

A Galaxy of Opportunities

In-depth exploration of the current realities, emerging trends and economic viability of the burgeoning space industry

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Foreword

Discover a Universe of Potential with KPMG’s “Galaxy of Opportunities” Series

As business leaders deeply engaged in the synergistic growth of Aerospace & Defense, space adjacent industries and the capital markets, we invite you to immerse yourself in KPMG’s ongoing series, “A Galaxy of Opportunities.” This in-depth exploration of the current realities, emerging trends and economic viability of the burgeoning space industry promises to enhance our collective understanding of how terrestrial and off-Earth ventures can harmonize to spur economy-wide innovation and growth.

The series provides valuable insights into the intriguing universe of the commercial space industry, as we navigate the convergence of space and on-earth industries. It provokes an intellectual journey into the realm of capital amalgamations and maps how space ventures are moving into new frontiers and significantly shaping capital markets as well as traditional and space sectors.

Obtain insights about the emerging role of private equity in the final frontier and discover today’s opportunities and tomorrow’s predictions within the arena of the global space economy. Thoughtfully explore the ethical considerations across the space value chain, as our series concludes with an emphasis on the disciplinary self-awareness and long-term strategic decision-making required in an era of large-scale exploration and expansion of space, commerce and transportation.

This wealth of information is bundled in five insightful articles embodying our strategic goal for visionary industry integration. Through an integrated understanding of both terrestrial and space industries, we can develop new market opportunities, stimulate groundbreaking innovation, and achieve global economic advancement.

Join us on this journey through the potential commercial space industry interconnectedness. Together let’s envision today a future where industries coalesce, fostering disruptive economic growth both on Earth and beyond.



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The background of the entire page is a photograph taken from space, showing the curvature of the Earth. The sun is visible on the horizon, creating a bright starburst effect with rays of light. The Earth's surface is covered in a dense layer of white clouds, and the blue of the atmosphere is visible at the top and bottom edges of the frame.

The convergence of space and terrestrial industries:

Fostering innovation and economic growth

Brian Miske



Abstract

The horizontal expansion of the space industry facilitates cross-sector innovation and new market opportunities. It also represents a paradigm shift, bridging the gap between space and terrestrial industries and catalyzing innovation across various sectors. Enabled by the increasing commercialization of space activities led by private companies, this transformation offers new market opportunities and disrupts traditional industry structures. In this article, the first of three, we explore the impact of the horizontal expansion on global capital markets and the broader economy, outlining how the space industry is set to revolutionize industries and address global challenges.

A perspective on how this horizontal expansion is creating new market opportunities and driving innovation across sectors, challenging the conventional understanding of space as an isolated domain

The horizontal expansion of the space industry signifies a remarkable shift in perception and approach, propelling us into a new era of innovation and growth that transcends traditional industrial boundaries. As the space industry evolves from a vertical to a horizontal model, it breaks free from its long-held image of an isolated domain and begins adding value to a wide range of industries and customers. This industry shift is propelled by the increasing commercialization of space activities, led by pioneering private space companies. As space technology becomes increasingly integrated into a diverse range of terrestrial industries—from telecommunications and agriculture to transportation and defense—the landscape of the space industry is rapidly evolving into a more potent, multisectoral domain.

The horizontal expansion of the space industry is not without its challenges, as companies navigate the complexities of integrating space technology into terrestrial industries. However, the potential for new market opportunities and the drive for innovation across sectors make the horizontal expansion of the space industry a compelling and transformative phenomenon.

The far-reaching implications of the horizontal expansion of the space industry continue to challenge conventional thinking by creating new market opportunities and driving innovation across multiple sectors. This nexus of space and terrestrial industries has led to the development of groundbreaking technologies and previously unimagined solutions to global challenges, including climate change, natural disasters, and resource management. As the space industry's influence becomes more pervasive, it continues to reshape the global economy, pushing

the boundaries of human achievement ever further. The horizontal growth of the space industry not only represents a departure from the traditional focus on aerospace manufacturing, satellite launches, and space exploration but also heralds a promising new future where space permeates every aspect of our lives on Earth.

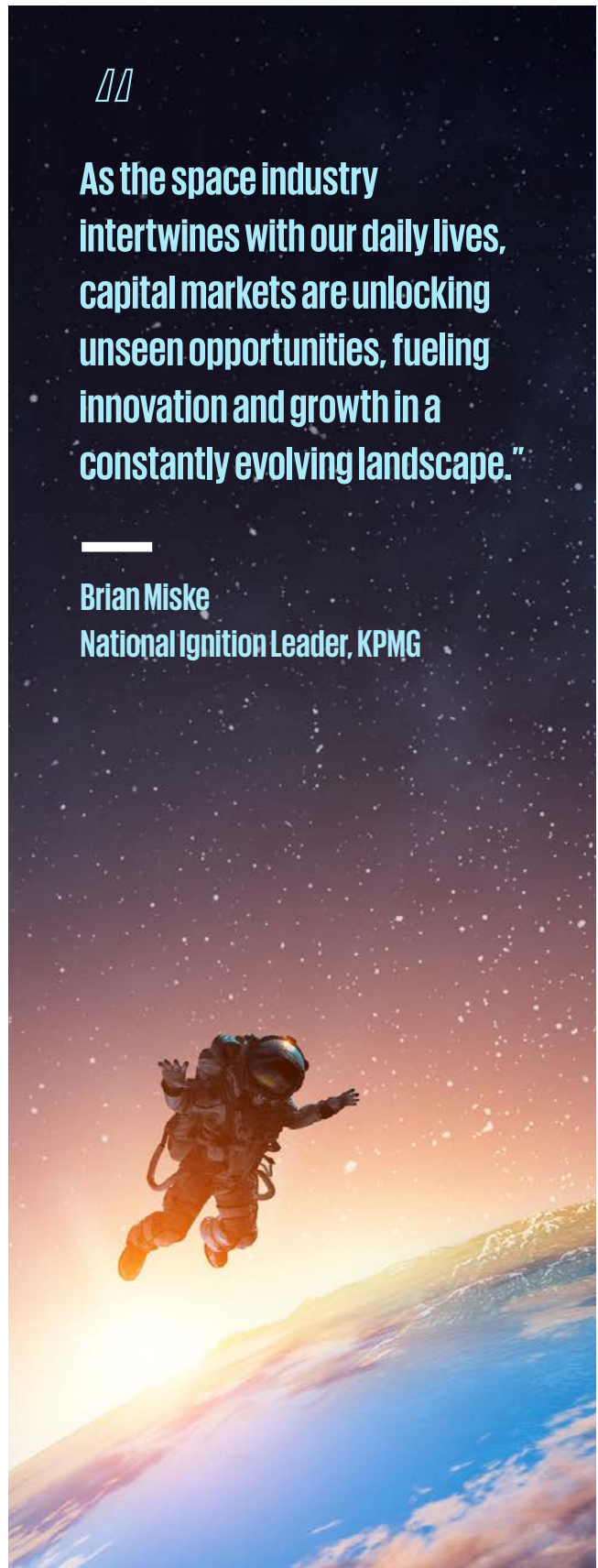
According to the Space Report, “The global space economy reached a new high of \$546 billion in 2022, an increase of 8% from a revised 2021 figure of \$506 billion. As in 2021, nearly 80% of this year’s space spending stemmed from commercial revenue, which is divided into two sectors: Products and Services, and Infrastructure and Support Industries.”¹ Growth is occurring across commercial sectors as well as government. “The Department of Defense’s unclassified space spending totaled \$17.1 billion in 2022. Space Foundation also estimates total defense space spending, including classified and unclassified budgets for all military branches and intelligence agencies. This estimate reached \$42.9 billion last year, a 21% increase year-over-year.”²

Embracing the power of collaboration, NASA is fostering dynamic partnerships with private firms to accelerate and streamline the return to the Moon. As the space industry intertwines with our daily lives, capital markets are unlocking unseen opportunities, fueling innovation and growth in a constantly evolving landscape. By leveraging a competitive and self-investment-driven approach, these alliances are giving rise to a thriving lunar economy, transforming space exploration and commercialization. “True commercial partnerships for development and operation of some elements of the exploration architecture represent the most rapid and cost-effective path to return to the Moon. In these partnerships, NASA outlines high-level mission objectives and safety requirements, but does not dictate system designs. Companies are required to compete for awards and to co-invest; and they are paid on a fixed-price basis only upon achieving pre-defined milestones. Further, these industry-led partnerships allow NASA to be one customer of many, stimulating a vibrant, commercial lunar economy. Already, due in part to the stability that NASA brings to the market as a customer, numerous private companies are developing lunar systems and signing commercial contracts with customers around the world.”³



As the space industry intertwines with our daily lives, capital markets are unlocking unseen opportunities, fueling innovation and growth in a constantly evolving landscape.”

Brian Miske
National Ignition Leader, KPMG





The perspective on the space industry: Transition from vertical to horizontal

The space industry has undergone a remarkable transformation in recent years, shifting from a predominantly vertical orientation to a more comprehensive horizontal perspective. This change has been sparked by the increasing commercialization of space, as private companies emerge as key players in the sector. Consequently, space technology and services have begun integrating into a broader array of terrestrial industries.

Traditionally, the space industry has centered on government-funded exploration, military applications, and satellite communication, maintaining its vertical structure. However, the rise of private space ventures has revolutionized the sector, not only accelerating technological advancements but also expanding the industry's scope to encompass commercial space activities. As a result of this diversification, the space industry's horizontal expansion is taking precedence over its vertical roots.

The Morgan Stanley report demonstrates this shift, estimating that, "the revenue generated by the global space industry may increase to more than \$1 trillion by 2040."⁴ The thriving commercial space sector, which is driving the industry's horizontal expansion, is fueled by a diversification of space activities. This encompasses space tourism, satellite constellations for global internet coverage, pharmaceutical research, in-space assembly

and manufacturing, and asteroid mining, all of which contribute to the industry's transformation.

The evolving space industry now attracts individuals driven not only by the allure of exploring space turning science fiction into reality, but also by the opportunities it presents for pioneering new enterprises, generating prosperity, and fostering employment. This newfound perspective highlights the tremendous potential and promise the maturing sector holds. Indeed, the space industry's growth is increasingly recognized as a powerful catalyst for groundbreaking advancements



This shift is absolutely a reality today not only in the very visible successes of commercial space ventures but also in the growing number of innovators in this 'space' developing solutions to terrestrial challenges through technology that is or will be deployed in space."

Lorna Stark

Line of Business Leader, Government andw
Healthcare, KPMG



“To realize a \$1 trillion space economy by 2040, we must continue to unleash private enterprise and rely on government experience to provide the demand signals, the frameworks, and the security that incentivize market action.”⁵

and economic development. This shift in perspective has far-reaching implications, as it challenges the notion that space is an isolated domain. The integration of space technology into various terrestrial industries, such as telecommunications, agriculture, transportation, and energy, has created new market opportunities and driven innovation across a multitude of sectors. The US Chambers of Commerce identified the need to broaden to the space economy beyond the confines of the traditional vertical to seize the opportunity. “To realize a \$1 trillion space economy by 2040, we must continue to unleash private enterprise and rely on government experience to provide the demand signals, the frameworks, and the security that incentivize market action.”⁵

Moreover, the horizontal expansion of the space industry has prompted the development of a new space ecosystem, complete with new participants, business models, and investment opportunities. As an example, the growth of small satellite constellations has disrupted traditional satellite manufacturing and launch markets, providing cost-effective and frequent access to space for a myriad of applications, including Earth observation and global connectivity.

The space industry’s intersection with terrestrial industries highlights its transformative potential as it evolves into a horizontal, multisectoral domain. As the space industry expands from a vertical to a horizontal framework, it emphasizes its increasing relevance and impact on the global economy and its capacity to spur technological advancements and economic growth.

In conclusion, the horizontal expansion of the space industry marks a significant paradigm shift, challenging the conventional perception of space as an isolated domain dominated by national governments and instead highlighting its integration with various terrestrial industries. The increasing commercialization of space activities, led by pioneering private companies, has fueled this transformation, created new market opportunities and drives innovation across sectors. As the space industry continues to expand and permeate many aspects of human life, it holds significant potential to revolutionize industries and address global challenges.

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Key considerations

1

How can organizations adequately prepare to capitalize on the emerging market opportunities presented by the convergence of space and terrestrial industries, and identify sectors where space technologies could have a transformative impact?

2

As the space industry transitions from a vertical to a horizontal model, what strategies should businesses adopt to navigate the complex integration of space technology within their terrestrial operations, and mitigate the potential risks involved in venturing into this new domain?

3

How can governments and private investors work together to support the development of the space economy, while ensuring an equitable distribution of benefits and opportunity and minimizing potential environmental and geopolitical risks associated with expanding commercial space activities?



Capital connections:

The intersection of commercial space activities
and global financial markets

Brian Miske and Kristin Haug



Abstract

This is the second of three articles related to the series “The Horizontal Expansion of the Space Industry: Creating New Market Opportunities, Driving Innovation, and Influencing Global Capital Markets.” The convergence of commercial space activities with global financial markets is generating a dynamic investment ecosystem underpinned by technological advancements and evolving capital market trends. In this article, the second of the series, we explore this intricate interplay and its implications for the space industry, examining the influence of capital markets on the burgeoning sector as it undergoes a technology-driven shift. We discuss the challenges and opportunities faced by investors, highlighting the extended investment horizons and substantial capital requirements characteristic of space ventures. Furthermore, we uncover parallels between the commercial space sector and other innovative industries, such as biotechnology, renewable energy, and artificial intelligence, drawing valuable insights into the unique investment dynamics and risk assessment models adapted to these pioneering fields. By investigating the intersection of commercial space activities and global financial markets, we pave the way for a comprehensive understanding of the landscape, fostering the development of innovative approaches and frameworks necessary to create a more inclusive, accessible, and profitable space ecosystem.

Investigating the interplay between commercial space activities and the global financial landscape

As the commercial space sector converges with the global financial landscape, we witness a fascinating interplay between two unrelated fields. The growing commercialization of space, along with technological advancements, has transformed investment and innovation dynamics, creating numerous opportunities and challenges as these two sectors intersect.

This remarkable interaction can be observed within capital markets, where the commercial space sector has created a unique ecosystem of high-risk ventures and sizable investments. The capital-intensive nature of the space industry has redefined conventional ideas of risk and return, attracting various investors to the space domain.

The outlook on investment dynamics in the space industry is grounded in realism. While we recognize the vast opportunities for investors in space commercialization, it is essential to acknowledge that there are inherent risks associated with this rapidly expanding and attention-grabbing sector. This balanced understanding can also be observed in other sectors and technology endeavors, which have experienced similar levels of risk.

For instance, industries such as biotechnology, renewable energy, and artificial intelligence have followed comparable trajectories, showcasing immense potential for growth and innovation while also presenting

significant risks and uncertainties. By analyzing these parallels, we can gain valuable insights into the unique challenges and opportunities that arise when investing in groundbreaking fields, helping us navigate the complexities of the space industry with a balanced perspective.

Considering space as a horizontal industry for both traditional and nontraditional companies requires an understanding of two crucial factors: the substantial capital needs and the extended investment horizons. Space ventures demand significant funding due to high development costs and lengthy timelines for returns, as activities often take years or decades.

As the space industry continues to attract diverse investors, including government entities, private venture capitalists, and institutional investors, innovative approaches for evaluating and managing investment risks are necessary. By addressing the unique challenges and adapting strategies accordingly, both traditional and nontraditional space companies can contribute to building a more inclusive, accessible, and profitable space ecosystem.

Additionally, the impact of capital markets extends beyond merely funding space ventures; it influences the direction and governance of space activities. The emergence of private space companies and entrepreneurial ventures has changed investment and innovation dynamics, with traditional space agencies now competing against private companies for market share and profitability.

The connection between commercial space activities and the global financial landscape has also prompted a change in investment patterns, risk assessment models, and new frameworks. While government expenditure once dominated the space industry, the surge of private capital has introduced competition and entrepreneurship into the space sector. One of the new frameworks can be focused on the rise of spaceports and launch facilities around the world. This exemplifies the shift from a vertical to a horizontal space industry model. These facilities



cater to a spectrum of launch vehicles, fostering a diverse ecosystem of space access and stimulating the growth of commercial space transportation services.

This confluence of the space industry and other sectors not only brings about unparalleled investment levels, but also fosters technological breakthroughs and collaborative efforts across diverse fields. For instance, the emergence of space-based internet constellations has led to partnerships between space firms and telecommunication leaders, highlighting the far-reaching impact of space technology and its capacity to reshape conventional industry limitations. By considering broader second and third order effects, we can better understand the subsequent implications of incorporating space technology into different industries.

The dynamic interplay between commercial space activities and the global financial landscape forms a transformative junction, redefining investment patterns, risk assessment models, and technological innovation. The melding of these two sectors has reshaped the space industry, ushering in a more entrepreneurial, commercially driven, and competitive environment. As this relationship continues to evolve, it will undoubtedly influence the future of space exploration, technological innovation, and economic growth.

As we venture further into this interaction and its inherent complexities, it becomes crucial to explore the numerous opportunities and obstacles that arise when these traditional and nontraditional sectors merge and redefine the space industry. By examining the challenges and potential solutions in this evolving landscape, we can better understand the implications and future of this transformational convergence.



States and municipalities have sought to open new spaceports to attract commercial space transportation and associated high-tech firms and create technology hubs for research and development.¹

The convergence of commercial space activities and the global financial landscape: Opportunities and challenges

The integration of commercial space activities and the global financial landscape has ushered in a new frontier filled with opportunities and challenges, as the inexorable force of technology and the fourth industrial revolution reshape investment dynamics within the space industry. The applications are vast. “The 4IR and space have a positive, mutually reinforcing relationship: Scientific advancements and the convergence of technologies are leading to advances in space exploration, while advances in space are leading to the creation of new technologies and applications. Advances in blockchain technology, artificial intelligence, 3D printing, materials science, nanotechnology, and biotechnology have led to two key trends—decreasing launch costs and increasing capabilities of smaller satellites—both of which are leading to new capabilities for the sake of exploration and with direct benefit to society on Earth.”²

This convergence has propelled the space industry into a golden age of commercialization, marked by a surge of innovation, investment, and entrepreneurship, which drives efficiency and market-driven advancements. However, it also presents numerous challenges, as traditional investment practices and regulatory frameworks must adapt to the unique demands and complexities of space ventures.

Capital markets play a pivotal role in this transformation, fueling space ventures and, in turn, being reshaped by them. As a result, capital markets face the need to develop innovative approaches to risk assessment models, investment horizons, and financial valuation methods suited to the space economy’s dynamic landscape. The impact of capital markets on space commercialization also encourages a diverse array of investors to enter the field, ranging from venture capitalists and angel investors to institutional funds and sovereign wealth funds.

Investments in space technology have yielded considerable returns, altered risk assessment models, and prompted extensive research to understand the transformative effect of capital investments in space ventures. However, the fusion of commercial space activities and global finance also brings challenges, including regulatory uncertainties, market ambiguities, and increased competition that demand critical attention. Consider a broader provocative analogy of Moore’s Law for Space: “Just as Moore’s Law has changed our

lives over the past 60 years, Moore’s Law in Space can change our lives over the next 60 years. With regards to space, commercial companies are expecting to see enormous growth in services and resultant profits provided through space. In such a future, investors would see exponentially growing opportunities. And engineering talent is likely to follow along in a continuous feedback loop. This could mean further human expansion into space, new scientific discoveries, and new markets. This space economy has the potential to create new jobs and sources of wealth, and to improve our life on Earth.”³

The progression of technologies generates a domino effect across the space exploration sectors, consequently attracting attention from capital markets and financial institutions. “As the private space sector becomes more engaged with Earth’s citizens, these companies will have to adjust their business models to not only fit the requirements of commercial accessibility, but also integrate a democratic ethos in all aspects of NewSpace development, tourism, and settlement. With the ability for the private sector to operate in more collaborative and competitive ways, technology will continue to evolve exponentially and the future of humanity”⁴

As the complex interplay between commercial space activities and the global financial landscape continues to evolve, capital markets emerge as a cornerstone of this transformation, nurturing space ventures and adapting to the space economy’s ever-changing needs. Exploring this unique ecosystem of financial opportunities and challenges, we must consider the innovative approaches and sustainable growth strategies required to effectively navigate the intricacies of this rapidly developing landscape.



Investment in space will be transformational for the capital markets, leading to an acceleration of the level of commercial innovation, which will benefit life both on earth and in space.”

Grant McDonald

Global Aerospace and Defense Leader, KPMG

The influence of capital markets on space commercialization:

A unique ecosystem of financial opportunities and challenges

The space industry finds itself at the crossroads of substantial investments and high-risk ventures, which leads to an ecosystem of financial opportunities and challenges that redefine the landscape of commercial space activities. Innovative technologies, along with the emerging space economy, are reshaping the dynamics of capital markets, compelling financial institutions to foster ingenuity and adjust their investment approaches and risk evaluations while navigating the novel opportunities arising from exceptional progress across numerous sectors. As the space industry rapidly expands, capital markets' influence becomes more profound, reshaping conventional investment models and spurring innovation.

“Innovative technologies, along with the emerging space economy, are reshaping the dynamics of capital markets, compelling financial institutions to foster ingenuity and adjust their investment approaches and risk evaluations while navigating the novel opportunities arising from exceptional progress across numerous sectors.” — Brian Miske

This transformation is characterized by the merger of significant capital investments and high-risk ventures, captivating a diverse group of investors from various areas. This change prompts the reevaluation of traditional financial strategies, leading to the emergence of innovative investment approaches suited for the space industry. The intricate interplay between commercial space activities and global financial trends suggests an era of transformation and growth, paving the way for a more inclusive, accessible, and profitable space ecosystem that impacts not only space exploration but also a multitude of industries. Capital markets not only fuel space ventures but also are transformed by them. In response to the industry's high-risk nature, novel financial instruments have emerged, such as space-focused venture capital funds, ETFs, and SPACs. The industry's growing commercialization attracts a diverse range of investors, eager to capitalize on upcoming opportunities.

“The intricate interplay between commercial space activities and global financial trends suggests an era of transformation and growth, paving the way for a more inclusive, accessible, and profitable space ecosystem that impacts not only space exploration but also a multitude of industries.” — Brian Miske



The intricate interplay between commercial space activities and global financial trends isn't just reshaping industries, it's redefining possibilities. This evolution necessitates a holistic approach to investment and innovation, urging stakeholders to embrace collaboration, creativity, and forward-thinking strategies to capitalize on the myriad opportunities presented by the burgeoning space ecosystem.”

Agnel Kagoo

Head of Capital Markets Advisory, KPMG



Several case studies and expert opinions reveal the transformative impact of capital investments in space ventures, demonstrating the potential for substantial returns and risks. As a result, innovative investment paradigms, risk assessment models, and financial instruments emerge, reflecting the unique demands of space activities and initiating a transformative shift in the financial landscape.

Overall, the unique ecosystem of the space industry presents financial opportunities and challenges driven by the convergence of significant capital investments and high-risk ventures. The space industry goes beyond being just an investment arena; it acts as a driving force for worldwide innovation and collaboration, generating unparalleled prospects and welcoming a fresh age of interconnectivity across multiple sectors. This evolving interplay propels a new era in the space industry's financial trajectory, revolutionizing investment strategies, risk assessment methodologies, and financial valuation frameworks.

“The space industry goes beyond being just an investment arena; it acts as a driving force for worldwide innovation and collaboration, generating unparalleled prospects and welcoming a fresh age of interconnectivity across multiple sectors.”

— Brian Miske

In conclusion, the convergence of commercial space activities and global financial markets has created a dynamic and transformative investment ecosystem, redefined the landscape of the space industry, and reshaped conventional investment models. Capital markets have emerged as a cornerstone in this transformation, nurturing space ventures and adapting to the ever-changing needs of the space economy. As this relationship continues to evolve, it will undoubtedly shape the future of space exploration, technological innovation, and economic growth.

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Key considerations

1

How can traditional financial institutions and investment models adapt to the unique challenges and risks associated with commercial space ventures? What new financial instruments and risk assessment frameworks are required to effectively navigate the intricacies of this rapidly developing landscape?

2

As the space industry continues to expand and attract diverse investors, what collaborative efforts and partnerships can be forged across various sectors to harness space technology’s potential to reshape conventional industry limitations and drive further innovation?

3

How can regulatory bodies and policymaking adapt to the rapid commercialization of the space industry and the growing influence of capital markets on space activities? What measures need to be implemented to create a more inclusive, accessible, and sustainable space ecosystem?

Exploring these thought-provoking questions will allow us to better comprehend the commercial space activities and global financial markets convergence and adapt to the evolving landscape that it brings.



Redefining frontiers:

The pivotal role of space ventures in shaping capital markets and Earth-based industries

Brian Miske and Kristin Haug



Abstract

The third article in our series, explores the transformative impact of space ventures on capital markets and their influence on diverse sectors, such as telecommunications, transportation, agriculture, and defense. As space technology expands its reach and reshapes the global investment landscape, it demands innovation in financial instruments, risk assessments, and investment strategies. We explore the emergence of novel financial instruments designed for space commercialization, such as venture capital funds, exchange-traded funds (ETFs), and special-purpose acquisition companies (SPACs). In addition, we examine how capital markets can adopt a horizontal approach across multiple sectors to drive innovation, uncover potential synergies, and expand ideas on the sources of funding. This, in turn, can create new market opportunities and respond to the unique challenges and rewards of space-related ventures. By fostering sectoral interconnectedness and driving sustained, systemwide innovation, space technology is spearheading a sea change in global industries and prompting a reevaluation of traditional financial frameworks. Through its pervasive impact, the space industry is not only redefining frontiers in the investment domain but also fostering transformative advancements and collaborative growth in terrestrial sectors worldwide.

The transformative impact of space ventures on capital markets

Space ventures are changing the way financial institutions and capital markets operate, creating a new era of innovation and investment possibilities. These new opportunities make financial markets think differently, leading to fresh ideas and improved ways of assessing risks. Space ventures are forcing financial institutions to think creatively and develop new investment models, risk assessments, and financial strategies.

New financial instruments designed for space commercialization are also emerging, such as venture capital funds focused on space, ETFs, and SPACs targeting space ventures. This shift shows the growing importance of the space industry in the financial world. Investors of all types, from venture capitalists to established aerospace companies, are now investing in the space industry, marking a notable change in investment portfolios. This diversity shows the influence of space ventures on the evolving dynamics of capital markets.

One example of space ventures leading to changes in capital markets is the interest in space-based internet constellations. Financial institutions are developing new risk assessment methods and investment strategies to benefit from potential returns and manage the risks related to the space industry. Capital markets and public sectors play a key role in this evolution.



Space is truly an exciting new frontier for the capital markets, leading to innovation in the development of new financial products to support the growing space ecosystem. The benefits on earth will be profound.”

Grant McDonald
Global Aerospace and Defense Leader, KPMG

Capital markets can accelerate access, adoption, and investment in the space industry by shifting from the traditional aerospace and defense sector verticals to a more horizontal approach encompassing multiple sectors. This holistic approach can drive innovation, leverage synergies and cross-sector opportunities, enhance funding sources, and create new market niches. Several strategies can be implemented to achieve this vision:

Encourage cross-sector partnerships:

Financial markets can promote collaboration between space companies and other industries, such as telecommunications, agriculture, mining, logistics, and data analytics. These partnerships will foster the development of innovative space applications and services that cater to diverse markets, attracting investment from a broader range of sectors.

Foster innovative financial instruments

Capital markets can develop and promote financial instruments tailored to the unique needs of space-related activities that span multiple sectors. Examples include space-focused venture capital funds, ETFs, and SPACs targeting space ventures. These tools can provide space companies with the necessary capital to invest in multisectoral projects and opportunities.

Educate and engage investors

Capital markets can educate potential investors on the benefits and opportunities of investing in the space industry as a cross-sector driver of growth. Webinars, seminars, and conferences focusing on synergies between the space industry and other sectors can foster increased interest and investment in this area.

Government policies and incentives

Regulatory bodies can introduce policies and incentives that encourage investment across sectors, such as tax benefits, public funding, and challenge grants related to space projects with cross-sector applications. This approach can facilitate the flow of capital into space enterprises engaging in multisector initiatives.

Support incubators and accelerators

Capital markets can support the creation and growth of incubators and accelerators focused on space start-ups with cross-sector applications. These programs help early-stage companies develop and commercialize their groundbreaking technologies, driving innovation and attracting investment in the space industry.

Develop sector indices and benchmarks

Financial markets can create sector indices and benchmarks that track the performance of space-related companies across multiple industries. This approach will make it easier for investors to identify investment opportunities and monitor the performance of their portfolio in the space industry.

As the space industry continues to evolve and reshape risk management and investment frameworks, its influence on capital markets shapes investment strategies and financial methods, signaling an exciting future where the space industry plays a pivotal role in the direction of global investment. By fostering a horizontal approach and promoting connections across sectors, capital markets hold the potential to accelerate access, adoption, and investment in the space domain. This integrated strategy can lead to diversified investment portfolios, drive innovation, and fuel economic growth. It will propel the global space industry forward while unlocking new opportunities for businesses and investors alike. In this context, it becomes increasingly relevant to explore the realm of space technology investments, particularly as they offer unprecedented returns and reshape risk assessment models for the financial industry.

Space technology investments: Unprecedented returns and reshaping risk assessment models

The investment landscape in space technology has undergone a remarkable transformation, marked not only by exceptional returns but also by a growing trend toward interindustry collaboration. As space technology evolves and expands into various sectors such as telecommunications, transportation, agriculture, and defense, it presents exciting opportunities and challenges for investors. This shift has prompted a reassessment

“The rapid horizontal expansion of the space economy is challenging conventional wisdom, pushing boundaries, and fundamentally altering the dynamics between commercial space activities and global financial markets. This evolution underscores the need for innovative strategies to navigate this emerging area effectively and presents tremendous opportunity for capital markets participants fueling this growth.”

Kristin Haug

Head of Financial Services, KPMG Ignition

of traditional financial frameworks and risk assessment models to better accommodate the complexities and uncertainties inherent in space-related ventures.

Investments in space technology have generated unprecedented returns, exemplifying the potential rewards of commercialization and technological advancements in the space industry. This potential has attracted a broad range of investors, reflecting the transformative impact of space technology on the broader investment landscape. To accommodate the unique demands of space-related activities, investors are adopting innovative approaches to assess, manage, and invest in high-risk, high-reward ventures. The opportunities are evolving at a rapid rate. “Huge technological developments have continued, with new sectors developing space solutions to help tackle some of humanity’s greatest problems on Earth.”¹

As space technology investments continue to transform the investment landscape and reshape traditional financial frameworks and risk assessment models, they also pave the way for innovations that extend beyond the realm of finance. The expanding frontiers of space technology have a pervasive impact on Earth’s industries, prompting a new era of interconnectedness and innovation across diverse sectors. With this foundation, we now transition to explore the numerous ways space technology influences industries on Earth and the emerging opportunities that arise from this confluence of advancements and collaborations.

Expanding frontiers:

The pervasive impact of space technology on Earth's industries

Space technology, once seen as limited to exploration and satellite communication, now reaches across multiple industries on Earth, reshaping sectors such as telecommunications, transportation, agriculture, and defense. This groundbreaking influence sparks interdisciplinary innovation and collaboration, enhancing our modern societal landscape.

Originally perceived as exclusive to space exploration and satellite communication, space technology now permeates various Earth-based industries, transforming fields such as telecommunications, transportation, agriculture, and defense. This revolutionary impact promotes interdisciplinary ingenuity and collaboration, enriching the contemporary societal framework.

There are a multitude of private and commercial company initiatives that vividly demonstrate space technology's profound effect on telecommunications. By seeking to deploy satellite internet constellations, these projects pioneer global connectivity, and the integration of satellite constellations in telecommunication infrastructure embodies this shift, bridging the digital divide.

Additionally, transportation systems have reaped the benefits of space technology. Satellite navigation systems like GPS and Galileo have significantly enhanced maritime, aviation, and land-based transportation's navigational accuracy, safety, and efficiency, fostering a more connected world. Even the defense industry has undergone substantial transformations due to space technology's integration. Space-based technologies, such as satellite imaging and communication systems, have bolstered national security and military operations by providing improved global situational awareness and strengthened communication capabilities. Additionally, space technology has made inroads into agriculture as satellite imagery, remote sensing, and GIS revolutionize farming practices. Breakthrough innovations in these technologies enable intelligent forecasting, targeted farming techniques, and efficient resource management, ultimately increasing productivity and championing long-term sustainability.

The pervasive influence of space technology across various terrestrial sectors, including telecommunications, transportation, agriculture, and



Navigating the space economy requires a different mindset. It's not just about profit, it's about patience and vision. Operational risks, regulatory uncertainties, and space's unforgiving nature demand a commitment beyond traditional investments. Capital markets participants entering this arena must understand that it's a marathon, not a sprint. But for those who endure, the rewards are limitless, and the opportunity to shape the future of space commerce is unparalleled."

Peter Torrente

National Head of Banking & Capital Markets, KPMG

defense, showcases its capacity to drive innovation, economic growth, and interdisciplinary cooperation. Capital markets play a crucial role in developing and accelerating the space economy by providing the necessary funding for cutting-edge projects and fostering public-private partnerships. As space technology evolves, capital markets facilitate the transformation of traditional industries, enabling the emergence of unique cross-sector collaborations that accelerate technological progress and interconnectedness. By mobilizing resources, promoting investment in promising ventures, and supporting an ecosystem that drives growth, capital markets further unlock the potential of the space economy and its broader implications for the future.

Key considerations

1

How can capital markets capitalize on the transformative impact of space technology across multiple sectors, and what innovative strategies should they employ to encourage interindustry collaboration and investment?

2

How can financial institutions adapt their risk assessment models to better account for the unique challenges and high-reward potential associated with space ventures, particularly as the space economy continues to expand and redefine global investment landscapes?

3

In what ways can financial institutions and investors harness the invaluable opportunities arising from the confluence of space technology advancements and collaborations to drive growth and innovation in Earth-based industries?

In conclusion, space ventures are transforming the global capital markets and Earth-based industries by driving innovation, fostering multisectoral synergies, and creating new market opportunities. Through the development of novel financial instruments, cross-sector collaborations, and innovative approaches to risk assessment and investment strategies, capital markets are poised to leverage the growing potential of the space industry. As the space economy evolves, so do the ways it impacts various terrestrial sectors, leading to an era of interconnectedness and growth across industries, from telecommunications and transportation to agriculture and defense. By supporting the flourishing space economy, capital markets have the ability to redefine frontiers, prompting a reevaluation of traditional financial frameworks and unlocking new opportunities for businesses and investors worldwide.

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Private equity in the final frontier:

Today's opportunities and tomorrow's predictions



Brian Miske, Gavin Geminder, and Josh Kirton

Abstract

This provocative article examines the burgeoning role of private equity in the commercial space sector. It canvasses the current investment landscape, characterized by an influx of investors seeking growth in the high-stakes arena of space commerce, and contemplates the future of these ventures. Against this backdrop, the article posits a thesis that these new entrants are encountering a unique set of challenges that necessitate inventive approaches and strategic foresight. The core intellectual offering of this piece is the “Space Integration Ladder,” a strategic framework devised to assist these industries in evaluating their space venture readiness and plotting a pragmatic course toward not just aiming for but also securing a stronghold among the stars. This article is poised to serve as a vital strategic compass for private equity firms eager to navigate the space economy’s complexities and to stake their claim in what may be the final frontier of commercial enterprise.

Introduction

The allure of space—the infinite expanse with its celestial bodies and boundless opportunities—has long captured human imagination. Today, it beckons a new category of explorers: private equity firms and innovative sectors aiming to commercialize the cosmos. This article thoroughly examines this nascent venture field, where the potential for growth is as vast as space itself. However, the leap into this final frontier is not without its perils. This article not only charts the current investment landscape marked by a seismic shift from government to private undertakings in space but also diagnoses the unique challenges that await the uninitiated and the prepared alike.

In recent years, the commercial space industry has been catapulted from science fiction to tangible reality, evolving into a competitive theater where startups and behemoths alike strive to claim their stake. Visionary entities such as SpaceX, Blue Origin, and Virgin Galactic have demonstrated that space is no longer an exclusive playground for superpowers but a field ripe for private ingenuity and capital. These pioneers have catalyzed a dynamic investment ecosystem—one where technological leaps, declining launch costs, and an expanding market create a fertile ground for financial engagement; according to PitchBook, the space tech market is poised to grow at an 11% CAGR to \$321B by 2025.¹ Yet, the celestial market presents a new stratum of investment considerations for private equity firms used to earthly enterprises, from orbital mechanics to extraterrestrial resource rights.

The unique challenges facing private equity in space extend beyond the complexities of rocket science. This article delves into the specific hurdles that distinguish space finance: operational risks spanning from launch anomalies to the harsh space environment, prolonged capital lock-in periods, and an evolving regulatory framework yet to catch up

with commercial ambitions. The journey to profitability in space ventures is a marathon, not a sprint, punctuated by regulatory uncertainties, such as the Federal Communications Commission (FCC) in the US issuing its first fine for space debris² and the need for substantial, patient capital.

To demystify these challenges and enable investors to set a course for success, we introduce the “Space Integration Ladder”—a thorough framework that allows private equity firms to evaluate their strategic position and readiness for engaging with the space economy. This tool is designed to help firms not only venture optimistically into space but also do so with a calculated trajectory that helps maximize the probability of successful orbit in the commercial space sector. It is a synthesis of market wisdom, technological assessment, and strategic acumen—a guide for those who seek to pioneer responsibly and profitably in the high frontier. As we embark on this exploration, the article provides a panoramic view of today’s opportunities and crafts a predictive lens to glimpse tomorrow’s fiscal considerations.

The Space Integration Ladder: A framework for success

As private equity and nontraditional players set their sights on the commercial space sector, the **“Space Integration Ladder”** emerges as a vital framework to facilitate their successful entry and progression. This tailored model enables firms to measure their space sector investment readiness and craft strategies attuned to the industry’s unique intricacies.

Structured into three progressive stages—Foundation, Growth, and Expansion—the ladder provides a roadmap for ascent.

FOUNDATION

At the Foundation stage, firms take stock of their technological acumen, sector-specific knowledge, and resource base, then begin exploring strategic alliances with established space entities, deploying smaller capital allocations to test, learn, and lay the groundwork for future endeavors.

GROWTH

Moving up to the Growth stage, the focus shifts to utilizing strategic partnerships and tapping into the market’s momentum to foster advancement. It’s at this pivotal point that firms must weigh venture choices against a backdrop of risk assessment, capital deployment, and projected returns, ensuring alignment with their overarching investment goals.

EXPANSION

The pinnacle, the Expansion stage, represents a firm’s full-fledged immersion in the space economy, marked by exploring opportunities in vertical integration and emerging technologies. This level demands an expansive strategic outlook and unwavering commitment, with an emphasis on scalability, competitive positioning, and revenue diversification. At this juncture, firms not only participate in the space value chain but also shape its future trajectory.



The 'Space Integration Ladder' is our North Star in the celestial realm of space investments. It's more than a framework; it's a roadmap to success. From the Foundation stage, where we evaluate our readiness and forge key alliances, to the Expansion stage, where we boldly explore new frontiers, this ladder guides us through the complexities of space commerce. With it, private equity firms can make informed decisions, navigate the unknown, and secure a lasting foothold among the stars."

—
Gavin Geminder, Advisory PE Leader at KPMG

Private equity pioneers in the space economy – Illustrative transactions:



In August 2023, KKR completed a €30 million convertible bond investment in launch service provider Rocket Factory Augsburg AG (RFA) alongside existing strategic investor OHB. KKR believes that RFA's launch service offering is well-positioned to benefit from the growing global demand for cost-effective and flexible access to space. According to KKR Partner Christian Ollig, "[RFA's] exceptional track record of achieving technical milestones and their unwavering focus on cost leadership are precisely the right strategy for future success in the global marketplace."⁷



In May 2023, Advent International, alongside minority investor British Columbia Investment Management Corporation, completed their acquisition of Maxar Technologies in an all-cash deal that valued the company at an enterprise value of \$6.4B. Maxar is a provider of comprehensive space solutions and secure, precise, geospatial intelligence.⁸



In January 2023, Veritas acquired CAES Space Systems (later rebranded to Frontgrade Technologies) through a leveraged buyout for an undisclosed amount supported by \$68M of debt financing. Frontgrade is a provider of high-reliability, radiation-hardened solutions for space applications. According to Veritas Chief Executive Officer and Managing Partner, Ramzi Musallam, "[Frontgrade] is uniquely differentiated by the breadth of its technical capabilities and segment expertise, as well as its long history of delivering critical solutions to customers...we will deploy our significant government technology experience working with Mike Elias and rest of the [Frontgrade] team to accelerate growth and value proposition to customers."⁹

Private equity pioneers seizing commercial opportunities in the space economy

The commercialization of space shows no signs of slowing down, and investment trends indicate a growing interest from private investors. Since 2014, private investors have deployed \$298 billion into 1,832 unique companies.

Private capital is heavily concentrated in specific aspects of the space economy, with investors in the space economy allocating 87% of their capital to the satellites industry. Just 11% of private capital flowed to launched-related companies and a meager 2% to emerging space industries, including logistics, stations, lunar, and industrials.³ Rapid technological advancements and decreasing costs will continue to disrupt the industry further, offering numerous commercially viable opportunities for private equity firms in the space economy.

Private investment in the space economy, much like in other industries, has not been immune to ongoing macroeconomic challenges like higher interest rates. 2023 saw a 25% year-on-year decline in investment in the global space economy compared to 2022.⁴ Yet, the expected improvement in global market conditions driven by forecasted interest rate cuts and continued demand for space services has created optimism for a rebound in space economy investments in 2024 and beyond.⁵

In the future, private equity firms are expected to play an increasingly prominent role in driving innovation and capitalizing on emerging opportunities within the commercial space industry. Accompanied by significant advancements in rocket technology, satellite miniaturization, and space tourism, private equity investments are predicted to fuel the growth of space-related ventures across various sectors. Private equity firms that strategically position themselves along the Space Integration Ladder and leverage the unique advantages of the commercial space industry are expected to reap substantial financial returns and secure crucial advantages in this evolving landscape. Speaking after the recent investment in Maxar Technologies, Advent International Managing Partner Shonnel Malani commented:

"[Space] has changed in its risk-return profile. Formerly a high-risk sector, which was typically heavily subsidized by governments, space is now an exciting area of growth that private equity can invest in credibly and responsibly."⁹

As the industry continues to evolve, private equity firms must closely monitor market dynamics, actively pursue partnerships, and adapt their investment strategies accordingly. Those who recognize the immense potential of the final frontier and successfully navigate the ever-changing space industry landscape can expect to harvest remarkable rewards while charting a path into previously unexplored realms.

Space Integration Ladder overview:

The Space Integration Ladder is a visual framework that helps companies assess their readiness and strategically position themselves for success in the commercial space industry. It consists of three distinct stages: Foundation, Growth, and Expansion.

FOUNDATION STAGE:

Firms at the Foundation stage conduct thorough assessments how space economy investments align with the risk/return profile of current and future funds, resource availability, and sector-specific expertise to confirm their readiness for space-related investments. This involves seeking to forge pivotal strategic alliances with established space entities and identifying priority external hires to bolster the depth of available knowledge. With this knowledge, firms at the Foundation stage begin to deploy capital to test and learn.

GROWTH STAGE:

Ascending to the Growth stage, firms actively exploit market opportunities and pursue strategic collaborations to propel their presence in the space sector. Here, the imperative is to judiciously select partnerships and investments in space ventures, ensuring they are in harmony with the firm's risk/return profile, investment horizon, capital commitments, and technical expertise.

EXPANSION STAGE:

At the apex, the Expansion stage, firms are deeply enmeshed in the space sector's value chain. This stage is marked by the exploration of opportunities in vertical integration or the advancement of nascent space technologies, such as space-based services, the direct establishment of a space presence, satellite launches, or involvement in space tourism, indicating a firm's ambition to double down on commercial space opportunities.

Using the Space Integration Ladder:

Stage 1: Foundation—developing a robust base and strategic vision for venturing into space investments.

- 1 Analyze how exposure to space economy investments aligns with the risk/return profile of current and future funds.
- 2 Benchmark your capabilities against industry standards to understand your competitive stance.
- 3 Analyze the space economy and develop a strategic plan outlining clear objectives for entering the sector and priority areas to begin investing capital.
- 4 Identify the skills and industry acumen needed to make and oversee future space economy investments and, where needed, deepen the depth of available knowledge through external hires.
- 5 Initiate dialogues with established space companies, research institutions, and technology providers to build networks with subject matter experts.
- 6 Start with smaller capital allocations to test the waters and learn about commercial opportunities in the space economy.

Stage 2: Growth—establishing strategic partnerships, calibrating investment choices, and positioning for growth within the space sector.

- 1 Negotiate and formalize partnerships or joint ventures that enable shared resource utilization, risk mitigation, and knowledge sharing.
- 2 Leverage partnerships to gain access to subject matter professionals with insights into industry trends, regulatory environment, and technological advancements.
- 3 Develop a portfolio approach to balance high-risk, high-reward ventures with more stable investments, ensuring alignment with the risk/return profile of current and future funds.
- 4 Invest in capacity-building within your firm to ensure you have the expertise to manage and support space economy investments effectively.

Stage 3: Expansion—fully capitalizing on commercial space opportunities by exploring vertical integration and nascent technologies.

- 1 Review and refine your investment strategy to emphasize scalability and sustainable growth within the space economy.
- 2 Explore opportunities for vertical integration or the development of emerging space technologies to establish a competitive edge.
- 3 Consider larger, more transformative investments or acquisitions that can significantly advance your position in the space economy.
- 4 Stay abreast of trends and technological breakthroughs to ensure your firm remains a relevant and dynamic player in the market.

Conclusion

Embarking on the Space Integration Ladder is an exhilarating journey of perpetual evolution, strategic refinement, and bold progression. Private equity firms embracing this model commit to a vibrant cycle of meticulous evaluation, robust development, strategic alliances, discerning investments, and ambitious scaling. By systematically advancing through each echelon of this framework, they sharpen their competitive edge and align their operations to seize the boundless prospects emerging within the rapidly expanding commercial space frontier. This is not merely a process, but also a strategic odyssey that propels firms to new heights of industry prominence and success in the cosmic marketplace.

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Ethical considerations in the space value chain



Lee Anderson and Brian Miske



Delving into the moral dimensions of commercial space endeavors, we assess the responsibilities and obligations of stakeholders across the value chain, ensuring both growth and fairness.

The new space era of ethics

Space exploration has always required navigating ethical questions. From the high-risk nature of human space flight to the origins in weapons technology and wartime competition, governments were solely responsible for the public perception of space exploration and for the consequences when things didn't go as planned. In the new space age, however, the number of participants has increased exponentially as has the role of the private sector. That transfer of stewardship from public to private hands brings us to an inflection point where ethical questions take on a new urgency. We are not only challenged to anticipate the impact of space exploration at a higher volume, but also that of a true space economy. Across the value chain, organizations and governments must bring self-awareness and long-term thinking into their decision-making.

Navigating ethics within exponential change

As the space value chain integrates more completely into our global infrastructure and national security operations, the pace of change introduces unique challenges. Private organizations who are leading the charge in modernizing space systems are moving faster, and with fewer guardrails, than their government counterparts. New customers and new industries are being courted, and new business models emerging based on lower launch costs and increased accessibility to different space environments.

Additionally, the increase in activity has prompted a higher level of awareness among the public. For many, this becomes a question of opportunity cost: why are we spending so many resources in space, when we have so many problems to address on Earth? This pervasive argument requires organizations to be clear on the benefit of their activities to Earth's stakeholders, and to have an effective communication strategy.

Because space is considered nonsovereign territory by the Outer Space Treaty, there are many unanswered questions about the ethical use of resources in space, and how to ensure it remains a stable environment for all stakeholders on Earth. Resources can be rare minerals and water, or even real estate. There is much we do not know about how the increase in launch activity and number of satellites on orbit will impact the environment. Questions such as, "What is happening to the atmosphere when space craft burn up on re-entry?" or "What if the Kessler Syndrome were to occur?" are becoming more urgent.

The lack of regulation creates a kind of Wild West, first-come-first-served environment. It also creates a perverse advantage to moving quickly before too much data exists that might lead to regulatory bottlenecks. All of these dynamics and more are creating a complex landscape for decision-makers whose businesses depend on space-based activity. The exponential changes in activity, impact, and awareness bring up challenging questions about how to grow a scalable space economy while maximizing benefits to people on Earth.

Value chain:

Optimizing risk through an ethical lens

Increased activity in space comes with risk, and it is the responsibility of leaders in the space sector to ensure those activities provide more benefit than they create harm. Across the value chain, consideration of direct and indirect ethical implications can help businesses optimize risk. Separating the exercise of ethical risk optimization from organizational risk helps distinguish ethical considerations that could have adverse impacts on the business. This analysis can be summarized with two key assessments: (1) clarity on the benefits the activities generate – what is the value and who benefits, and (2) know what to track for a clear and up-to-date view on potential risks or harm. By plotting this assessment across the value chain, organizations can see both potential opportunities for value add and potential areas of adverse impact in their space activities.

UPSTREAM

Organizations will be considering the impact of resource extraction and processing, manufacturing, and launch. The direct implications are highly localized and direct to specific communities, while indirect implications are global and impact everyone on Earth.

MIDSTREAM

Organizations will be considering the applications of data, cybersecurity and data protection, and the servicing of satellites in orbit, including the International Space Station. Questions about what belongs in space, who is responsible, and how to govern without regulation will be top of mind for organizations, regulators, and the public.

DOWNSTREAM

Organizations will be considering the actual and potential return of space-sourced resources to Earth, the marketing and advertising of and in space environments, and the premise of space tourism. Highly visible downstream activities are prime opportunities for public messaging about the why of space exploration, and the value returned to people on Earth.



With the trend toward greater horizontal activity in space, evidenced by the dramatic increase in commercialization, while remaining competitive, we will also see a greater degree of collaboration across the space ecosystem. This will benefit not only commercial space companies but governments and the general population as well."

Grant McDonald
Global Aerospace and Defense Leader, KPMG



| 1) Potential benefits and beneficiaries of activities on the value chain | | 2) Potential ethical risks to monitor |
|--|---|--|
| <ul style="list-style-type: none">• Research and development• Resource extraction and processing• Manufacturing and assembly• Launch services | <ul style="list-style-type: none">• Satellite operations and data collection• Cybersecurity and data protection• Satellite servicing• Space ground systems | <ul style="list-style-type: none">• Return of resources from space to Earth• Applications and user services• Marketing and advertising in/of space• Space tourism |

Current ethical challenges

Innovative organizations are forming to benefit from the lower cost of launch and improved technological capabilities that enhance their core services and make new service offerings possible. At all stages of the value chain, new business models are creating value both directly and indirectly for their customers and broader segments of the population. Satellite communications constellations, for example, promise to make real-time communication possible across the globe, even where current telecom infrastructure doesn't exist. This promises huge benefits and social mobility opportunities, and the chance to leapfrog expensive infrastructure projects. However, access to these new channels has already been subject to ethical debate regarding who should have access, when, and who controls access.

Other new business models depend on space-based data gathering. Broadly speaking, these businesses create or pay for access to different Earth observation capabilities and the analytics layers that turn that data into actionable information. Much of this data is used in ways that benefit people on Earth and provides economic value. However, ethical questions around how the data is used and preserved, especially with the increasing application of artificial intelligence and machine learning, are bringing awareness to the risks related to surveillance and equity.

In addition to daily lives and livelihood being considered, our use of the space environment is also an ethical challenge. The risk is very real for space to become



In an interconnected cosmos of industries and markets, the ethics of space exploration and operation must spread horizontally across the entire value chain for true success to be achieved.

Brian Miske
National Ignition Leader, KPMG

inaccessible if responsible behavior in orbit is not followed. Space debris remediation is an urgent priority for the global space community as the cadence of launch increases and our reliance on space-based infrastructure gets further entrenched. Beyond Earth's orbit, we have been sending and leaving "stuff" on the moon and Mars for decades. As activity increases, organizations will need to be transparent about their efforts to preserve space environments based on what we have learned from unintended consequences to our environment on Earth.

Who gets to put things in space or go to space is largely a question of economic means. What you can do once you get there, beyond the bounds of prelaunch guardrails like ITAR, is largely unregulated. It is in these

Ethical challenges differ for different stakeholders:

| Government space agencies | Private industry (start-ups, incumbents) | Policy makers | Customers and space-adjacent |
|--|--|---|---|
| <p>Stewardship:</p> <ul style="list-style-type: none"> How to support a robust and diverse economy? How to protect our nation's critical infrastructure? How to create coalitions and allies in the space ecosystem? | <p>Access:</p> <ul style="list-style-type: none"> Who gets to go to space? What should we send to space? <p>Perception:</p> <ul style="list-style-type: none"> How to communicate the broad-reaching benefits of a space economy for Earth? | <p>International norms:</p> <ul style="list-style-type: none"> How to govern without regulation? How to regulate while supporting innovation? How to protect the space environment from bad actors? Who owns resources mined in space? | <p>Intentions:</p> <ul style="list-style-type: none"> How to support a robust and diverse economy? How to protect our nation's critical infrastructure? How to create coalitions and allies in the space ecosystem? |

unregulated grey areas that ethics become our strongest tool for ensuring sustainable access to the space environment in the long term.

Leaders in ethical behavior will seek to understand the potential social and economic disparities introduced through their activities and those of the broader industry. Those organizations will also monitor the long-term implications of their activities, across the value chain, to Earth and to the space environment. Equally important to risk mitigation is wide-spread value creation. Clearly articulating the known benefits, engaging with those communities to ensure the impact is known, and measuring the impact over time will help space organization remain aware of added value opportunities.

Position your organization to be a leader

There is incentive to create better systems for tracking the impact of space activities on the economy. Demonstrating to governments, investors, and the public how space activities can improve quality of life and safety for people on Earth can help sustain and propel the progress made over the past two decades. A challenge remains in tracking the adjacent impacts of the industry, which are difficult to map comprehensively, much less quantify. However, the direct impacts such a weather monitoring and access to information are compelling enough to want to protect and expand access.

Public perception and discourse will continue to be a catalyst for identifying ethical questions that businesses should account for in their decision making.

The beneficiaries of space activities won't all be shareholders. However, the broader public might not be aware of how space activity benefits them. Similarly, those who are likely to experience the most harm may not have a voice in the room or a seat at the table. An ethical approach would ensure that leaders in the new space era take the following steps, proactively mitigating harm to lives on Earth and in space, in the pursuit of a sustainable space economy:

1. Building ethical considerations into the business model
2. Understanding and communicating the benefits to customers and broader populations
3. Awareness of risks and a clear strategy for monitoring key indicators
4. Ethical governance to abide by both regulations and agreed norms.

How KPMG professionals can help

Government space

Collaborating with state and federal governments on key space matters, including policy and program design, implementation, and economic analysis

Legal and Regulatory

Helping to navigate the complexities of the legal and regulatory compliance requirements of operating in space

Reporting and predictive modeling

Customizing reporting solutions, data visualization, and intelligent forecasting to maintain up-to-date view of operational impacts for informed decision-making in the space ecosystem

Strategic Business Planning

Developing tailored business plans, incorporating market insights and regulatory guidance to help ensure the successful execution of space initiatives

Risk Mitigation

Working with leadership to establish enterprise risk management and monitoring for impacts related to doing business in the space ecosystem



Join KPMG Ignition to explore the rapidly evolving space economy

KPMG Ignition is an experience-led capability that helps clients explore the unknown, navigate the limitless potential of the space industry, gain invaluable insights, and discover new opportunities. Embark on a transformative journey to unlock and accelerate your organization's full potential in the dynamic space sector.

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