February 2026

Responsible Investment in the Space Sector

A Guide to Stewardship for Sustainable Value Creation

SECURE
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FOUNDATION

About Secure World Foundation

The Secure World Foundation (SWF) is a private operating nonprofit foundation dedicated to promoting the secure, sustainable, and peaceful uses of outer space, ensuring its preservation for future generations. As the only organization devoted entirely to space sustainability, SWF collaborates with international partners in governments, industry, and civil society to foster policies and practices that enhance the protection of the space domain. Recognizing the rapid increase in the number of actors in outer space and the urgent need to promote norms of behavior and best practices to ensure sustainable activities in space, SWF is committed to facilitating dialogue, informing policy decisions, and fostering international cooperation in the peaceful uses of outer space. Through these efforts, SWF strives to ensure that space remains an accessible, safe, and stable operating domain for commercial, military, and civil use by all nations.

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RESPONSIBLE INVESTMENT IN THE SPACE SECTOR:

A GUIDE TO STEWARDSHIP FOR SUSTAINABLE VALUE CREATION

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Space now drives real economic activity, and investors need to treat it like a domain with its own rules. It is strategic, shared, harsh, and often uncertain. Those traits raise mission, environmental, and geopolitical risks that do not show up the same way on Earth. Investment choices can also shape behavior in orbit, which protects long-term stability and future value.

Opportunity and the Space Economy 04

Investors will see big opportunities across services, infrastructure, and new markets, but they will also face volatility. Government demand still anchors much of the sector, while some commercial segments struggle to scale. Revenue models vary widely, and timelines slip. Natural hazards, debris, congestion, regulation, and geopolitics can disrupt operations fast. A clear frame for risk and return matters before capital moves.

Stewardship for the Space Economy 08

Responsible investment is not just about screening risk. It is how investors use influence to protect long-term value, including the shared orbital resources portfolios depend on. In space, one actor's behavior can raise costs and risk for everyone. Safer design, predictable operations, and clearer norms reduce avoidable failures. Strong stewardship supports mission assurance now and market growth later.

A Stewardship Checklist for Investing Responsibly in the Space Domain 10

This checklist helps investors pressure test a company before investment and during ownership. It covers mission design, launch choices, trackability, collision avoidance, cybersecurity, and end-of-life disposal. It also looks at data sharing, governance, staffing, and regulatory awareness. It helps teams spot gaps early, set measurable expectations, and track progress over time. Designed for pullout or reference, this tool supports pre-investment evaluation and active stewardship in existing portfolios.

Action for Responsible Investment in Space 18

Investors can do more than review a checklist. They can raise diligence standards, push for safer practices, and support enabling services like tracking, servicing, and debris removal. Active ownership matters because failures in orbit create direct losses and long-lasting damage that affects every operator. Investors should plan for full lifecycle costs, not just launch and early revenue. Capital can help set norms that stick.

Conclusion 19

Space offers real returns, but investors can only reap them indefinitely if the domain remains usable. Debris, interference, and instability raise operating costs, increase insurance and compliance pressure, and can trigger stricter regulation. Profitability and sustainability go hand in hand because the business depends on safe access and predictable operations. Investors can pursue growth, but they need to insist on responsible behavior that protects the environment their investments rely on.

CHAPTER 1.
Space - An Emerging Economic Domain

EACH TIME HUMANITY HAS EXPANDED ITS ABILITY to utilize a new domain, investment and economic activity in that domain have followed. Space is rapidly becoming an economically important domain, attracting investment that is fueling the emergence of diverse activities such as in-orbit satellite servicing, space-based manufacturing and assembly, space resource development and human spaceflight, alongside established areas such as launch services and satellite services. Space-based technology, and the services and applications we derive from it, are critical for modern life and the proper functioning of many technologies we use daily. As global reliance on satellite services and applications grows, the importance of policies, practices, and technologies to maintain safety and stability in the space environment becomes increasingly critical to maintaining the societal and economic benefits of space activities in the future. Many of these societal benefits are provided by commercial space activities carried out in an expanding space economy and enabled by private sector investment. As both an operating domain and an investing domain, space has a number of unique risks and attributes that require special consideration in both investment and operational decisions in order to realize the full potential of the space economy.

These special considerations arise from the following characteristics of the space domain:

Space is a **strategic** domain

Interests and considerations of national governments, in economic, diplomatic, and national security dimensions, drive decision-making and funding decisions which significantly affect the direction of space programs. Geopolitical risk is an aspect of many space activities.

Space is a **shared** domain

Commercial space actors operate in a globally shared orbital environment that is in essence a limited natural resource and where the realities of physics and orbital dynamics mean the actions of one actor inherently affect the operations of other actors. Collective action risk is faced by all space actors.

Space is a **harsh** domain

The physical environment space actors face is harsh - the realities of temperature, radiation, micrometeoroids; and the remote and difficult-to-reach nature of the locations of space assets pose unique operating challenges and costs for space companies. Changes in the environment can have an impact on mission assurance and risk. Moreover, the environmental risk inherent in space operations can be worsened by human activity.

Space is an **uncertain** domain

Operating and business conditions in space can be difficult to predict with confidence. Determination of the impact of natural environmental hazards, such as space weather and micro-meteoroids, as well as the determination of spacecraft position involves inherent uncertainties. Space ventures are often long-term projects with upfront capital costs required, in speculative market areas. These factors add uncertainty that can affect returns and profitability.

All of these characteristics challenge business continuity, operational stability, and risk management in space ventures. In the space domain, short-term investment decisions can have unpredictable, long-term consequences for the space environment. As investors enter the space sector from other sectors of the global economy, there is a need to increase awareness of the unique aspects of the space domain so as to mitigate the potential of investments being made without consid-

ering implications for the space environment, or the effect of space activities on other actors. It is likewise important to recognize that, because objects in space are all in motion following the laws of physics, environmental disruption in space is not a localized phenomenon, as it often is on Earth. This means that the operational and economic consequences of environmental disruption in space might be more significant for space-based industries than for terrestrial industries. This reality is an important consideration for long-term value creation through the space economy.

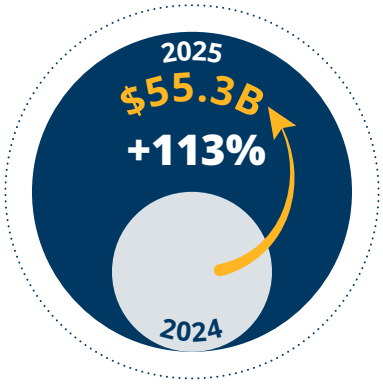
With that in mind, the purpose of this guide is two-fold: first, to provide guidance to the investment community about stewardship, stability, and sustainability aspects that should be considered when making investment decisions in space activities, and second, to highlight the ongoing role of the investment community in the corporate governance of space companies so that long-term value can be created through space investment while promoting safety of space operations and stability in the the space environment. Lack of attention to these aspects could limit future investment and growth opportunities in the space sector.

IN THE SPACE DOMAIN, SHORT-TERM INVESTMENT DECISIONS CAN HAVE UNPREDICTABLE, LONG-TERM CONSEQUENCES FOR THE SPACE ENVIRONMENT

SECTION II

Opportunity and the Space Economy

THE COMMERCIAL SPACE SECTOR IS IN THE midst of a worldwide expansion. This growth in activity and capability levels offers the potential to expand global society's access to space technology, applications, and services, as well as the societal and economic benefits derived from that access. Analysts at the space-focused venture firm Space Capital estimated that space companies attracted $55.3 billion in investment globally in 2025, more than double the total tracked in 2024 by the same firm.[1] Space Capital expects investment activity focused on the space sector to continue to grow in future years. The majority of investment (tracked by source, not size, of the deal) continues to be from venture capital sources, although longer term and downstream capital sources are becoming involved. Other analysts, at industry analyst firm Bryce Tech, reported that in 2024 more than half of investors making investments were first-time investors in the space domain.[2]



Estimates show space companies attracted $55.3 billion in investment globally in 2025, amore than double the total tracked in 2024.

This incoming investment is driven by an expectation of opportunity in space technology, applications, and space-enabled activities. It is difficult to estimate the size of the space economy with a high degree of fidelity; analysts' reports estimate the size of the global space economy in 2024 between US$415 and $613 billion.[3] However, there is

1 Q4 2025 SpaceIQ Space Investment Quarterly. SpaceCapital

2 https://brycetech.com/reports/report-documents/start_up_space_2025/

3 Satellite Industry Association, 2025 State of the Satellite Industry Report; and Space Foundation, Space Report 2025 Q2

shared expectation that this economy will continue to grow at a rapid pace; analysts' forecasts – maybe optimistic – indicate the possibility of growing to reach $1.8 trillion by 2035.[4]

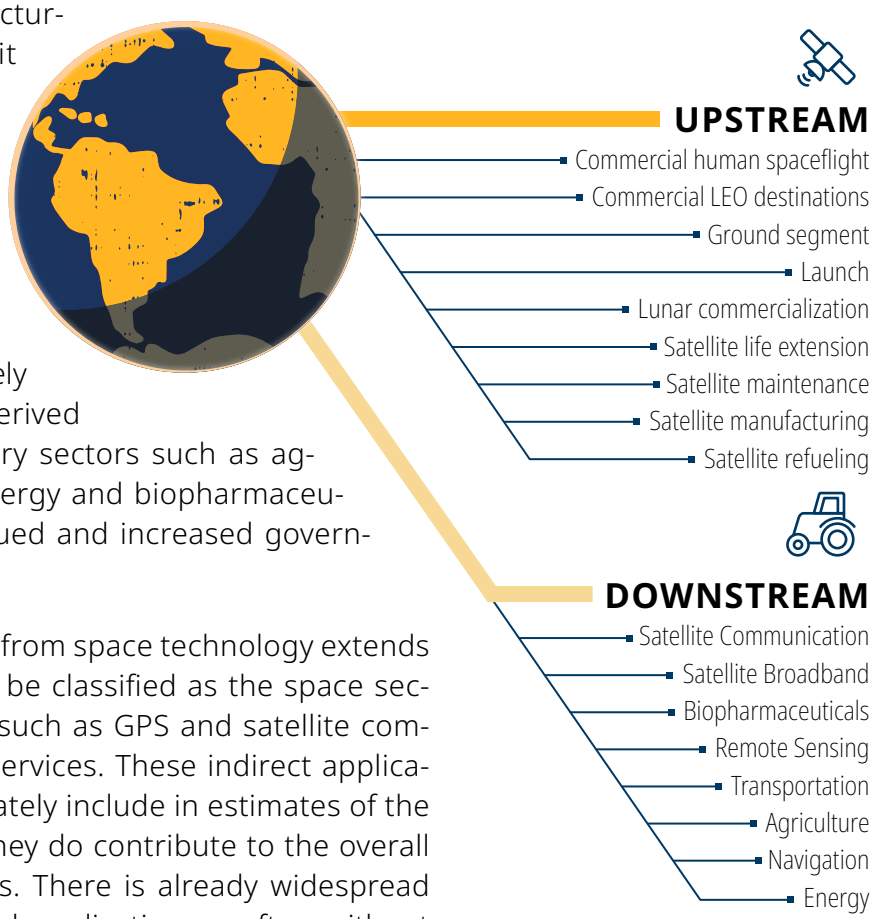
Currently the only significant business-to-business (B2B) or business-to-consumer (B2C) markets in the space sector are in satellite telecommunications services and associated ground systems (including manufacturing), with much smaller markets in commercial remote sensing and launch. Additional revenue comes from performance in support of government space programs, both civil and military. Even with the increase of commercial and private sector space activities, space remains a predominantly government-driven market in terms of funding. Government budgets – both civil and defense – are the largest source of funding in the space economy, including as a key revenue source (e.g. customer) for commercial space businesses. There is an increasing number and diversity of governments investing in and developing space technologies/programs. Governments act as investors, customers, and funders for space projects. In these financial-related roles governments can both act as a factor driving stability (and growth) in the space sector and as an influence that can drive change outside of purely commercial market factors.

GOVERNMENTS ACT AS INVESTORS, CUSTOMERS, REGULATORS, AND FUNDERS FOR SPACE PROJECTS.

Despite long-term optimism for continued growth of the space economy and inflows of investment into the space sector, the sector does face certain economic challenges and uncertainties. The space sector is not isolated from broader macro-market trends, including risks of recession. The continued importance of government as a key customer and source of funding exposes elements of the space sector to risk as governments face pressure to reduce spending and enhance efficiency of programs. Certain segments of the space industry - in particular, commercial remote sensing - have failed to scale commercial markets as quickly as expected, and remain dependent on government customers. Companies which have already received venture investment face both pressure to provide exits and to deliver on business plans. These factors may be contributing to both recent consolidation and layoff rounds that have occurred in the space industry since 2023. A wave of SPAC investments in the early 2020s led to a set of space companies going public before they were ready to do so and they subsequently performed poorly, which may be creating some hesitancy in public markets for future space investments. The space industry also remains challenged to attract human capital in competition with other technology- and innovation-intensive industries.

4 https://www3.weforum.org/docs/WEF_Space_2024.pdf

Nonetheless, private sector space actors are introducing a range of new applications, services, and approaches to space activities. These include new direct-to-consumer and business-to-business services in remote sensing and communications; new in-space servicing assembly and manufacturing (ISAM) activities, including in-orbit satellite life extension, refueling, and maintenance; interest in space resources utilization and lunar commercialization; and expanding activities in commercial human spaceflight and commercial Low Earth Orbit (LEO) destinations. In addition, growth forecasts for the space economy largely anticipate increased uptake of space-derived services and data in non-space industry sectors such as agriculture, insurance, transportation, energy and biopharmaceuticals. Forecasts also anticipate continued and increased government uptake of satellite services.



However, the value and benefit created from space technology extends beyond the direct activities that might be classified as the space sector. Space services and applications – such as GPS and satellite communications - underlie many societal services. These indirect applications are difficult to quantify and accurately include in estimates of the size of the space economy, although they do contribute to the overall investment potential of space activities. There is already widespread societal reliance on space services and applications – often without end users' full awareness. As the space sector matures, and reaches more B2B and B2C markets, this end-user reliance and awareness will expand, potentially creating additional market opportunities. Beyond these indirect economic impacts, space contributes to creating societal value through exploration and science resulting in intangibles such as knowledge creation and inspiration. While these outcomes are not directly investable, they do contribute to the overall sense of opportunity around space.

Growing the space economy - and generating returns from it - will be easier if the environment is stable. There are risks to this stability. These risks begin with natural hazards; space is a harsh operating environment in which naturally occurring factors, ranging from solar weather and radiation to micrometeoroids, can adversely affect the operations of satellites and other space systems. Human activities are introducing further risks into this naturally-hazardous environment. The first is space debris - the defunct satellites, rocket bodies, and fragmented objects in space that no longer serve a useful purpose. A second key challenge is orbital congestion and the associated need for coordination. The orbits in which satellites and constellations operate – and

the radiofrequency spectrum that they rely on to provide services - are limited natural resources that should be used rationally and equitably to ensure that space activities will continue to be viable, now and in the future.

Space industry activities also face regulatory uncertainty that can pose a risk to space investment. The novel space services and applications being developed by commercial space actors may not fit clearly within existing regulatory and licensing frameworks; and the efficacy and efficiency of those frameworks that do exist are being challenged to keep pace with the rate of development in industry. Governments are also competing to develop commercial space industries for their own national interests. This might lead to regulatory or incentive-based competition where governments seek to attract commercial space companies. Lack of commonality in regulatory principles and approaches creates the potential for fragmented regulation, forum-shopping and further uncertainty.

Space activities are sensitive to geopolitical risk due to the strategic nature of the space domain. Militaries around the world rely increasingly on satellites for reconnaissance, communications and even command and control functions. As such, several countries have launched efforts to develop counterspace capabilities in order to deny, degrade or destroy the space capabilities of an adversary. Commercial space capabilities (including launch) may also be used in – or be affected by – conflict on Earth.

As a growing industry, many new actors are entering the space sector from other industrial sectors and do not recognize that space is a fragile and strategic domain. This itself poses risks to the stability of the domain – decisions made early in the life-cycle of a space project or business can lead to long-term implications in orbit. Investors have a potential role in helping to ensure portfolio companies are aware of the unique characteristics of the space domain. Adopting a philosophy of responsible investment in the space sector can be a step towards addressing these risks.

SECTION III

Stewardship for the Space Economy

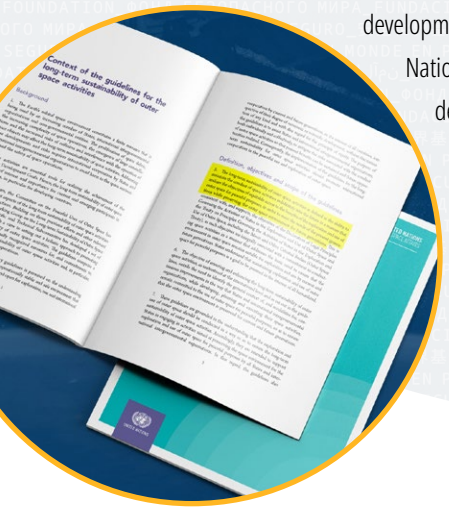
RESPONSIBLE INVESTMENT RECOGNIZES THAT THE CONSIDERATION OF potential value created by an investment opportunity should extend beyond the immediate financial return. Broadly speaking, it seeks to maximize investment returns and long-term value creation through investment while recognizing and considering the role of non-financial outcomes in investment performance. These non-financial aspects might include sustainability, governance, social, and environmental factors. Responsible investment practices are motivated by several factors, including financial performance, client and investment partner demand, regulatory and policy requirements, fiduciary responsibilities, and motivations for sustainability and benefit outcomes.[5] Not all investors following responsible investment goals share the same motivations and objectives.

Responsible investment is linked closely to the concept of stewardship, or the "the use of investor rights and influence to protect and enhance overall long-term value for clients and beneficiaries, including the common economic, social, and environmental assets on which their interests depend."[6]

5 See e.g. https://www.unpri.org/introductory-guides-to-responsible-investment/what-is-responsible-investment/4780.article

6 https://www.cfainstitute.org/insights/articles/how-investors-achieve-impact-through-stewardship

SPACE SUSTAINABILITY IS ABOUT USING OUTER SPACE in such a way that all humanity will be able to continue to use it in future for peaceful purposes and for societal benefit. In this regard, space sustainability can be seen as an extension of the concept of sustainable development on Earth. The United Nations has deliberated the concept of space sustainability extensively. In 2019, the United Nations Committee on the Peaceful Uses of Outer Space encapsulated the understanding that has emerged from these deliberations as follows:



> *"The long-term sustainability of outer space activities is defined as the ability to maintain the conduct of space activities indefinitely into the future in a manner that realizes the objectives of equitable access to the benefits of the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations."*

In the space economy, stewardship should be an important consideration in the interests of long-term value and benefit creation, to support mission assurance in specific space activities (or investments) in the short term, and for maintaining stability and safety of the operating domain in the medium and long term. The collective operating environment of the space domain means that actions of one actor can affect the ability of others to operate safely. A sustainable operating domain is essential for positive investment outcomes for those investing in space companies and/or companies that rely upon use of the space domain (including the downstream applications of space data and services). An investment strategy that considers the importance of responsible operations practices in space and on Earth and seeks to promote a stable and safe operating environment will contribute to growing the potential returns from space activities.

IN THE SPACE ECONOMY, ONE ACTOR'S DECISION CAN AFFECT EVERYONE ELSE'S ABILITY TO OPERATE SAFELY.

Stability in the space domain is inherently linked to managing risk to return on investment. Return on investment and growing benefit from space depends upon maintaining a stable and safe operating environment. For the long-term success of investment in the space sector, it is important that investors consider responsible use of the domain as part of their overall assessment of an investment opportunity. Responsible use of the domain drives stability and predictability, and reduces risk in a number of ways. It increases safety and operational consistency in the domain. Instilling responsible design and operations practices early in the lifecycle of space investment can contribute to reduced costs of operations. It can help to drive regulatory stability and consistency while contributing to common business norms across jurisdictions in support of fair market competition. Adherence to common stewardship practices in space-sector investing based on the principles of responsible investing will support these outcomes.

SECTION IV

A Stewardship Checklist for Investing Responsibly in the Space Domain

INVESTORS ARE PART OF AN OVERALL ECOSYSTEM of actors that can influence and help to instill responsible operations practices in the space sector. By adopting a stewardship approach in space-investing investors can support both performance of specific investments as well as conditions of stability in the operating domain supportive of long-term growth. **This section provides a checklist that investors might consider with the aim of supporting the instillation of responsible operating practices within the companies that they invest in.** It provides a list of elements to guide the development of space companies and activities that are compatible with responsible operations, that is, to operate space systems considering not only commercial and/or mission objectives & service quality, but also their impact on the orbital environment and on other operators. The goal is to provide a checklist that would help investors and those engaged in commercial space activities to consider and mitigate risks to mission success and business continuity, as well as act to reduce the risk of potential harm to the environmental stability from mission failure through voluntary compliance with better-than-required behaviours.

CONSIDERATIONS FOR

Mission Design and Operation Practices

As a core principle, safety should be an inherent priority in design and operations practice throughout the life cycle of any space mission.

OPERATIONAL RESILIENCE AND ENVIRONMENTAL IMPACT

This consideration seeks to ensure that spacecraft operations minimize negative impacts on the operating environment, which might have downstream effects on other operators or activity.

- [ ] Are missions considering risks posed by existing environmental hazards - both natural and human caused - in the space environment (e.g. space weather, micrometeoroids, space debris)?
- [ ] Are missions planned to adhere to current international guidelines, best practices, and standards for space debris mitigation, recognizing that different regions in space might have differing guidelines or practices?
- [ ] Have mission planners and spacecraft designers adopted design-for-demise practices for applicable space missions?
- [ ] Have mission planners and spacecraft designers considered use of environmentally safe fuels and materials, to the extent possible?

LAUNCH CONSIDERATIONS

This consideration seeks to ensure that launch services are selected in a way that considers the impacts the launch phase of a given space activity might have on stability and safety in the operating environment.

- [ ] Is launch vehicle reliability and safety a driver of launch provider selection?
- [ ] Is the launch provider following established practices for responsible launch activities (e.g., Does the launch provider dispose of their upper stages responsibly? Do they have practices for minimizing debris creation during launch?)
- [ ] Does the launch provider have a process for conducting or obtaining pre-launch conjunction assessment?
- [ ] Does the launch provider have a robust process for ensuring payloads are compliant with applicable licensing requirements?
- [ ] Does the launch provider follow best practices for confirming that payloads accepted for launch have been tested and certified to meet all relevant launch environment survivability and electromagnetic compatibility criteria?

DETECTABILITY, IDENTIFIABILITY, AND TRACKABILITY

This consideration seeks to ensure that spacecraft operators take steps to ensure their spacecraft are identifiable and trackable, for the purpose of avoiding collisions with other operating spacecraft.

- ☐ Have mission planners and spacecraft designers considered how easily their spacecraft can be detected and tracked from Earth?
- ☐ Have mission planners and spacecraft designers implemented active and/or passive measures (means such as onboard transponders, enhanced radar reflectivity, GPS-based position transmitters) that increase ease of detection, identification, and tracking of spacecraft with ground-based and/or space-based sensors.
- ☐ Are spacecraft designed for rapid detection and positive identification after launch, as easily as possible, especially during multi-manifested rideshare launches,, through active and/or passive means such as onboard transponders, enhanced radar reflectivity, GPS-based position transmitters receivers, etc.?

THE GROWING DEMAND FROM NEWER ACTORS WHO want to launch smaller satellites has lead to the emergence for rideshare launches to space, where many satellites are placed on the same rocket, often from multiple customers. For example, in January 2025 SpaceX's Transporter-12 rideshare mission carried 131 satellites to LEO on a single Falcon-9 rocket. While launches of this type enhance access to space for smaller companies and operators, they also pose challenges for space safety and for operational efficiency for the companies involved. As satellites are deployed in orbit from these launches, it can be very difficult to identify, track, and catalog specific individual satellites. In some cases, it can take weeks or months to identify the satellites after deployment. This can cause uncertainty in space safety information and can delay specific operators in executing their mission. Satellite operators can help to address this challenge by designing enhanced tracking and identification means into their spacecraft.

REFERENCE: SANDRA IRWIN, "SPACEX'S RECORD-SETTING RIDESHARE MISSION A CHALLENGE FOR SPACE TRAFFIC CONTROL," SPACENEWS, JANUARY 21, 2022, HTTPS://SPACENEWS.COM/SPACEXS-RECORD-SETTING-RIDESHARE-MISSION-A-CHALLENGE-FOR-SPACE-TRAFFIC-CONTROL/

COLLISION AVOIDANCE

This consideration seeks to ensure that spacecraft operators place priority on operational measures and practices, which in conjunction with information sharing and communication practices, act to minimize the potential for collisions between space objects.

- ☐ When selecting operational orbits (e.g., altitude and inclination), is the collision risk environment considered as part of selection parameters?
- ☐ Have clear strategies been defined and implemented to avoid collisions with other objects in space, including collision probability thresholds and maneuver lead times?
- ☐ Have management provided appropriate resources to the operating teams to implement the established collision avoidance strategies, including consideration of on-board collision avoidance capabilities (if feasible)?
- ☐ Have practices for maneuver conjunction screening been established, in the event spacecraft are planned to be maneuvering?
- ☐ Has the company, if operating spacecraft, registered with appropriate space safety information sources, including national space traffic coordination programs or systems where available?

CYBER SECURITY & ASSURANCE

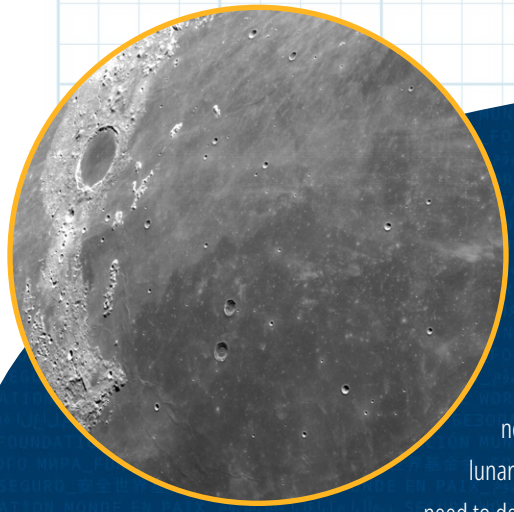
This consideration seeks to ensure that spacecraft operators take action to ensure their spacecraft and operations take proper steps to mitigate cyber security risks across all segments (ground, space, launch) and during all orbital phases of a mission. This includes information protection and mitigation of operational risk from cyber threats.

- ☐ Does corporate leadership have practices or policies in place to review cybersecurity risks?
- ☐ Have management provided appropriate resources to the operating teams to implement the established cyber security standards and best practices appropriate to their mission(s)?

POST-MISSION DISPOSAL

This consideration seeks to ensure that spacecraft operators take action to ensure their spacecraft are responsibly removed from the environment at the end of mission, in order to ensure debris is not left behind.

- ☐ Have mission planners and operations concepts ensured that appropriate passivation measures (e.g., discharge of batteries, venting of propellants, ceasing of transmissions) are planned for as part of end of mission operations?
- ☐ Does the company have plans for de-orbiting or safely disposing of a spacecraft at the end of its mission? Are those plans updated based on operational experience and current best practice in the industry?
- ☐ Has a backup plan and alternate means of post-mission disposal been considered in case the main disposal method/ strategy fails?
- ☐ Where relevant, have mission planners and spacecraft designers considered design and operations features that prepare current and future spacecraft for services such as inspection, refueling, and timely post-mission disposal?



SPACE ACTIVITIES ARE INCREASINGLY EXPANDING INTO CISLUNAR space and onto the lunar surface. However, operational best practices for this area of activity are not as well defined as for operations in GEO and LEO. Many of the practices that have been developed for operations in GEO and below will not suffice or even apply to the different physical and operational environment in the cislunar regime. There are currently no established consensus practices for mitigating the creation of debris in lunar orbit and on the lunar surface, nor for post-mission disposal of spacecraft in cislunar space. On the lunar surface itself, dealing with the lunar dust disturbed by lunar activities will be a shared challenge faced by all lunar operators. There will also be a need to develop interoperability in key infrastructure in the interests of safety. As the tempo of activities in the cislunar domain increases there is need to develop specific operations practices for that domain, and refine those practices based on lessons learned from shared operational experience.

CONSIDERATIONS FOR

Corporate Practices

Principles of responsible behavior in space activities need to be instilled in the initial phases of company development, and reinforced consistently.

INFORMATION AND DATA SHARING

This consideration seeks to provide for communications and information-sharing practices to enhance coordination and safety among users of the space environment.

- [ ] Has management looked for, to the extent practicable, opportunities to share lessons learned from both successes and anomalies while protecting intellectual property and commercially sensitive information?
- [ ] Has management considered approaches for open and transparent communication of mission intention and purpose?
- [ ] Is mission operations contact information published for the company, in order to facilitate coordination between operators in the event of possible conjunctions?
- [ ] Does the company have established practices or channels for direct communication with other spacecraft operators for safety of flight purposes?
- [ ] Has the company, if operating spacecraft, considered the emerging best practice of open sharing of their satellite ephemerides? Beyond this, has the company considered sharing their maneuver plans? Has the company considered publishing the probability-of-collision threshold they use for triggering a collision avoidance maneuver?
- [ ] In addition, has the company considered publication of information concerning the type and quality (e.g., accuracy, timeliness, period of applicability) for any information being shared regarding their spacecraft's operations and orbital maneuvers?

GOVERNANCE

This consideration seeks to ensure that management has given appropriate resources to corporate governance structures which will enable regulatory and safety performance.

- [ ] Have management designated or established a regulatory and/or compliance function early in the company's lifetime, and well prior to the intended launch of any spacecraft?
- [ ] Is the company management team aware of the unique regulatory requirements that affect the space domain (including spectrum/frequency coordination and access requirements, export control, and space debris mitigation) and have procedures been put in place to ensure compliance?
- [ ] Have corporate practices and internal processes been established to manage for the safety of space operations?
- [ ] Are factors of reliability and resilience considered in supplier choices?

HUMAN CAPITAL

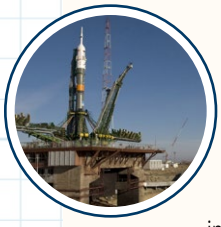
This consideration seeks to ensure training and familiarity with the unique aspects of the space domain.

- ☐ Have management or corporate practices been established to provide staff opportunities to remain abreast of the current state-of-the-art in their areas of responsibilities, including spacecraft operations?
- ☐ Are efforts made to enhance familiarity of staff who may be entering the space domain from other industries with the unique aspects of the space domain?

GEOPOLITICAL RISK

This consideration seeks to ensure management and funders have considered the broader implications of involvement in a strategic sector.

- ☐ In commercial space projects or activities involving multiple States, are management aware of any geopolitical risks of space systems or activities being used as bargaining chips or held hostage by one or more States to achieve their political and/or military objectives?
- ☐ Are management aware of any dual-use concerns or sensitivities raised by their technology or services? Are these potential uses aligned with founder's (or funder's) values?
- ☐ Does use as a military or defense product expose the company to any additional risks (e.g. counterspace, financial, operational, or intellectual property)?



ON 4 MARCH 2022, THEN UK-BASED LEO satellite constellation company OneWeb was planning to launch a group of 36 satellites on a Russian operated Soyuz-launch vehicle from Russia's spaceport at Baikonur, in Kazakhstan. By late February 2022 the satellites were in Kazakhstan and integrated into the launch vehicle. After the Russian government invaded Ukraine in late February, OneWeb's satellites were caught up in the political responses to the invasion. The Russian government refused to let the launch go forward unless a number of strict conditions were met (including that OneWeb's service would not be used to support military operations), - which were unacceptable to both the company and the UK government. Essentially, OneWeb's satellites were being used as collateral in negotiations. OneWeb ultimately announced it would not use Soyuz launches, and purchased a number of launches on other providers, delaying the deployment of the constellation and likely increasing the cost of launch services. OneWeb never recovered the satellites from Kazakhstan. This situation resulted in significant financial cost to OneWeb - the company's 2022 annual financial report included an impairment charge of $229.2M related to the lost satellites and subsequent changes to the constellation launch plans. This provides an example of the ways in which geopolitical risk can affect space ventures. ■

Reference: Jeff Foust, "OneWeb takes $229 million charge for canceled Soyuz launches," SpaceNews, September 7, 2022, https://spacenews.com/oneweb-takes-229-million-charge-for-canceled-soyuz-launches/

IN RECENT YEARS, SIGNIFICANT EFFORTS HAVE BEEN made by a number of industry, government, and civil-society groups to develop and promulgate guidelines, principles, and best practices for space sustainability and/or space operations. Some key examples include:

The Space Safety Coalition (SSC): An "ad hoc coalition of companies, organizations, and other government and industry stakeholders" that has published a Best Practices for the Sustainability of Space Operations document.

The Global Satellite Operators Association (GSOA): A trade association focused on the satellite industry, has published a Code of Conduct on Space Sustainability, which contains a set of recommended best practices to mitigate the risk of on-orbit collision, minimize the threat of non-trackable debris, protect humans in space, and limit the effects of satellite sunlight reflections on ground-based optical astronomy.

The Net Zero Debris Charter: A document written collectively by a group of space agencies and industry actors, facilitated by the European Space Agency, which lays out a set of "high-level guiding principles and specific, jointly defined targets" intended to drive the space community towards stopping creation of space debris as a result of space activities by 2030.

NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook: Prepared by NASA's Office of the Chief Engineer as a guidebook for spacecraft operators detailing best practices for operating safely, focusing on practices lowering collision risk in orbit.

These initiatives and others have resulted in a collective set of recommendations, principles, and guidelines which may provide detail to company leadership in implementing the elements of the checklist provided here. They may also form the starting point to describe core norms in development of sustained growth in the space economy.[7]

[7] Miki Sode, Ian Christensen, Nishan Degnarain; "Reviewing Space Sustainability Principles - Towards Norms For Sustained Space Economy Growth," IAC-24,E9,3,7,x90380, paper presented at the 75th International Astronautical Congress (IAC), Milan, Italy, 14-18 October 2024.

In summary, investing responsibly in space requires an appreciation by investors of the uniquely challenging environment in space and the importance of developing specialized skills, approaches, and attitudes that support a responsible approach to operating in space.

SECTION V

Action for Responsible Investment in Space

There are actions investors themselves can take in support of broader stewardship approaches to the space domain. Encouraging the development of responsible space activities can itself create new investment and market opportunities. These include direct investment potential in new and novel services that may be created in support of space sustainability, such as: space situational awareness services, debris remediation, satellite servicing, post-mission disposal, active debris removal, etc. It can also help create sustained downstream investment in the markets and services that are partially or fully enabled by space applications and technology. As part of a responsible approach to space investing, space investors should:

- Recognize that responsible investment in space activities requires a certain amount of domain-specific knowledge and an awareness of domain-specific risks, beyond what may be required in other sectors, to be able to make deep and balanced assessments of the viability and risks of the proposed investment, and the full spectrum of consequences of failure.
- Recognize that investors must operate to the highest possible technical, market, and operational due diligence standards to make the informed and responsible investment decisions.
- Recognize the need to plan for the entire life-cycle of a space project and to make operational and financial provisions for the timely and safe disposal of orbiting assets when they reach the end of their operational life.
- Link investment decisions to state-of-the-art best practices for the safety and sustainability of space activities.
- Recognize that mistakes made, failed companies, and assets abandoned in space result not only in financial losses to the investor(s) concerned, but also non-financial impacts that could reduce the ability of others to have equitable access to a safe and stable space environment, reduce future space investment opportunities, and the success of other space-based endeavours.
- Be aware of the actual and potential dual-use capabilities of space systems and the importance of maintaining as much transparency on intentions and activities as is practicable to allay concerns about the intent of space activities.
- Promote responsible space investment practices within the investment community and among other space investors.

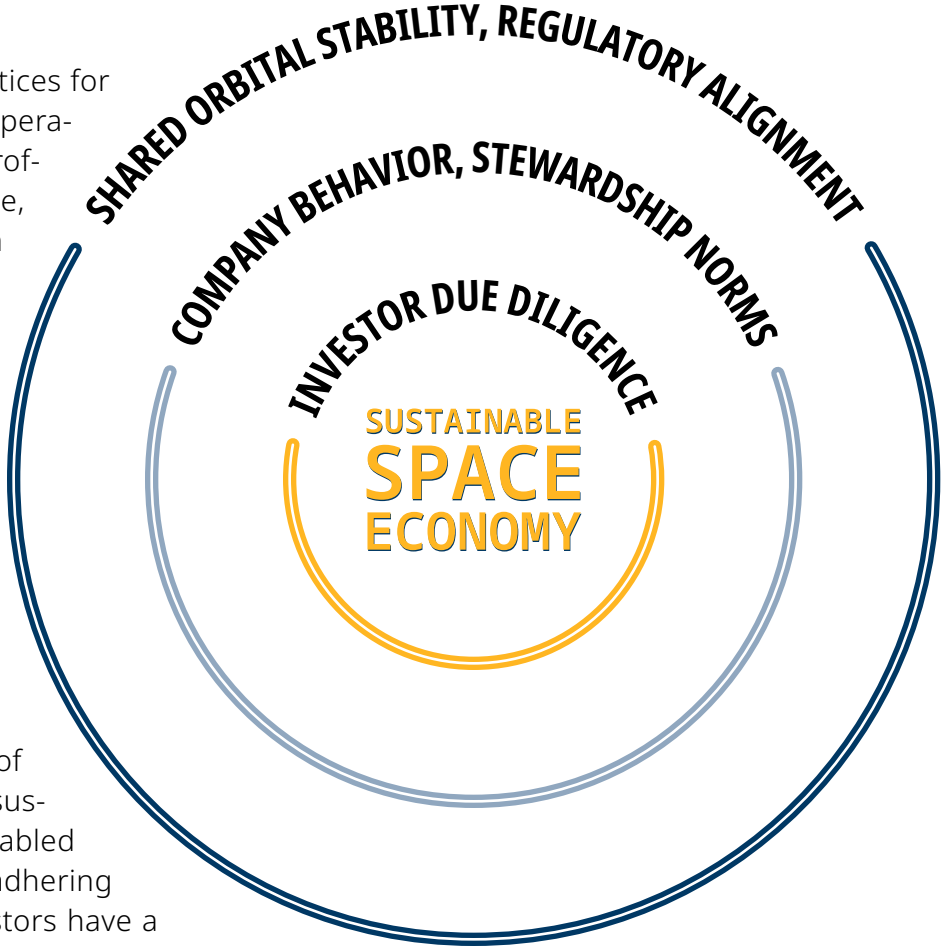
SECTION VI
Conclusion

WE ARE AT A HISTORIC POINT IN the industrial development of space, with new companies, products and services being announced almost daily. From serving existing space markets, to creating entirely new markets, the burgeoning space economy offers significant opportunities for investment and value creation. The staggering array of options for investment is exciting because space investment lies at the nexus between what was not too long ago science fiction, and what is today technologically feasible, to create emerging markets and business opportunities. However, this excitement must be tempered by the realization that space is both a fragile and strategic shared domain, and that humanity should not tread too heavily on the Earth's orbital space environment, lest we endanger our ability and the ability of future generations to use that environment as the driver of societal benefit and economic prosperity envisaged by many proponents of investment in the space economy.

There are consequences to not encouraging responsible behavior in space activities; decisions that we make now might limit future investment opportunities and returns. In an increasingly complex and congested domain, failure to limit debris creation and to develop effective practices for coordination of space traffic will lead to increased collision risk and increased potential for harmful interference, which would in turn impose increased costs on operations, making business cases and returns more difficult to achieve. Failure to operate in responsible ways may lead to regulatory reactions that might limit business growth or impose additional costs.

SPACE INVESTMENT LIES AT THE NEXUS BETWEEN WHAT WAS NOT TOO LONG AGO SCIENCE FICTION, AND WHAT IS TODAY TECHNOLOGICALLY FEASIBLE

In this guide to *Responsible Investment in the Space Sector: Stewardship for Sustainable Value Creation*, we have made the argument that the long-term financial sustainability and profitability of commercial ventures in space depends on all space actors behaving in a responsible and sustainable fashion that does not harm the space environment, and that investors have an important role to play in shaping the behaviors of commercial space actors towards responsible operations practices.



As the space economy expands, practices for sustainable and responsible space operations will be necessary for ensuring profitability and long-term growth. To date, most analyses of the potential growth of economic opportunities in the space sector have addressed the financial sustainability of commercial space activities while overlooking the importance of responsible behaviors in space to ensure the sustainability of those activities from an environmental perspective. Given the unique physical and operational aspects of the space domain, the diversity of regulatory regimes space companies must interface with, and the proliferation of opportunities for access to capital, a sustainable space economy can be enabled through attention to promoting and adhering to responsible behavior. Space investors have a key role to play in achieving this outcome. ■

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