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Reentry, Resources, and Constellation Rivalries: Space Industry Review April 2025

SPACE INDUSTRY REPORT

APRIL 2025

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INTRODUCTION

As we look back on April we reflect again on what is becoming a fast-changing industry landscape, shaped by shifting international relations, and also growing aspirations in orbit and on the Moon. As of writing, iSpace's 'Resilience' lunar lander has entered lunar orbit, lining itself up for a landing attempt from 6 June. Furthermore, Interlune (US) has just announced the unveiling of its lunar harvester, in cooperation with Vermeer Corporation, which will refine large quantities of lunar regolith in order to extract the isotope, helium-3, for terrestrial applications in quantum computing, medical imaging and fusion power generation.

We're also seeing the conversation surrounding the use and ownership of these resources expand. This area has been the subject of much debate, with existing binding international law providing some divergency and ambiguity. In our introduction this month, we'll briefly analyse some of these frameworks.

Signing the Outer Space Treaty 1967 (Image: UN Photo)

The Outer Space Treaty 1967: Non-appropriation

The UN Outer Space Treaty has been widely adopted, with 116 States party to the treaty. This includes the US, China and Russia. Article II of the treaty defines a clear principle of non-appropriation by claim of sovereignty. Furthermore, article VI makes States responsible for the activities of private companies on the Moon, thus subjecting them also to the non-appropriation principle.

However, article I states that outer space shall be free for exploration and use, and there shall be free access to all areas. This could then imply that the use of resources does not amount to appropriation as it counts as 'use' rather than 'occupation'. Also, article I states that space shall be used on the basis of equity, while article IX introduces the principle of 'due regard' for others. This could then suggest that States must use resources in a way that aren't depletive and maintain access for other States.

The OST was adopted nearly 60 years ago and it's widely understood that its primary purpose was to ensure the prevention of weapons placement in space amid the cold war.

Nonetheless, the OST remains the foundational instrument of international space law, and its articles and principles provide the legal navigation necessary to expand on International governance and address the matter of space resources.

The Moon Agreement 1979: Resources commons?

The UN Moon Agreement was an attempt to expand on the principles of the OSt and clarify some of the ambiguities surrounding the use and utilisation of space resources. Firstly, the agreement is not only for the Moon, but to be used also on 'other celestial bodies in the solar system', other than Earth. It also builds on the principles of peaceful uses set out in the OST and prohibits the placement of weapons in lunar orbits.

In regard to resources, article IV outlines that the '...use of the moon shall be the province of all mankind.' More directly, article II states that the Moon '...and its natural resources are the common heritage of mankind.' It furthermore requests that States '...establish an international regime...to govern the exploitation of the natural resources...' This would not be dissimilar from the role of the ITU in distributing and regulating the use of Earth orbits and spectrum.

However, the Moon Agreement has yet only 16 States Parties to it, and the US have declared their disagreement of including resources within the global commons.

Artemis Accords: Norms for space activities

To date, the US-led Artemis Accords, a set of non-binding principles for responsible behaviours in outer space, has gathered the signatures of over 50 States. The Accords does not consider that the use of resources amounts to appropriation under article II of the OST, and also seeks that resource activities will be carried out in accordance with the OST.

However, firstly China and Russia are not signatories, and it remains highly unlikely they will be. Furthermore, the Accords ask fo the use of 'safety zones' when carrying out resource extraction activities, which has been inferred to as amounting to appropriation of territory and excluding others from resource-rich areas of the Moon. In fact, a US House debate in December 2023 suggested the use of these zones in order to secure resources ahead of their competition.

Nonetheless, the Artemis Accords are gathering much support and can provide a platform for discussion, while the non-binding nature means that these principle could be iterated and adapted for future needs.

Working Group on Space Resources - COPUOS

The Working group on Legal Aspects of Space Resource Activities, an expert group within the Legal Subcommittee of the UN Committee on Peaceful Uses of Outer Space, was given a mandate in 2022 to explore the benefits of a set of principles on space resource activities.

This set of draft principles now been published, which we will discuss in our legal review. In May, the Legal Subcommittee will also hold its annual meetings, where the group will discuss the draft principles, as well as hear from delegates on this matter. We look forwards to analysing that feedback next month.

Best wishes,

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NEWS ANALYSIS

Rocket Lab Electron launch (Image: Rocket Lab)

Rocket Lab soars, SpinLaunch plan constellation and Astra make comeback

In last month's report we discussed the critical role played by Rocket Lab (US/New Zealand) in the Artemis project, launching the CAPSTONE cubesat for NASA, designed to test the stability of lunar orbit in anticipation of the Lunar Gateway station, as well as an impressive launch cadence for their Electron rocket. Their posted revenue is also reflecting this ongoing success. Last year it is understood that the company earned $436.2 million, representing a 78% increase from the year before. Furthermore, in the last quarter, revenue increased by 121% compared to 2023, which is the company's biggest.

Rocket Lab will though still have their work cut out in what is becoming an ever increasingly competitive market, driven by launch demand, and calls for more diversity. SpinLaunch (US) are a company looking to offer an unconventional launch service, utilising a centrifuge to accelerate vehicles up to 8,000 km/h. Once released, the vehicle should ascend above the stratosphere, where a small propulsion system kicks-in, which will transport it into orbit. On its path to reach orbit, the company has been testing its suborbital accelerator, which measures 33-metres and is the largest span vacuum chamber in the world.

On 3 April, SpinLaunch announced that they have signed a $136 million contract with Kongsberg NanoAvionics to develop a 250-satellite constellation

named Meridian Space. The broadband communications satellites, while not competing in numbers with larger megaconstellations such as Starlink and Amazon Kuiper, are to be smallsats, weighing 70kg each, providing high-speed broadband connectivity and meeting rising global demand. Their 5G enabled non-terrestrial network (NTN) also rivals Spain's Sateliot, another satellite startup aiming to deploy a constellation of 100 5G IoT (Internet of Things) enabled satellites.

April also saw the resurgence of rocket startup Astra (US). In June 2022 the company's Rocket 3.3 launch partially failed when the upper stage reached only an 80% orbital velocity after an unusually high fuel consumption rate. In 2024 Astra shares collapsed and it was delisted from Nasdaq. However, last month the company shared new details about its recent $44 million contract with the US DoD. The funding is to help Astra with the development of its Rocket 4, using it for point-to-point delivery services, capable of carrying just under 600kg of payload. Astra is among several companies selected by the Defence Innovation Unit (DIU) to provide responsive space delivery services, utilising orbital reentry technology.

Astra-1 Mission 2022 (Image: Kenniston/Astra)

> Astra sign $44 mn contract with US DoD for Rocket 4 development
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The company is aiming for a 2026 launch of Rocket 4, and furthermore aims to develop a mobile launch platform, providing a greater deal of flexibility in being able to operate independently of static launch sites. Space technology is only becoming increasingly critical for defence applications, and may see more support outside of the US as well. European nations have committed more spending for defence in light of changing relations with the US, and it would be likely that space systems will be included within those budgets.

In regards to re-entry tech, Germany's Atmos Space Cargo have also successfully carried out a demonstration of their Phoenix space system, which uses an inflatable atmospheric decelerator system. The technology can be used for launching orbital microgravity research and in-space manufacturing projects, and could also be applied for defence applications and point-to-point delivery.

JAXA and iSpace missions, UK lunar soil project and China update on Moon landing

After the lunar landings from commercial US entities Firefly Aerospace and Intuitive Machines, Japan's iSpace is preparing for its own attempt, now scheduled for the 6 June. This will be the company's second attempt, after their first mission felt short when it crash landed on descent, back in April 2023.

Their lander, named Resilience, is due to land in the Mare Frigoris region on the near side of the Moon. The site, also known as the 'sea of cold' was chosen firstly as it provides a stable terrain and is better suited for the lander while it descends. Furthermore, it is believed to contain regolith suited for sampling. The mission is to deploy their own 'Tenacious' lunar rover, which will carry out a historic soil sample collection after receiving the first-of-its-kind resources utilisation license under Luxembourg's 2017 space legislation. The contentious matter of resource usage and appropriation is something currently being discussed in different fora, such as the legal subcommittee of the UN Committee on Peaceful Uses of Outer Space (COPUOS), which we will analyse in more detail in our legal review.

iSpace have been taking a notably longer trajectory to the Moon compared with the previous two US missions. The mission launched on 15 January, and has been carrying out series of manoeuvres on its journey to the Moon. As of 24 April the company announced their Success 6 Milestone (out of 10), marking the completion of their 'deep space manoeuvres', and will aim to enter lunar orbit by 7 May.

iSpace have also been busy building new partnerships and signing cooperative agreements in recent months. In February the company signed agreement with muSpace for payload services to the Moon, while in March an MoU was signed with Chuo University to study the feasibility of sending AI-equipped robots to he Moon for exploring lava tubes. This is just to name a couple. Perhaps somewhat more significantly, in April iSpace signed an MoU with Redwire Space, a company developing lunar exploration and infrastructure, among other technologies. The partnership is to explore lunar missions under NASA's Commercial Lunar Payloads (CLPS) programme as well as 'other customers' (iSpace).

iSpace are developing their next generation APEX 1.0 lander, currently being built for US firm Draper, which is due to launch in 2026 to the lunar far-side. Redwire and iSpace are aiming to secure future CLPS contracts, with Mike Gold, President of Civil and International Space at Redwire, saying that:

"The combination of Redwire's advanced digital engineering, integration and testing, and lunar subsystems and payloads with ispace's proven Lunar landing platform and mission operations creates a world-class team to support the future of humanity's operations on the lunar surface and beyond." (iSpace)

What's more is that Gold also is looking beyond CLPS and reliance on State and anchor investment in lunar missions, stating that new customers are appearing for lunar missions, saying that 'it's about building a new economy.'

iSpace have also been selected as a partner organisation of JAXA, under their Space Strategy Fund. The partnership will focus on searching for water resources on the Moon, which will see the company sending a satellite into lunar orbit, as well as play a '...central role in the development and operation of the exploration satellite' (iSpace). According to iSpace, the satellite will observe the brightness temperature distribution on the lunar surface at multiple frequencies and acquiring data to estimate the distribution of water and ice on the Moon.

JAXA have also announced a Mars lander project, supported by their $6.7 billion space investment over the next 10 years. The project involves research in the development of inflatable decelerators for a lander, which would utilise technology from both their SLIM lunar lander and the upcoming Martian Moons Exploration (MMX) mission to the moon Phobos. The decelerator would replace the use of a supersonic parachute, and also use thrusters for the landing, with the plan to deliver rovers weighing 100 to 200 kg.

Image: Adobe

> iSpace to play 'central role' in operation of lunar satellite
>
> **iSpace**

SLIM was their lunar lander which achieved a soft landing on the Moon in January 2024, which also saw Japan become the fifth nation to land on the Moon. The mission was also a triumph in precise landing technology, with the lander arriving 55 metres from its target, whereas typical ranges can be in terms of kilometres.

UK-based Naicker Scientific are also exploring lunar water utilisation, and have recently been awarded funding by the UK Space Agency under the Aqualunar Challenge. Their 'SonoChem' system uses sound waves, which forms small bubbles within contaminated water. The pressure and temperature within these bubbles then removes the contamination. This technology can then be applied on the Moon for the processing of clean drinking water, and could then be applied to, for example, on Mars or also be utilised on Earth.

Also, the US Defence Advanced Projects Agency (DARPA) has made a request for proposals for the development of a lunar orbiter which will scout for lunar ice. The vehicle would fly in very low orbits, as low as 10 km. The project, named Lunar Assay via Small Satellite Orbiter (LASSO), would aim to map the entire surface of the Moon, and DARPA are seeking six-page proposals from organisations on the project.

Space resource utilisation is an integral part of developing a new space and lunar economy, in being able to use local resources for the more effective and sustainable uses of space. As mission cadence to the Moon increases, this matter is becoming an increasingly contentious legal matter as well. In our legal review, we will discuss this area some more, and consider the recent draft set of principles for space resource activities, which have been published at the UN COPUOS.

Calls for CLPS 2.0 while China gain ground in lunar exploration

While the lunar economy expands, and more commercial interest develops, it is still currently vital that existing and emerging lunar exploration companies seek State and agency funding in order to support longer-term ambitions. However, the lunar economy is set to be worth in the region of $140 billion by 2040, according to PwC, and the DARPA is currently researching the development of an interoperable, scalable and monetizable lunar economy over the next decade, through their LunA-10 project. The results from the research are due in May this year.

Nonetheless, government support is what is currently enabling missions such as the recent lunar landings from Firefly and Intuitive Machines, through NASA CLPS. The programme was started in 2018 with a budget of $2.6 billion, but with it coming to end in 3 years, industry is asking Congress to establish CLPS 2.0. While asking for continued support for their emerging companies, additional requests include; a higher mission cadence, expanding contracts to more government agencies and more support for testing facilities.

Chief executive of Astrobotic, John Thornton, also called for NASA to allow for buying multiple lander missions from companies, which would then allow them to '...buy in bulk from their US supply chains and save CLPS money.' However, uncertainty over NASA budgets remaina, especially in relation to scientific research budgets, and it is to be seen if there would be a continuation of CLPS. The US administration might also consider the "technically" limited success of CLPS missions so far, with Firefly Aerospace's Blue Ghost-1 mission being the only one to fully-succeed. Both Intuitive Machines missions landed on their side, while the 2024 Astrobotic Peregrine mission ended after experienced a fuel leak while in transit to the Moon.

Nonetheless, Intuitive Machines have announced their fourth mission, due to launch in 2027. The mission is also contracted under CLPS and will carry 6 NASA payloads, as well as a European Space Agency-led drill suite designed to search for water at the lunar south pole.

While there has been uncertainty about the US lunar programme under the new Trump administration, competition from China has only been increasing. China are 'on track' to land taikonauts on the Moon by 2030, according to a recent update, and will soon be testing their Long March-10 rocket due to transport the mission.

In the meantime, the US-led Artemis III mission to land astronauts on the Moon has faced ongoing delays, and will not launch until mid-2027, narrowing the gap between

them and China. However, Donald Trump's nominee for NASA administrator, Jared Isaacman, has said that both Moon and Mars exploration programmes can be pursued simultaneously. Concerns had been raised about Trump's comments on Martian exploration and close ties to Musk who has made landing on Mars a life ambition. Isaacman, though, in a Senate committee meeting said that 'we don't have to make a binary decision of moon versus Mars, or moon has to come first versus Mars,' adding that 'we could be paralleling these efforts and doing the near-impossible.'

Observing the competition with China, Senator Ted Cruz said that 'an extreme shift in priorities at this stage would almost certainly mean a red moon, ceding ground to China for generations to come.' The Trump administration has built a manifesto on cost-cutting, and NASA is at the brunt of this at the moment. The government though will surely be wary of curtailing the power of US commercial innovation and support for their private lunar exploration companies.

LTV rover developments, Bridgestone and Honda deepen space ties

In the meantime NASA are continuing to support their goal of incorporating a new crewed lunar rover into the Artemis architecture. The Lunar Terrain Vehicle (LTV) Services feasibility assessment project awarded three teams last year to research and develop a new concept for a rover, a system which would also see NASA contract the services of commercial companies on the Moon.

One team is being led by Intuitive Machines, and in April they announced that they had successfully integrated and tested an autonomous driving system for their rover named RACER. NASA are due to select one of the proposals by the end of the year, and Intuitive Machines are competing with teams led by Lunar Outpost and Venturi Astrolab.

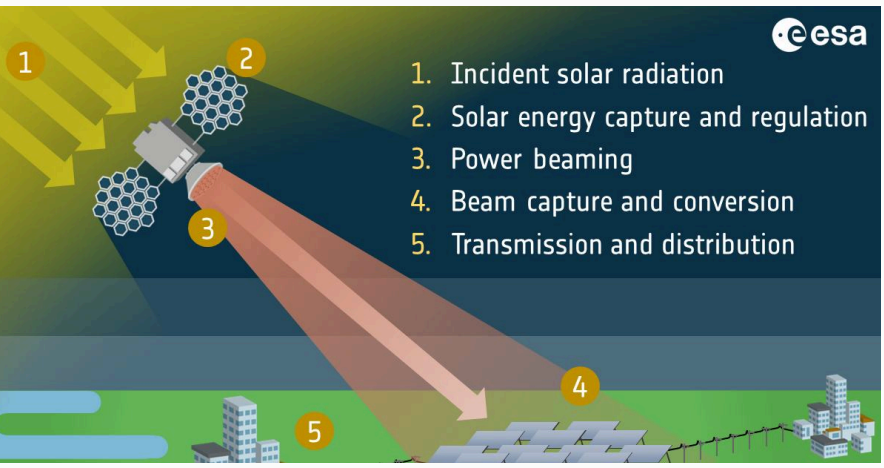
Furthermore, Bridgestone have unveiled developments on their lunar tyre solutions, designing a metal-based solution rather than traditional rubber tyres. This solution is developed in order to withstand the harsh lunar conditions and temperature variations. The company also partnered with Astrobotic in 2024 to develop tyres for their 24U CubeRover, and their involvement in the sector also reminds us of the important and steadily growing participation of the automotive sector in space.

In April it was also announced that Honda and Sierra Space will partner to test sustainable energy sources with their water electrolysis system on the ISS. This is a component of hydrogen fuel cell technology and testing onboard ISS will help validate the use of such technology in space. Sierra Space are due to transport the demonstration onboard their Dream Chaser spaceplane.

Space based solar power solutions, competing megaconstellations and reentry testing

Agencies and organisations are also exploring the use of space for sustainable energy solutions on Earth, namely through space based solar power (SBSP). The idea is not new, and its feasibility is currently being explored by ESA through their SOLARIS programme, which is to prepare for a possible decision in 2025 on development of the technology.

Furthermore, UK based company Space Solar have completed an 18 month project named CASiDi, which studied the costs of SBSP through wireless power transfer, a ground receiver, and in-space assembly systems. In the study they claim that targets for SBSP are feasible and could be key in establishing clean global energy needs. The study, funded by the UK Space Agency, advanced the design of their CASSIOPeiA satellite, which will collect solar energy and beam it to ground receivers using high frequency radio waves. They aim to develop a megawatt scale system within five years, and a gigawatt scale offering within twelve years.



ESA illustrate SBSP processes (Image: ESA)

> "...The goal of SOLARIS is to prepare the ground for a possible decision in 2025..."
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> **ESA**

Additionally, Aetherflux (US) is another company pursuing the technology. In April they raised $50 million towards the development of their novel SBSP solution, using a constellation of modular satellites in low Earth orbit (LEO). The company aim to launch their first demonstrator in 2026. The satellites would collect the solar power and transmit it to Earth using lasers with a diameter of ten metres, while using a modular approach means that their constellation could be iteratively expanded and improved.

Aetherflux will though be competing in an incredibly congested orbit, with Amazon launching the first satellites of their planned 3000+ broadband connectivity constellation in April. The first batch of 27 satellites were launched atop an ULA Atlas V rocket and will reach an altitude of 630 kilometres. Five more satellite deployments could take place this year. Jeff Bezos claims that there is room in the marketplace for Kuiper, despite stiff competition from Starlink and others, adding that the constellation is to be used used for commercial users, but also for defence

applications as well. Amazon are also leading experts in cloud computing through Amazon Web Services, which coupled with LEO connectivity could give them a further advantage over their competition.

China are also competing in this area, with launches of the Guowang and G60 constellations already taking place. Both are planned to consist of 10,000+ satellites. While these megaconstellations also add to the rapid congestion of low Earth orbit, there are also concerns about the lasting debris from the 1000+ launches expected over the next several years. The problem here being that the launches will leave spent upper stages in high altitude orbits, with a lifetime of '...greater than one hundred years,' according to Jim Shell of Novarum Tech, posting on X.

The lasting debris problem has perhaps been best exemplified this last month with the story of Russia's Cosmos 482. The mission was launched by the Soviet Union in 1972; a probe which was to land on the planet Venus. However, problems with the Soyuz booster meant that the vehicle has remained in Earth orbit since then. The landing module is now heading for an uncontrolled reentry to Earth, after spending over fifty years in orbit. Furthermore, with the vehicle being designed to withstand the harsh conditions of landing on Venus, it is thought that it could survive reentry to Earth.

Reentry is expected between nine and ten May, and astronomer John McDowell said that if the heat shield survives, it will have the '...usual one in several thousand chance of hitting someone.'

In 2015 there were 237 payloads launched into space, and in 2024 that number shot up to 2857. This number is only expected to drastically increase, and with that comes the proliferation of space debris. While the UN treaties, particularly the Liability Convention, place responsibility on states for damage caused by space objects, the debris problem continues to grow.

SPACE LAW REVIEW

Key terms: Dual-use; Multi-domain; Golden Dome; ESSI; Wolf Amendment; Outer Space Treaty; Moon Agreement; Artemis Accords; Draft Principle set of Recommend Principles for Space Resource Activities.

Space: the 'new' domain of defence

Russia's invasion of Ukraine in February 2022 marked the beginning of what some commentators call the 'first commercial space war',[1] marked by the significant role of commercial space technology in low Earth orbit, namely Starlink, in the conflict. In fact, even as the invasion took place, space assets were already subject to a cyberattack, targeting Ukrainian broadband satellite infrastructure, disabling modems which connect with the Viasat KA-SAT satellite network.[2] The European Parliamentary Research Service say that cyber attacks have been ongoing since the 2014 occupation of Crimea, highlighting the cyber realm also as growing domain of defence.[3]

As the war unfolded, the benefits derived from access to Starlink became clear, with Elon Musk claiming that the Ukrainian front lines would collapse without it.[4] Furthermore, the expanding role of commercial space entities for defence has provided questions regarding the role of commercial entities in defence, with a senior Russian Foreign Minister claiming that commercial satellites could become legitimate targets for retaliation,[5] while there have been accusations of Elon Musk using the provision of Starlink as a means of making forays into foreign policy. It was reported that he denied the use of Starlink to support an attack on Russian forces in Crimea in 2023, for example.[6]

Since the start of the conflict, the reliance upon and utilisation of space technology for defence have continued to develop.

According to *Handelsblatt*, the German military is considering developing their own version of Starlink, which would involve establishing a constellation of hundreds of satellites;[7] although the Defence Ministry could not go into further details at this time. This follows news in March that Germany is also planning to launch intelligence-gathering satellites from SaxaVord Spaceport in Scotland,[8] which also perhaps highlights a strategic move towards European autonomy in space systems.

Taiwan has also indicated its further support for strategic autonomy of space systems for defence. In April, the Quadrennial Defence Review (QDR) referred to the need for resolute defence and multi-domain deterrence, consistent with their National Defence Strategy since 2021.[9] 'Multi-domain' is reference to land, sea and air, and increasingly space and cyberspace as well. According to the Taipei Times, in 2029 Taiwan are looking to also launch their own communications system similar to Starlink,[10] but consisting of just four LEO satellites. The article continues, that the Taiwanese government had been in talks with SpaceX regarding access to Starlink, but concerns had been expressed about Elon Musk's close links to China.

While the US government are considering cuts to NASA science budgets, and the Artemis SLS and Orion face being cut altogether in favour of commercial systems, there also remains a commitment to space domain defence. In April, the 'Foo Fighter' (Fire-control On Orbit-support to the Warfighter) satellites, being designed by Millennium Space Systems, passed a key design review, and will deliver Proliferated Warfighter Space Architecture for the US military.[11]

Furthermore, earlier this year Present Trump (re)introduced the idea of a sophisticated space shield missile defence system, known as the 'Golden Dome',[12] emulating the 'Star Wars' project initiated by Ronald Reagan in the 1980s. Companies have already expressed their interest in providing their services for it, with Boeing having said that their reusable spaceplane, the X-37B, as well as well as its 'Foo Fighter' satellites (subsidiary of Boeing) could be used. Also, L3Harris' Hypersonic and Ballistic Tracking Space Sensor (HBTSS) satellite prototype recently completed a successful test, proving its a ability to compete to join the Golden Dome.[13] At the end of April it was revealed that US Republicans planned to introduce a $150 billion package to Congress, which would provide $27 billion for the project.[14]

Recent geopolitical developments and subsequent strains on international relations have significantly impacted defence budgets elsewhere, with the German incoming chancellor aiming to unlock €500 billion infrastructure fund, while removing spending limits on defence. Furthermore, recently the EU has released a detailed analysis in their report titled 'EU capabilities in space: Scenarios for space security by 2050',[15] within which it highlights the need to provide robust legal frameworks to safeguard space assets in light of the growing threats facing them and their increased use in defence.

At the same time, Russia is also reportedly incorporating space infrastructure into their military complex. According to The Odessa Journal, Russia's space agency, Roscosmos, continues to serve as a tool for Russian military,[16] with the head of the agency saying that over a thousand space industry employees have been directly

involved in the war, and emphasised the importance of their satellites in providing intelligence gathering systems.

While the use and incorporation of space systems in defence is nothing new (GPS use in the 1991 Gulf War meant it was dubbed as the 'first space war'), there is a growing reliance on it, and deeper engagement with commercial companies. Furthermore, the Outer Space Treaty explicitly bans the placement of weapons of mass destruction into orbit,[17] which may arguably place the Golden Dome initiative in contravention of the treaty, should it utilise space-based anti-missile weaponry. Also, though Starlink and similar satellite systems might be used for defensive purposes, it could also be argued that the expanding role of space for military applications goes against the treaty and its common interest for the use and exploration of space for exclusively peaceful purposes.[18]

As the defence domain of space expands, so must the considerations to monitor the delicate balance between peaceful and defence applications, as well as technologies seen as potential 'dual use', such as on-orbit servicing (OOS) vehicles.

UK provides vision of leadership through sustainability, China build cooperation through lunar exploration

We talked much in recent months about the changing geopolitical landscape, which is driving stronger autonomy in space, not least in regards to Europe. Last month highlighted the ESA 2040 Strategy, aimed at building a 'more prosperous, resilient, independant and inspiring life for all in Europe',[19] with goal three specifically highlighting European autonomy and resilience.

One of the major catalysts for change in Europe was perhaps summed up well by Philippe Baptiste, France's minister of higher education and research who, following the 6 March launch of an Ariane-6, congratulated Ariane and also added 'we are facing a new global reality in the space sector...the return of Donald Trump to the White House, with Elon Musk at his side, already has significant consequences.'[20] However, space has arguably been characterised by multipolar leadership for a longer time, marked by the rapid emergence of China as a leading global space power, alongside advancements by European nations, India, and others.

The UK is making confident strides in space technology, with debut launches soon expected from Orbex and Skyrora, while UK spaceports expect to make the country a hub of European satellite launches. In regards to private investment, the UK has been the second most attractive region, only behind the US, accounting for 17% since 2015.[21]

However, according to former science minister, George Freeman MP, the role of the UK could also be that of a regulatory watchdog, while also leading on insurance and finance.[22] Mr Freeman highlighted the work of the UK space sector and Lloyds of London to create the Earth Space Sustainability Initiative (ESSI), which aims to set global standards for space regulations.[23] The ESSI strives to bring together

different stakeholders (business, academia, governments and international organisations) to '...ensure that space continues to support the environmental, economic and scientific interests of current and future generations.'[24] In order to achieve this, the British Standards Institution published a draft regulatory framework, which is currently open for review and **comments**.[25] The framework was drafted in part by the ESSI expert team, and is to provide guidance, advisory recommendations and best practices. The current version of the framework is the 'BSI Flex 1969 v1.0 2025-03 Overarching principles and framework – Guide'.[26]

Meanwhile, the UK is also making efforts to display leadership through sustainability via other channels, firstly with the launch of the Astra Carta, a non-binding set of principles which builds on the Terra Carta, published by the Sustainable Markets Initiative.[27] The Astra Carta aims to expand on commitments to protect the space environment and align businesses with sustainability goals and approaches.

Additionally, through the UK Space Industry Act 2018, the UK regulator (CAA) is granted powers to manage debris mitigation via licensing (schedule 1(1)(g)), while the UK Space Agency is also funding projects to explore debris remediation technologies with Astroscale and ClearSpace.[28]

China are also cementing their role as a global leader in space, building on overall commitments to provide an alternate vision of global leadership, as highlighted in the March edition of our Legal Review.[29] In April it was announced that China will lend their Chang'e-5 lunar samples to a number of organisations, including two US universities;[30] this being despite the prohibitive US Wolf Amendment which limits the work NASA can do with China.[31] Furthermore, China has selected partner payloads which will fly on their 2028 Chang-8 lunar mission, which will include Hong Kong, Pakistan, Türkiye, South Africa, Russia, Thailand, Egypt, Iran and Italy.[32]

While there are new leaders emerging in the way of China and European nations, cooperation in space remains a key foundational matter which supports and enhances peaceful uses, transparency and trust. The concept is also enshrined within the Outer Space Treaty, which reaffirms '...the importance of international cooperation in the field of activities in the peaceful exploration and use of outer space.'[33] This necessity for cooperation will grow as space is becomes increasingly occupied by commercial entities, and new agreements will need to be established, for example, when different stakeholders operate onboard a commercial space station. These are not distant aspirations, but near-term realities, and it remains vital for dialogue on the development of new frameworks for cooperation to continue.

Draft principles for resource activities, while more actors eye resource utilisation

The growing number of actors in outer space also has implications on access to the finite number of resources. iSpace's upcoming lunar mission will land at the Mare Frigoris or 'sea of cold' on the near-side of the Moon, as it is a region believed to be rich in regolith suitable for sampling.[34] Furthermore, the mission will feature a sample collection by their Tenacious lunar rover, under a historic first-time contract governed under Luxembourg's 2017 space resources law.[35]

Should the iSpace mission be a success it could be a curtain-raiser for a new era of commercial resources extraction. Meanwhile, the rules surrounding the utilisation, appropriation and transfer of space resources remain contentious and ambiguous. The Outer Space Treaty prohibits the appropriation of space, but doesn't make a clear definition in regard to resources.[36] The Moon Agreement 1979 was an attempt to settle this matter, with article 11 stating that the Moon '...and its natural resources are the common heritage of mankind,' and that neither '...the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State.'[37] However, the treaty never gained traction and has attracted only 17 signatures.

Nonetheless, national and commercial interest in space resource utilisation continues to expand. In South Korea, the town of Taebaek is set to become testing ground for national space mining missions, for extracting resources such as helium-3.[38] Furthermore, lunar prospecting startup Magna Petra have announced that they will utilise the NASA Mass Spectrometer Observing Lunar Operations, or MSOLO, instrument on a mission no sooner than 2026 in order to '...measure low molecular weight volatiles in hopes of inferring the presence of rare isotopes, such as Helium-3...'[39] The company have previously announced their intention to develop mining technology which uses capture and containment equipment that allows for the extraction of isotopes without permanently altering the environment.[40] They also follow startup Interlune, who aim to retrieve helium-3 and see market demand for quantum computing and medical imaging applications, and plan a mission to measure quantities of the isotope on the Moon in 2027.[41]

Although there might be growing intrigue in regards to space resources, the issue of global governance and legal harmonisation among nations is far from settled, as highlighted with the OST and the Moon Agreement. However, the matter of resources is being addressed at the UN Committee on the Peaceful Uses of Outer Space. The Working Group on Legal Aspects of Space Resource Activities, working within the Legal Subcommittee, was given a 5-year work-plan to develop a set of initial recommended principles for such activities. In 2025, prior to the annual meeting of the legal subcommittee, a draft set of principles has been produced.[42] This consists of two parts; an initial set of recommended principles for space resource activities; and possible additional draft provisions.

As a brief overview, part one provides principles which reflect some of the foundational principles of the Outer Space Treaty, such as compliance with international law, freedom of access and non-appropriation, peaceful uses, avoiding harmful contamination, cooperation, and State responsibility for activities of non-state entities. They also provide new principles, including aspects of sustainability in resource activities, additional safety and rescue provisions, and information-sharing; the latter point being widely discussed at the moment, in particular through the possibilities of utilising article XI of the Outer Space Treaty to register the nature of space missions.[43]

Furthermore, there are the possible additional provisions to the principles, with part 2 (principle 2) stating that the '...extraction of space resources [and/or the utilization of space resources do] does not inherently constitute national appropriation under Article II of the Outer Space Treaty.'[44] This provision would align with the principle set out in the Artemis Accords,[45] and could therefore gain favour with the US and Artemis signatories.

However, principle 6 states that '...resource activities shall be conducted for the benefit and interests of all humankind and shall be the province of all humankind,'[46] which may mis-align with the US and the Trump executive order in 2020, which states that the US does not view space as a global commons, and encourages support for the use and recovery of space resources.[47]

Discussions regarding the draft principles will take place during the 64th meeting of the legal subcommittee, and we look forwards to feedback and input from delegations, observers and commentators.

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8 May 2025

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