EDITION 0008

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Space Resources and Future Markets, Anticipating Starship Impact, and Analysing White House Efforts to Streamline Commercialisation

SPACE INDUSTRY REPORT

AUGUST/SEPTEMBER 2025

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INTRODUCTION

As our readers might have observed since we first began publishing our new Monthly Space Industry reports in January this year, at ANASDA, we take a keen interest in the growing space and lunar activities. This has included analysing the space treaties, such as the principles within the Outer Space Treaty, as well as emerging domestic legislation, including in the US and Luxembourg, which aims to enable commercial space mining activities. Our research has also aimed to unpack what current developments are taking place regarding resources governance, such as at COPUOS and the recently published first draft of the Set of Recommended Principles for Space Resource Activities', the establishment of the Action Team on Lunar Activities Consultation (ATLAC), and also provisions outlined in other non-binding legal approaches, such as the Artemis Accords.

Developments in space resources governance are happening at a critical time. Firstly, commercial missions are now taking place, or are soon to take place, which aim to prospect and search for resources on the Moon and near-Earth asteroids (NEAs). Furthermore, national strategies around the world are identifying space as a key domain, for defence, sustainable development, communications, and also for the utilisation of resources. In addition, space and particularly lunar exploration are becoming heightened geopolitical matters, with the head of NASA recently declaring that the US would claim the 'best' parts of the Moon for America. Following this, on September 9, the European Commission identified key areas related to future raw materials dominance, and specifically referred to advancing '... mining technologies including space mining, starting with the Moon.'

In this edition, our introductory article will strive to analyse some of these national regional strategies, as well as present some of the factors driving the growth in interest in space resource mining.

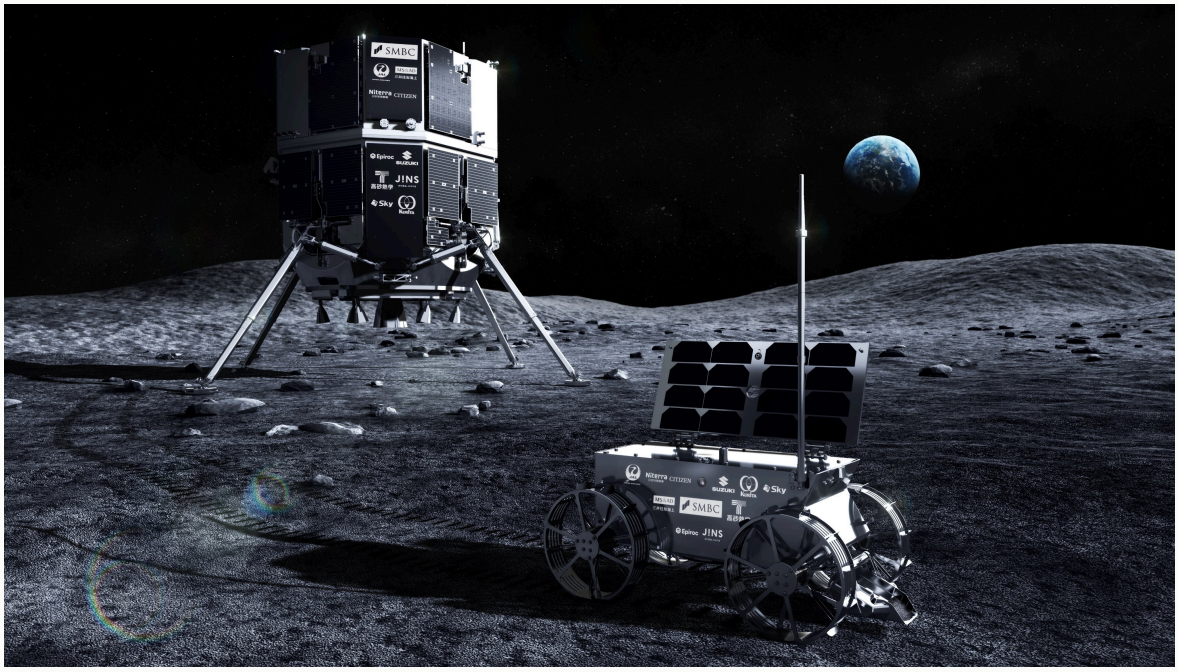
EU Space Strategy and the Expanding Scope of Space Resources Prioritisation

'As space increasingly becomes a frontline for geopolitical influence, governments that act now can secure strategic advantages,' said Thibault Werle, managing director and partner at **Boston Consulting Group**. This notion can also certainly be applied to space resources activities, especially in light of the recent comments made by the acting NASA chief.

In fact, the US have taken a fairly strong position on resources, firstly with the adoption of the **US Commercial Space Launch Competitiveness Act in 2015**. The Act sets out to '...facilitate commercial exploration for and commercial recovery of space resources by United States citizens,' and promotes '...the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources.' This position was reaffirmed by

President Trump in 2020, who published an **Executive Order** that seeks to provide certainty regarding the right to recover and use space resources, by rejecting the notion of space as a 'global commons', and encouraging '...international support for the public and private recovery and use of resources in outer space, consistent with applicable law.' Furthermore, the US rejects any recognition of the **1979 Moon Agreement**, a treaty which seeks to recognise space resources as a global commons and build an international regime for resource governance.

Luxembourg also established national legislation to support resource mining, in their Law of 2017 on the Exploration and Use of Space Resources. Article I states that 'Space resources are capable of being owned', while the law also establishes a licensing mechanism, whereby mining actors must procure '...a written mission authorisation from the minister or ministers in charge of the economy and space activities.' This mechanism was first utilised this year, when the iSpace-Europe 'TENACIOUS' commercial lunar rover was granted a license to collect lunar regolith and transfer ownership to NASA, under Luxembourgish law. In 2021, Japan also enacted legislation with provisions on resource ownership, titled the 'Act on the Promotion of Business Activities for the Exploration and Development of Space Resources', or the **'Space Resources Act'**. This allows for private ownership of space resources which are mined, and requires actors to gain a license by submitting a detailed business plan under the Space Activities Act.



Europe has also now taken a decisive turn toward resource mining. The September 9 report from the European Commission, titled '**Resilience 2.0- Empowering the EU to Thrive amid Turbulence and Uncertainty**', observes the critical awareness of the shifting global order, '... from geopolitical and geoeconomic upheavals, conflicts and security threats, through the triple planetary crisis (climate change, pollution and biodiversity loss)...to technological and

demographic changes, and threats to democracy and values…' The report then establishes a path toward a '…transformative, proactive and forward-looking ('resilience 2.0')' strategy. In an era of growing competition for resources and a clean tech market share, the EU observes that there may be an emerging 'OPEC-style dominance of specific resources or technologies', which includes rare earths and metals such as lithium, copper and nickel, which are essential for renewable energy and electric vehicles.

Furthermore, according to a report from the Jacques Delors Centre, China processes '…40% of copper, 60% of lithium, 70% of cobalt, and close to 100% of the graphite used worldwide.' Reflecting on this, the EU strategy aims to roll out efforts to generate energy independence, data sovereignty, and, regarding raw materials, advance '…mining technologies including space mining, starting with the Moon.' The utilisation of space resources is increasingly becoming shaped by geopolitical dynamics.

ISRU to Terrestrial Application: Reasons Why Strategies Aim for Space Mining

Firstly, it needs to noted that the use and utilisation of space resources will likely serve the primary purpose of in-situ resource utilisation (ISRU) applications. This is an essential step towards establishing a long-term and sustained presence on the Moon, such as through the Artemis Programme, the Chinese-led International Lunar Research Station project, or similar lunar base initiatives being led by India, Korea and Europe.

Among the first critical resources is locating and refining lunar water. Mining and refining water is necessary to make consumable water, oxygen, and fuel for the production of **hydrogen-based rocket propellants**. These enable longer duration and more cost-effective mission planning, in being able to refuel and return from the Moon, or as a means of fuelling spacecraft for missions to Mars and into deep space. Replacing the need to launch costly supply missions from Earth further reduces barriers and enables more activity. It is believed that lunar ice '…is mainly found in the dark craters near the South Pole, which are permanently shaded from sunlight.' (DLR)

Multiple water volatiles exploration missions are planned or have taken place, including the NASA PRIME-1 drill payload, sent on the second Intuitive Machines mission earlier this year, while in May this year, iSpace (Japan) signed a memorandum of understanding with Takasago Thermal Engineering Co to study the **feasibility of sending its thermal mining technology** for water extraction on the Moon's surface. Furthermore, Takasago also sent a water electrolysis payload onboard the iSpace Mission 2 in 2025, which aimed to conduct the **world's first hydrogen and oxygen production** in the lunar environment. Furthermore, in September 2023, Starpath Robotics (US) came out of stealth and announced a grand commercial vision of water extraction, seeking to deploy a fleet of mining robots to collect lunar regolith, which would then be refined for water. Starpath raised $12 million in 2024, and believes there will be a thriving market for liquid oxygen (LOX) production on the Moon, even if only for the refuelling **demands from SpaceX's Starship**.

More recently, Blue Origin has **provided an update** on their Blue Alchemist system, which will utilise lunar regolith for the production of silicon, metals and oxygen. It has now successfully completed its Critical Design Review for the technology, which uses a reactor to produce iron, silicon and aluminium through molten regolith electrolysis, in order to manufacture products including solar cells and wires, while oxygen is the byproduct, used for propulsion and life support.

The company aptly described their technology, and perhaps indeed all those researching ISRU tech, as 'the breakthrough technology (that) aims to turn the Moon, and eventually Mars, into self-sustaining worlds where robots and humans can go beyond visiting and truly explore, grow, live, and thrive.'

Metals, Rare Earths and Asteroid Mining

Asteroid Psyche16 believed to be rich in metals (Image: Raw Pixel)

The EU report, however, additionally highlights space and lunar mining as a critical strategic resource to secure the future supply of metals and rare earths, and takes into account the geopolitical risk factors of accessing such resources on Earth in future. Furthermore, an EU report from June 2025, titled '**A Vision for the European Space Economy**', observes that the '...economic potential of space resource use is projected to generate market revenues of €73-170 billion between 2018 and 2045.'

Some companies are already active in the market for retrieving resources, including AstroForge (US), which has launched 2 missions to date aiming to demonstrate asteroid mining technology. The company is currently planning its third mission, named 'Vestri', a 200kg vehicle which will launch as ridehsare with the third Intuitive Machines lunar mission in

2026, and land on asteroid 2022 OB5 and assess the quality of its metals, **including cobalt, nickel, and platinum-group metals** (PGMs). AstroForge claim that metallic asteroids contain enough PGMs 'to power industries on Earth and beyond', and that 'one asteroid could supply Earth for 200 years.'

Among other space mining companies is TransAstra, which in September **provided an update** on their step-by-step approach, using their capture-bag technology. Firstly, the system will be deployed to capture orbital debris, and will be tested onboard the International Space Station (ISS). TransAstra chief engineer, Thibaud Talon, says that it can '...pretty much capture anything that fits into the bag, whether that is an asteroid or a satellite...', being that is designed around an inflatable, pressurised structure. Using the technology to address the spiralling debris problem not only demonstrates innovative technology supporting the sustainable development of outer space, but also enables them to demonstrate and test the technology toward the ultimate goal of capturing asteroids for mining.

These are only some of the companies building the technology for future asteroid mining; an industry which **Neil deGrasse Tyson claims will produce the first trillionaire**.

Lunar Helium-3: Quantum, Imaging and Fusion Power

Lunar helium-3 mining has gathered much attention. The isotope is believed to be abundant on the Moon, while it is extremely scarce on Earth, and has a current market value of **$20 million p/kg**, according to Interlune CEO, Rob Meyerson. According to Aaron DS Olson, there is only about 100kg of the isotope available on Earth, but due to constant bombardment by solar winds, helium-3 has accumulated on the lunar surface, and lunar mining company, Magna Petra, claim that previous estimates suggest there to be **1.1 million tons** of it on the Moon.

Magna Petra are aiming to mine helium-3 and have signed an agreement with NASA to send a volatiles spectrometer to the Moon no sooner than 2026, while Interlune (US) announced their first mission for 2025 , to send a multispectral camera onboard Astrolab's FLIP rover, to **measure lunar helium-3 density**. Interlune have also already signed contracts to mine and retrieve helium-3 for terrestrial markets, including a deal with the US Department of Energy Isotope Program (DOE IP) to deliver lunar helium-3 no later than April 2029, and also with commercial customer Maybell Quantum, who agreed to purchase thousands of litres of helium-3 for annual delivery between 2029 and 2035. This is to be used for quantum cooling, and allowing quantum computing to scale.

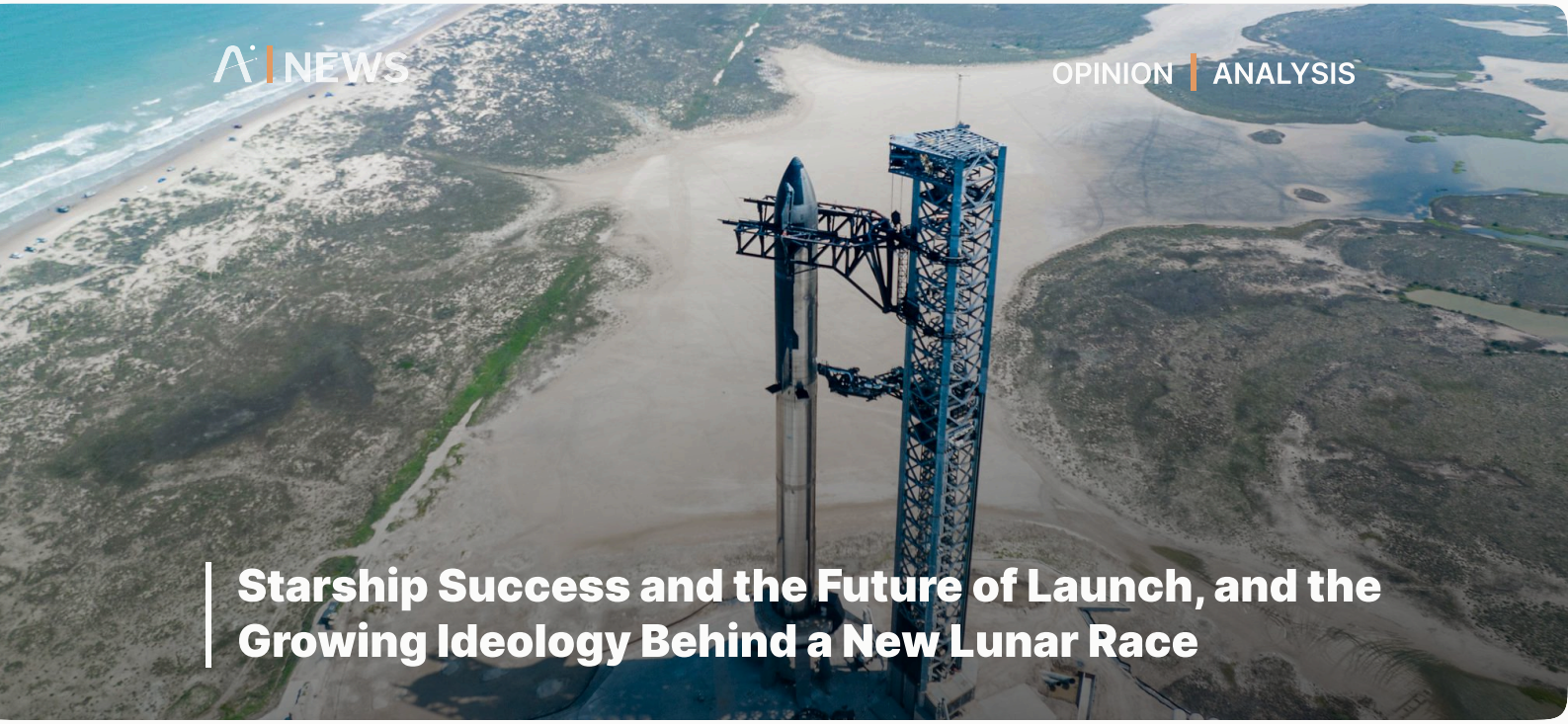
A demand for the isotope then appears to already exist. However, speculation is mounting as to its huge potential value for supplying fuel for nuclear fusion reactors. According to the European Space Agency, it is thought that it could provide safer nuclear energy, since it is not radioactive and would not produce dangerous waste products. However, some are more skeptical of the prospect of mining helium-3, such as **Professor Ian Crawford**, who believes

there estimates could be greatly overestimated, and actual stocks could be as little as 4 parts per billion (ppb). Conversely, Magna Petra sate they are aiming to build a 100-year supply chain of helium-3 for fusion energy supply, while Professor Ouyang Ziyuan, the chief scientist of the Chinese Lunar Exploration Program, estimates that lunar Helium-3 could solve the world's energy crisis for around 10,000 years.

Though fusion energy is not yet available at scale, in 2022 the Lawrence Livermore National Laboratory (LLNL) achieved a landmark breakthrough by creating a fusion reaction that generated more energy than was required to initiate it, a process known as ignition. At the same time, private companies are advancing the technology: Commonwealth Fusion Systems is targeting delivery of roughly 400 MW of clean, carbon-free electricity, enough to power around 150,000 homes by the 2030s and backed with $2 billion in funding, while **Helion Energy** has announced plans to supply fusion power for Microsoft data centres as early as 2028, backed by $1 billion in funding.

As we await further research, including from the eagerly anticipated Interlune helium-3 prospecting mission in the coming months, what is unfolding is the rise of a space mining market, not in some distant future, but already emerging today and in the years just ahead.

NEWS ANALYSIS



Starship Success and the Future of Launch, and the Growing Ideology Behind a New Lunar Race

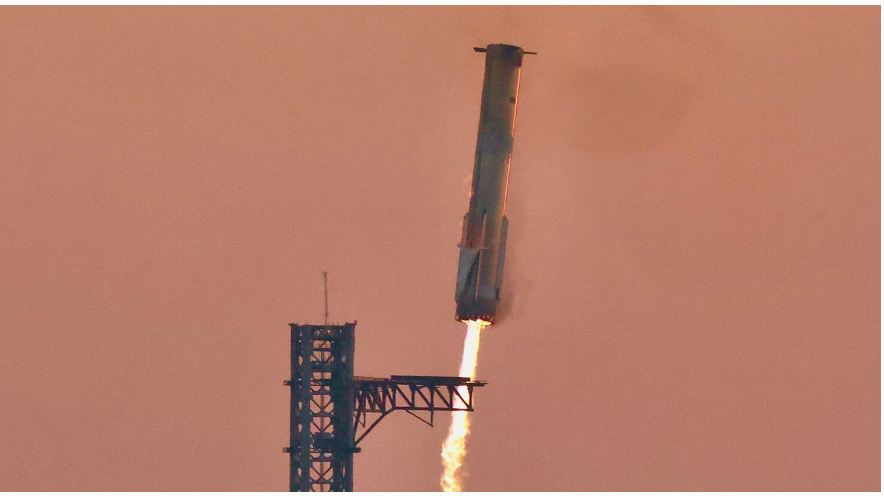
SpaceX's Starship (Image: SpaceX)

Starship Launch Success, amid Trump EO to Streamline Commercial Activity

Donald Trump's Executive Order, released on 13 August 2025, titled 'Enabling Competition in the Commercial Space Industry', seeks to streamline regulatory processes for launch, reentry, spaceport development and novel space activities. Among the key strategies for this, the EO serves to expedite the Department of Transportation's environmental reviews, eliminate duplicate processes, and proposes individualised mission authorisations, among others. (Our legal analysis of the EO can be found in this month's Legal Review article.)

The timing of the EO comes during an era of increasing competition and a domain which is becoming more contested and competitive. In July, our report discussed the impact of the announcement from NASA administrator, Sean Duffy, that the agency will aim to establish a lunar nuclear fission power reactor at the south pole of the Moon, by the end of the decade. Within the announcement, Duffy expressed how the US are 'in a race with China' to the Moon, a position shared by his predecessor, Bill Nelson. In Section 1 of the EO, the president reiterates the significance of this pivotal moment in the space industry, stating that it is critical that '...new space-based industries, space exploration capabilities, and cutting-edge defense systems are pioneered in America..', rather than by adversaries.

The 10th and largely successful launch of the SpaceX Starship then came at a demonstrative moment, showcasing the US commercial flagship for delivering astronauts to the lunar surface, launching payloads up to 150 tons into space, and eventually transporting humans to Mars. Starship, utilising its full reusability for both the Ship and the Super Heavy Booster, may also be set to disrupt the launch sector, and indeed the space sector as a whole, potentially offering a drastic reduction in launch costs, in a similar way that the Falcon-9 rocket has done since its first successful launches in 2010, and Falcon Heavy in 2018. The cost of launches has dropped from approximately $16,000 p/kg in the post-Apollo years, to as low as $1,500 p/kg today, using Falcon Heavy. However, a 2022 report from Citigroup expects that these costs could come down by another 95%, to as little as $100 p/kg, while an article from *AEI* suggests that Starship could reduce this cost to $10 p/kg. This will, though, surely require full reusability demonstrations and an increase in launch cadence first.



Starship booster landing

> launch costs could to fall to $100/kg by 2040, and in a bullish scenario, to as low as $33/kg
>
> **Citi GPS**

Nonetheless, SpaceX's most recent Starship launch was another step towards unveiling this future. The launch took place on 26 August, taking off from Starbase, Texas. The booster separated successfully and completed a booster burn, carrying out a planned splashdown. The Ship continued on its suborbital trajectory and successfully deployed 8 Starlink simulators, in the first successful payload deployment for Starship. It then successfully carried out re-entry manoeuvres, performed a 'landing flip', followed by a successful 'soft splashdown'. SpaceX are also looking toward the development of their V3 and V4 version of Starship. Currently, V2 is 122 metres tall, while V3 will be expanded to 124 metres, and according to a post from Musk, V4 will be significantly expanded to reach 144 metres.

In May this year, SpaceX also received an FAA license to launch Starship up to 25 times per year from Starbase, while the company also had its plans accepted by the FAA to increase Falcon-9 launches from 50 to as many as 120 from Cape Canaveral, with the FAA deciding that it does not require an Environmental Impact Statement. This may be seen as a success and more of a sign of things to come, considering the strategy laid out by Trump's EO.

SpaceX also seek to carry out Starship launches from Florida, at NASA's Kennedy Space Centre. The FAA has completed (as of 5 September) initial public hearings, part of the Environmental Impact Statement for approving launches. The company is seeking to gain a license for 44 launches from Florida, which could disrupt the local community and environment. **Some residents expressed concern** for local wildlife and eco-tourism, while commercial fishermen may be unable to access certain areas during launch windows. Furthermore, fishermen also raised the issue of rocket debris being caught in fishing nets, while the owner of a seafood company claims that there is no agreement on ways of collecting debris that remains on the seafloor.

It is to be seen how the EO might change the approaches to launch licensing, and whether environmental and societal matters will be granted the same protections. There is no doubt that the US is facing increasing competition in space, and it is through its vibrant and innovative commercial sector that it will aim to keep ahead. However, lawmakers, politicians and industry leaders will also need to consider the impact they have on the environment, as well as the subsequent reputational impact that their actions will create.

Further Launch Roundup: Russian Setbacks in a Diversifying Launch Marketplace

Though the global space launch industry continues to grow increasingly competitive, the founder of the space age, Russia (or the Soviet Union), seemingly appears to be facing a decline. Russia continues to be a world-leading space nation, carrying out the third largest amount of launches in 2024 (17), and remaining a key partner on the International Space Station (ISS).

However, Russia have seen a decline in their presence on the global stage, not least since the invasion of Ukraine and subsequent severing of ties with Western partners, but also through innovation and new technologies. The Soyuz launch series is the most launched rocket series in history, to this day, carrying out approximately 1,800 launches. However, Russia lacks a reusable launch system, although in June the Russian Space Agency did announce that one would be developed within **18 to 24 months**. However, SpaceX has a significant lead, carrying out 528 Falcon-9 launches within just the past 15 years.

Russia is also facing another setback. Leading Russian spacecraft manufacturer, RKK Energia, is reportedly on the verge of bankruptcy. According to an article from *Defence Express*, the head of Energia, Igor Maltsev, published a statement recognising the financial strains and project failures. The company is responsible for the development of Soyuz, satellites and launch vehicles, and carries with it the Soviet-era legacy of space leadership. However, Russia's apparent stagnation in space exploration comes as rivals press ahead, intensifying competition in the global marketplace.

US company, Firefly Aerospace, announced in August that it has been given FAA approval to resume launches of its Alpha launch vehicle, after a flight incident in April this year.

The company is also looking to establish a foothold in the Asian market, assessing the possibility of launches from Japan's Hokkaido Spaceport. Adam Oakes, Firefly's vice president of launch, said that launching from Japan '...would allow us to serve the larger **satellite industry** in Asia and add resiliency for US allies with a proven orbital launch vehicle.' Firefly is more recently known for its historic first and fully successful commercial lunar landing mission, Blue Ghost-1. It has also demonstrated success in launch, via the responsive launch mission, Victus Nox, demonstrating the rapid launch and deployment of US satellite technology, critical, for example, during conflict. Alpha, though, has only launched 6 times and has yet to demonstrate an increased launch cadence.

Rocket Lab (US/New Zealand) are a company demonstrating a high launch rate of commercial rockets, namely its Electron vehicles. On 23 August, the company successfully launched its 70th mission, which was also its 12th of 2025, lifting undisclosed satellites into orbit. Electron is showcasing itself as a reliable satellite launch system, while the company is also anticipating the entry of their medium-lift and reusable rocket, Neutron, which may be on schedule for a debut launch this year.

Rocket Lab Electron Rocket (Image: Rocket Lab)

> Rocket Lab launches their 70th Electron mission, and the 12th of the year
>
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In Europe, Portugal is the latest nation to expand its presence in the launch sector, by announcing the issuing of its first-ever spaceport license to the Portuguese Atlantic Spaceport Consortium (ASC). This will allow for launches to take place from the island of Santa Maria in the Azores, an archipelago in the north Atlantic Ocean. The first suborbital launches could take place by 2026, and may also host reentries of ESA's anticipated reusable space vehicle, Space Rider.

Furthermore, private vehicle developer, The Exploration Company (Germany/France) has taken further steps toward the development of their Nyx reusable orbital vehicle, passing Phase 1 of the International Space Station Safety Review. Nyx is designed to transport cargo, and eventually crew, to and from orbital space stations, and is scheduled to carry out its first mission to the ISS in 2028. ESA Director General, Josef Aschbacher, praised the step as '... strong evidence of the outstanding work carried out by European industry,' while ESA also

announced that rocket developers Avio (Italy) and Ivar Aerospace (Germany) will be recipients of its Flight Ticket Initiative, which was unveiled in 2023. The Initiative '...provides co-funding of launch opportunities to European companies and organisations to fly their services and test new satellite technologies in orbit.' (ESA)

Lastly, the Asian market is also experiencing ongoing commercial expansion in the launch sector, not least in China, which hosts several private companies developing expendable and, more importantly, reusable launch systems, including Space Pioneer, Galactic Energy and Deep Blue Aerospace. Additionally, Japanese company, Interstellar, announced in August that his had successfully raised an additional $61.8 million toward the development of its vertical integration of its satellite and launch platforms.

While SpaceX lead the industry in launch numbers, as well as satellite deployment, the launch segment is evolving quickly. One could consider whether the moves made by President Trump might be replicated in other jurisdictions around the world, in order to keep pace and establish self-determined futures in space.

China's Crewed Landing Vehicle Tests: Moving Ahead in the Lunar Race?

Last month, we highlighted the announcement from NASA acting administrator, Sean Duffy, that the agency will aim to develop and land a fission nuclear energy reactor on the Moon by the end of the decade, within what he described as a developing 'race' with China. Furthermore, Duffy also remarked that there are areas of interest on the Moon, areas rich in water ice and sunlight, and stated the US aims to '...get there first and claim that for America,' sparking legal questions over the concept of national appropriation in space, which is strictly prohibited in Article II of the Outer Space Treaty.

Duffy also seemingly expressed concerns about the China-Russia plan to also deliver a nuclear reactor on the Moon and subsequently declare 'keep out zones', while previous NASA administrator, Bill Nelson, has previously accused China of aiming to explore the Moon under the guise of scientific exploration, only to then say 'keep out, we're here, this is our territory.'

The race rhetoric continued to unfold in August, with China conducting successful and significant testing towards their crewed lunar missions. On 6 August, the China Manned Space Agency (CMSA) tested a mock version of its 'Lanyue' lunar lander, simulating lunar landing conditions, allowing for the vehicle to test its thrusters. Furthermore, on 15 August, the China Academy of Launch Vehicle Technology (CALT) carried out static fire testing. The three-stage rocket will transport the crewed mission to the Moon, and is capable of lifting 70 tons in low-Earth orbit (LEO).

The tests being carried out by China may confirm that it is on track to land taikonauts on the Moon by 2030, potentially leapfrogging the US and its allies to this aim. Although Artemis-I already launched in 2022, testing the capabilities of the SLS rocket and uncrewed

Orion spacecraft, the Artemis project is still facing the reality that some components of the mission may force more setbacks. Firstly, the human landing system (HLS) being used for Artemis-III, the first planned crewed landing under the Artemis programme, will be a variant of the SpaceX Starship, which has yet to complete a fully successful flight test, as well as an uncrewed landing test in the Moon, before the planned launch date in 2027. A Senate Commerce Committee hearing on 4 September raised concerns surrounding the Artemis programme, referring to the uncertain budgetary environment, with former NASA administrator Jim Bridenstine, describing the programme as being '...cast to and fro from one administration to the next...'. Meanwhile, former Deputy Commander of the US Space Command Lt. Gen. John Shaw, explained that, by contrast, 'the Chinese Communist Party is already employing its own integrated grand strategy for the Earth-moon system.'

Although the US already landed astronauts on the Moon over 50 years ago, the 'second lunar race' perhaps comes with a greater prize. Both Chinese and US-led alliances are aiming to return to the Moon and establish a permanent, sustained presence on the Moon. In order to do this, missions will need to scout and locate areas on the lunar surface which are rich in local resources, such as water, to be utilised for in-situ resource utilisation (ISRU) applications (such as for water consumption, producing oxygen and rocket fuel). There are also numerous companies looking to source and retrieve highly promising resources for terrestrial applications, such as helium-3. As mentioned, landing on the Moon could give actors a first-mover advantage, in being able to establish exclusion zones around their sites of activity; a provision put forward on the US-led non-binding legal framework, the Artemis Accords.

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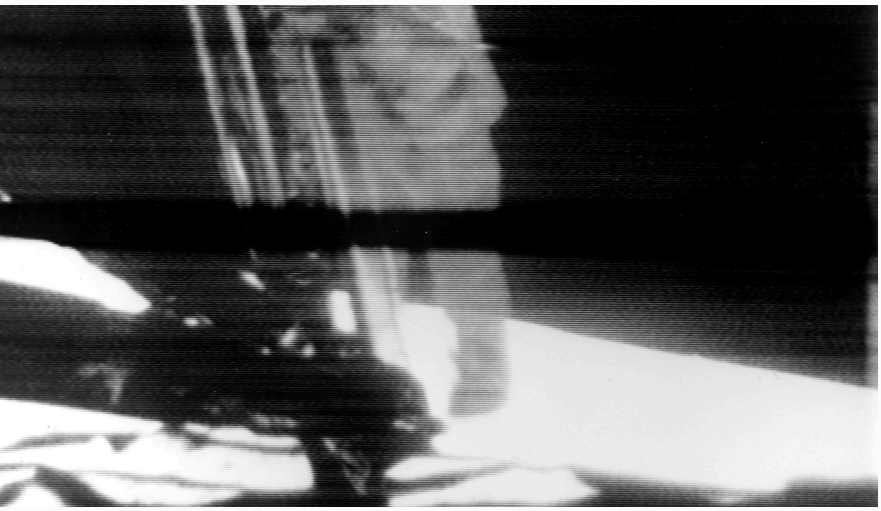

Apollo 11 landing (Image: NASA)

> The 'second lunar race' perhaps comes with a greater prize
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Furthermore, **speaking in an interview** with *ARS Technica*, Dean Cheng, a highly respected analyst on China, space policy, and the geopolitical implications of the new space competition, discussed the reputational damage that losing the new lunar race would do to the US, noting that it would be '...the end of American exceptionalism.' He also pointed out the effect on global economic and ideological leadership, which could see the US model, based on leadership through the promotion of democracy and capitalism, lose preference

over the Chinese-led model of economic modernisation. This argument is also reflected by **Elizabeth Economy, writing for Foreign Affairs** in June 2024, saying that 'Beijing claims that its vision, by contrast (to the US), advances the interests of the majority of the world's people.' She adds that, according to President Xi, their Global Security Initiative advocates that countries should '…reject the Cold War mentality, oppose unilateralism, and say no to group politics and bloc confrontation.'

The US-led Artemis programme, including the NASA Commercial Lunar Payloads Services programme, has already celebrated some significant milestones, among them the CAPSTONE lunar cubesat being successfully deployed and investigating the way for the Lunar Gateway orbital station, the success of Artemis-I, the first commercial soft landings on the Moon, and now bold plans to establish a nuclear reactor at the south pole. This isn't to mention the innovative and ambitious plans which lie ahead, especially from the private sector.

Some leaders are becoming increasingly aware of what returning to the Moon truly signifies this time. These lunar programmes are not just about going back, they are about establishing a lasting presence in space, on the Moon and beyond, to expand humanity's footprint and harness space for the benefit of Earth. Yet a 'race' mentality is emerging, one increasingly entangled with terrestrial politics and ideology, and it may well decide who become the leaders of tomorrow.

SPACE LAW REVIEW

SPACE LAW & POLICY

SUSTAINABLE & PEACEFUL USES OF OUTER SPACE

Discussing the challenges, threats and opportunities to international space law and governance, arising out of evolving international relations, geopolitical dynamics and more

Key terms: Executive Order; Code of Federal Regulations; Space Environment; Space Debris; Debris Mitigation; LTS Guidelines; Space Safety Coalition; Artemis Accords; Best Practices; Normative Behaviour.

Analysing the Trump EO, 'Enabling Competition in the Commercial Space Industry'. Economic Boost or Environmental Setback?

Over the past decade, the space industry has been defined by growing competition, increased access and an influx of more actors, notably from the commercial sector. The number of orbital launch attempts has increased from just 90 in 2017, to 263 in 2024,[1] while the number of objects launched into space has accelerated from 237 in 2015, to 2857 last year.[2] Yet, current space activity seems only to be the tip of the iceberg, as the European Space Agency expects there to be around 100,000 active satellites in orbit by the end of the decade,[3] an increase from around 13,500 today.[4] More value is being placed on downstream space services, and for a growing set of applications, such as for broadband connectivity and navigation; necessities taken for granted in everyday life. Furthermore, more diverse uses of space are increasingly being utilised, such as for mineral prospecting,[5] direct-to-cell-connectivity, and in-space manufacturing.

There is also currently a particular focus on the use of outer space in the defence domain, exemplified by the significant role the Starlink satellite megaconstellation has played in the Ukraine conflict,[6] as well as the more recent announcement from the Trump administration regarding the 'Golden Dome' missile defence initiative, which will establish space-based tracking and interceptors to protect the US from ballistic missile attacks, at a current estimated cost of $175 billion.[7] Additionally, downstream space services are supporting sustainable development on Earth, observed through the United Nations 'Space4SDGs' compendium,[8] while the World Economic Forum has observed the space economy to be valued at $1.8 trillion by the year 2035.[9]

As a result of the increasing strategic and economic value being placed on outer space, some States are taking steps to expedite regulatory and legal frameworks to enable growth and support resilience. This paper will analyse recent developments from the United States, the United Kingdom and the European Union, and consider whether their governmental and regulatory strategies support a growing and cooperative industry, or create possible setbacks.

US Executive Order: Supporting Launch Innovation or Stifling Environmental Protections and Politicising Space?

On the 13 August, President Donald Trump signed an Executive Order, titled 'Enabling Competition in the Commercial Space Industry'.[10] The Order sets out a strategy to streamline the regulatory environment for actors, expediting environmental reviews, eliminating '... outdated, redundant, or overly restrictive rules for launch and reentry vehicles', and assisting spaceport infrastructure development.[11] The acting NASA administrator, Sean Duffy, described the Order as unleashing '...the next wave of innovation,'[12] while FAA Administrator, Bryan Bedford, said that the administration '...strongly supports President Trump's Executive Order to make sure the US leads the growing space economy and continues to lead the world in space transportation and innovation.'[13]

However, there has been some backlash and protestation to the Order. Senior attorney for the Center for Biological Diversity, Jared Margolis, disagrees with Bedford, stating that the Order '...puts people and wildlife at risk from private companies launching giant rockets that often explode and wreak devastation on surrounding areas,'[14] while the FAA and SpaceX have previously received criticism for harm caused to ecosystems by rocket launches,[15] and this year the latter was publicly recognised as causing two further significant debris events after Starship test flights.[16]

However, the Order seeks to '...streamline commercial license and permit approvals for United States-based operators.'[17] To enable this, the Secretary of Transportation, in consultation

with the Chair of the Council on Environmental Quality, shall '...use all available authorities to eliminate or expedite the Department of Transportation's environmental reviews for, and other obstacles to the granting of, launch and reentry licenses and permits.'[18] The Secretary will be empowered to determine '...which Department of Transportation functions are not subject to the National Environmental Policy Act (NEPA)...', as well as '...categorical exclusions under NEPA (or relying on existing categorical exclusions) for launch and reentry licenses and permits within certain parameters', effectively lowering barriers of environmental assessment and accelerating the issuance of licenses.

This could include amending Title 14 the Code of Federal Regulations (CFR),[19] a compilation of codified laws and their interpretations by executive bodies.[20] According to the Order, this may allow the Secretary to address what regulatory requirements could be changed, specifically considering:

> (i) what regulatory requirements should be inapplicable for a launch or reentry vehicle that possesses a flight termination system or automated flight safety system;
>
> (ii) what regulatory requirements should be inapplicable or waived for hybrid launch or reentry vehicles that hold valid Federal Aviation Administration airworthiness certificates;
>
> (iii) whether to expand the conditions that demonstrate reliability for a reentry vehicle, sufficient to protect against a high-consequence event on reentry; and
>
> (iv) whether other existing requirements are too attenuated to a vehicle's actual launch or reentry to warrant retention in Part 450.

The Secretary of Transportation, according to the Order, then has 120 days within which to '... report to the Assistant to the President for Economic Policy a description of the actions that have been or will be taken...' regarding these potential streamlining measures. Deregulatory measures may then be seen as a means of expediting launch activities, specifically through limiting 'overly complex environmental and other licensing and permitting regulations...',[21] and eliminating '...duplicative regulations...'[22] This would seemingly benefit launch companies, such as SpaceX, which is looking to increase its launch cadence,[23] and avoid further lawsuits by environmental groups. However, it is to be seen by what means the Secretary will assist in streamlining regulations, and what potential legal, environmental and sustainability challenges could arise.

Reinterpretations of legislation, such as the National Environmental Policy Act (Nepa),[24] and applying them within the CFR, are already creating challenges. Jared Margolis adds that the

Order '...is directing the transportation department to do whatever they can to avoid Nepa, but it doesn't mean that's possible, or that they have the authority to do so,'[25] suggesting that the Trump Administration may, in fact, face more legal challenges as a result of their direct and executive actions.

Consideration for Protecting the Space Environment, and Space Debris Mitigation

Furthermore, it must also be considered how a deregulated licensing position will influence attempts to manage the space environment and establish new norms and provisions, for example, for space debris mitigation. President Trump has made broad steps to withdraw the US from climate commitments, such as announcing the withdrawal (again) from the Paris Climate Agreement this year,[26] and has signalled his administration's reluctant position on adopting new international governance agreements, which might be interpreted as restrictive to industry, for example shown during the US abstention from signing the Paris AI Declaration in February.[27]

Sustainability of space activities is essential in combating significant and spiralling debris numbers in space. The European Space Agency currently estimates there to be 1.2 million pieces of debris between 1 cm and 10 cm, and 140 million pieces greater than 1 mm to 1 cm in orbit,[28] each object being capable of creating catastrophic damage to vehicles or human life. As stated by Francis Lyall and Paul B. Larsen '...it remains fact that...the mitigation of space debris is a matter of voluntary action, not of clear legal duty...',[29] and there is no international binding treaty that addresses the matter. Furthermore, discussions on establishing measures for debris mitigation are ongoing and require a committed approach from leading space nations, in order to set new norms of practice and behaviour.

The United States has previously, though, demonstrated a notable commitment to international non-binding legal frameworks for space debris mitigation. The UN Long Term Sustainability Guidelines, published in 2019, provide a set of best practices and principles for States, such as through the adoption of national regulation, information sharing, and spacecraft design.

Speaking at the UN COPUOS Scientific Subcommittee meeting in 2024, the US delegation expressed its commitment '...to the milestone achievement by this Committee in adopting the 21 Guidelines for the Long-Term Sustainability of Outer Space Activities in 2019.'[30] Furthermore, the US also committed to deorbiting satellites within 5 years of ending their mission, through a Federal Communications Commission (FCC) ruling in 2022, whether '... ending their mission in or passing through the low-Earth orbit region.'[31] This not only adheres to international non-binding frameworks, such as the Inter-Agency Space Debris Coordination

Committee (IADC) 'Space Debris Mitigation Guidelines', which in fact request a much longer removal timeframe of 25 years,[32] but also sets an impressive international standard of normative behaviour from the world's leading space power.

The FCC also requires that operators provide a '...description of the design and operational strategies that will be used to mitigate orbital debris',[33] while in 2022, the FCC acted to enforce the end-of-life '5-year-rule' when operator, DISH, failed to sufficiently move its satellite into a disposal orbit, resulting in a $150,000 penalty. Additionally, the US has also included provisions on space debris mitigation within its non-binding framework for outer space activities, the Artemis Accords, with Section 12 requesting '...Signatories commit to plan for the mitigation of orbital debris, including the safe, timely, and efficient passivation and disposal of spacecraft at the end of their missions...' The Accords set out to establish standards of behaviour not only in outer space, but also on other celestial bodies, such as the Moon, comets and asteroids, and as of August 2025, has 56 State signatories.[34]

However, it is to be seen how the Executive Order could affect these initiatives, especially considering the ethos of the Order, to streamline and accelerate US commercial space prominence, contrasting with the additional regulatory hurdles and costs that mitigation and post-mission disposal plans might add. (According to a report from the Organisation for Economic Co-operation and Development (OECD), space debris mitigation costs could be 5-10% of total mission costs for GEO, and could be much higher for satellites in LEO).[35] Mitigation measures could include satellite protection, and also incorporate docking plates on vehicles to allow for future on-orbit servicing (OOS), such as refuelling and life-extension services, being developed by companies such as Astroscale.[36] This practice also aligns with norm-setting approaches from the Space Safety Coalition, which, within its 'Best Practices for the Sustainability of Space Operations', requests that operators install '...Interfaces and physical features to enable rendezvous and proximity navigation operations and docking (RPOD)...'[37]

Conclusion

Developments will unfold on how the work of the Secretary of Transport might review their findings in relation to protecting the Earth and space environment. The Order does not refer to any change to CFR Title 47 (outlining submission of orbital debris mitigation plans), but rather takes focus on Part 450 of Title 14, regarding launch and reentry requirements. Of course, any changes to these regulations which might dilute environmental protections on Earth will need to be carefully considered, especially in a time of rapidly increasing launch activity and more visible and widely reported impacts on the environment, such as the recent Starship explosions.

However, considering the position of the White House to permit an increase in competitive launch activity and maintain a lead on its competition, these environmental considerations will also need to be taken seriously within an increasingly congested Earth orbit, which itself is defined as a limited natural resource by the International Telecommunications Union.[38] Deregulating the space industry could also potentially have an impact beyond Earth orbit, into cislunar space and the lunar environment, as tensions increase in that domain.[39]

In an era of disruption and rapid growth in the space sector, as well as a growing value being attached to space and its resources, it will be challenging to balance competition with the implementation of space governance frameworks. Additionally, the actions which States and actors decide to take now will inform the normative behaviours and new legal frameworks for the future. In this promising future, one should also tread carefully.

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12 September 2025

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