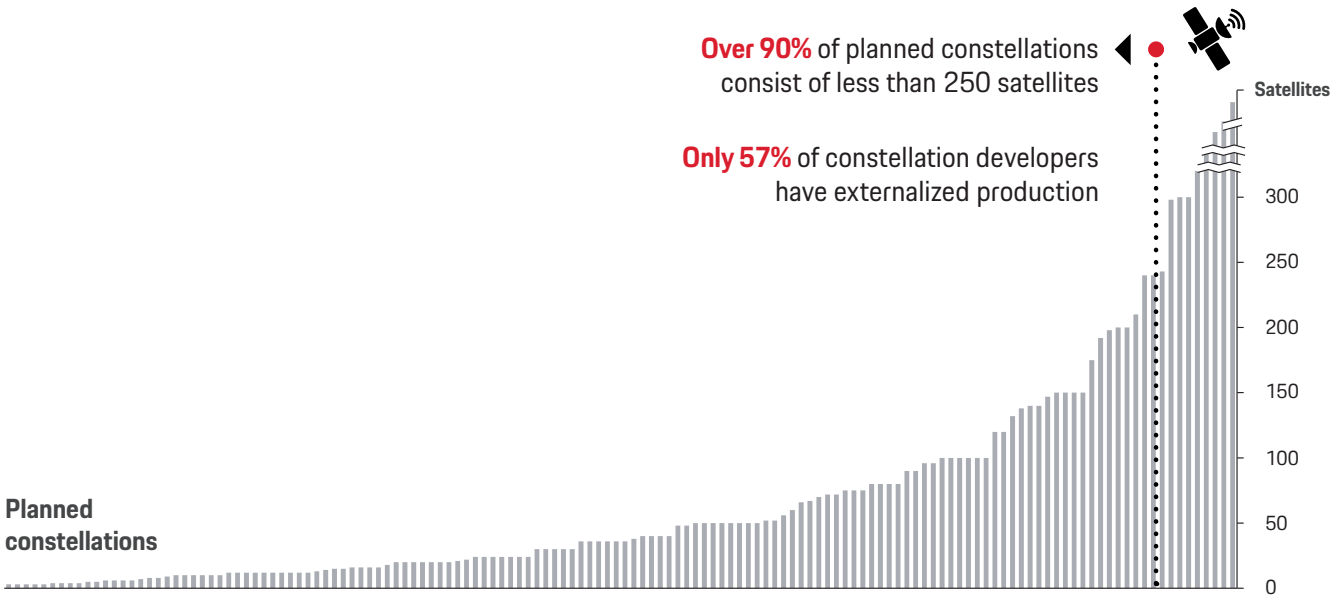


Fig. 13. Build vs. buy: due to decreasing unit costs, in-house manufacturing becomes viable when more than 250 small satellites are required for a constellation. Smaller constellations should outsource production to a serial manufacturer to benefit from reduced cost and equipment investment.[31]

Cutting out all intermediaries

The second strategy was termed the great Teslafication of industry by The Economist. It mimics the Silicon Valley "full stack" philosophy, which aims to internalize all production and services and thus all profits. Hence, the strategy goes significantly beyond major hardware like satellites and extends the view to the entire value chain—from chip and component design via launchers to ground station networks. Additionally, it gives full control over all aspects of the business. To build this ecosystem, companies can follow the usual avenues: do it yourself, mergers and acquisitions, and highly integrated partnerships. OHB is an interesting case here: the company builds satellites, invests in launchers, offers ground-segment-as-a-service, and end-customer services. However, whereas SpaceX has a singular ecosystem focus on broadband, OHB covers a wide array of technologies and services. The ecosystem approach is valid in both cases but is arguably more efficient when optimizing one specific value chain rather than many—much like Apple does for the iPhone. The strategy is certainly attractive but can only be seen as a long-term goal. It is better to focus on the core value proposition to get a service going and outsource whatever partners can do better and cheaper. The strategy also diverts attention and stretches resources. Companies will face many issues at the same time while neglecting the service development, its actual value proposition and, ultimately, the customer.

Increase service depth and breadth

Looking at the revenue side and total addressable market for a service provider, there are two complementary strategies to be followed. First, increasing service depth, i.e., the closeness to end customers and the quality of a service. Deriving insights from various data sources can make a service applicable to new customer groups. Ideally, the service becomes applicable to every player in a certain vertical (e.g., agriculture) or even everyone (e.g., satellite broadband). The second avenue is increasing service breadth: building a platform that hosts an application ecosystem that end users can access—much like the app store on a smartphone. The key challenge, however, is to get content onto the platform to increase its attractiveness to potential customers. Giving external developers access to the data to build applications for different customer groups would unleash the creativity required to build a truly sustainable marketplace. Over the mid-term, space service providers should consider opening their platform and data to external developers to build new businesses. Revenues would increase by charging for their data usage or by getting a cut of their revenues. Additionally, overall service attractiveness increases as the network effect drives new customers onto the platform.

The preceding outlines have detailed different corporate strategies for hardware and service providers. In practice, there are many dynamic factors like market timing and competitive environment that will heavily influence decisions. Also, the example of SpaceX demonstrates the importance of strategy evolution over time as primary goals are achieved or market dynamics change. The intention here was to give a high-level overview of options to support decision makers and companies in the process of defining their best-fit strategy.

CONCLUSION

To most people today, space is still more a place of science fiction than business. However, more and more people realize that the space industry is subject to a disruption it has not seen since its inception in the 1960s. Soon, space infrastructure may supersede its terrestrial counterparts in importance. However, in the early 2020s, the (New) space industry is also at a crossroads. An extensive industrial ecosystem is forming. There are two broad trajectories: either the business models do not take off, and the industry returns to its niche existence—or megatrends like connectivity, sustainability, and climate protection propel the industry to unseen levels of commercial activity.

The question for the industry but also its financial backers is whether New Space is a real business opportunity or a fading hype? Four perspectives help to close in on the answer. From a macroeconomic industry view, legacy revenue pools and players still dominate the value chain. Also, the financial performance of individual companies does not show any outliers. Established space companies are comparatively small with maybe a few billion dollars in revenue, while many New Space companies show little revenue and no profits. However, what has changed dramatically are the economics of the market. Costs for setting up a space service have plummeted while infrastructure capabilities have skyrocketed. Time-to-market today can be achieved in months rather than years. Capital to back space ventures is readily available. The right ingredients for starting a business are in place. Moreover, the industry focuses on megatrends that by design target a global market. Connectivity and Earth observation promise indeed to become markets worth several $100 billion. Hundreds of millions of people and devices are primarily in remote areas that are waiting to be connected to the Internet.

The space industry is a growing market with an attractive business outlook that justifies excitement from space companies and investors. However, bright prospects do not automatically lead to commercial success. Space companies must consider key success factors when building a new space service. They must quickly go to market with an economic solution to validate revenue potentials. Success factors center on the potential of services to quickly generate profits from large revenue pools that are tapped at limited costs. On the revenue side, three overarching factors drive success: positioning in the right market and business model, building a "sticky" service, and having the right go-to-market strategy. Although those points are relevant across industries, the complexity of space services makes them especially critical. The business model also needs a predefined path to achieve scale, as most space business ideas start out with very niche applications. On the cost side, an optimization of the entire space value chain from hardware manufacturing to service operation is required to limit expenses and time-to-market.

The hype around new space, however, has also created a major impediment for initial service success: outsized competition. Lucrative opportunities around connectivity and Earth observation have triggered a gold rush among space companies. The traditional segmentation of the value chain between hardware and service providers is disappearing. The rationale is obvious: services promise much larger revenue pools, recurring revenue streams and high margins. However, vertical integration is not without its perils. Few companies have the financial and human resources to cover the entire value chain. Rather than following others, any space company should analyze its current market position and the competitive landscape to then chart an individualized development path.

The 2020s will be a transformative period for the space economy unlike any before. Satellites will monitor every place on Earth and provide global broadband connectivity. Countless new services with large revenue pools will be developed, tying space even closer to our daily lives. Although the industry is on the right path, this future is not a certainty and still has to be built. Space companies still must develop "sticky" services that create completely new markets and bring unrivaled value to customers. What is certain, however, is that there is no going back for the industry and its companies. The disruption of the space economy is built on lasting trends that will alter the status quo towards new business models, value chains, and competitive landscapes. The (new) race to space is lifting off. Time to get on board.

In Brief

01 The space economy offers enormous potential for incumbents and newcomers alike, as it will grow from $400 billion in 2020 to over $1 trillion by 2030 on the back of megatrends like connectivity, sustainability, and climate protection.

02 The hype around the space industry is justified, as industry culture and economics have changed dramatically—including lower system costs, more capable technology, and a well-funded start-up ecosystem to build new services.

03 Despite the industry tailwinds, building a commercially successful space service does not come without its difficulties as the markets are immature without reliable sales channels or established customer bases.

04 On the revenue side, the service must be positioned in a relevant market, designed to be "sticky," and employ a smart go-to-market strategy to quickly monetize.

05 On the cost side, the service needs to employ an end-to-end approach along the space value chain to optimize top cost positions: hardware, launch, ground segment, and service operation.

06 Vertically integrated companies that cover the entire value chain from hardware manufacturing to service provisioning have become a top industry trend.

07 However, companies should be careful to follow this strategy by default, as it might jeopardize the current market positioning and perception as well as overstretch internal resources and budgets.

Appendix

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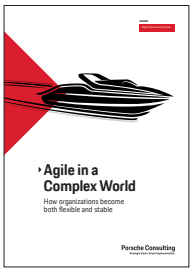
Further reading



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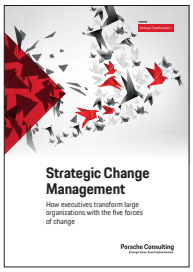

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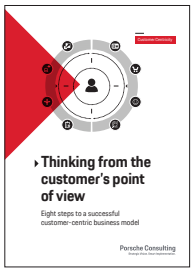

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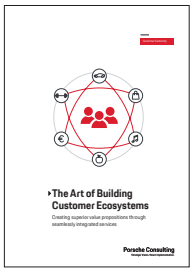

Customer Ecosystems

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