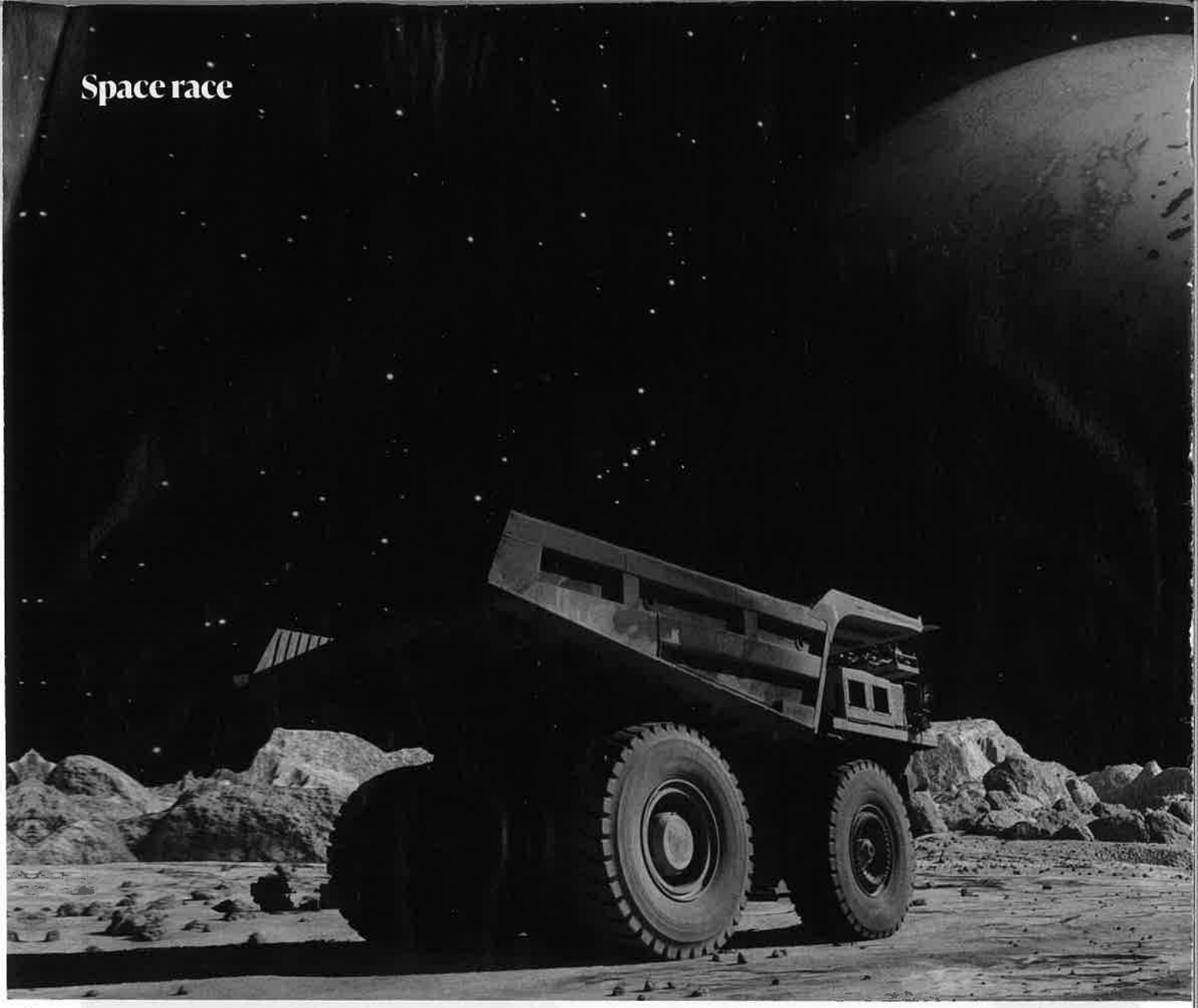

Space oddities

New technologies are changing our relationship with our Moon and the planets. Can New Zealand help shape rules around acceptable use of outer space? **BY ERIC TRUMP**

I've had a crush on the Moon for as long as I can remember. Maybe it has to do with being born a day after Neil Armstrong and Buzz Aldrin exited their tin can and floated in a most peculiar way across the regolith.

Or with my father, who marketed the Moon for Nasa's public outreach programme in the US. In a pinwale corduroy suit and aviator sunglasses with a Lucky Strike cigarette between his lips, he was the Don Draper of lunar boosterism. He bombed around in his Nasa-issued space mobile from school to Rotary Club to shopping mall, spreading Moon fever up and down the Eastern Seaboard. His attaché case bore model rockets and blurry photographs of the Moon's surface. It also had Nasa's glorious meatball logo stuck to it, the red chevron practically whispering *ad astra*.

I know I'm not alone in swooning for the Moon. Our celestial companion has been a muse of metaphor and mood for millennia. We now know that it's not a silver shell or

Limitless potential? As Earth's mineral resources diminish, countries are eyeing-up astro-mining – without settling questions of sovereignty.

a yellow skull, but just a cold, ashen stone – that its arid "seas" are basaltic plains and its "dark side" is actually illuminated. Still, on a mad summer night, who hasn't stood under its powdery blue light and asked, "What is there in thee, Moon! / That thou shouldst move my heart so potently?"

TWINKLE, TWINKLE

Thankfully, Nasa didn't send the poets. Instead, they MacGyvered a bunch of high-octane guys up there who carried Lifesavers in their pockets and moxy in their blood and said things like, "Whoopie!" or "Listen, babe, everything's going just swimmingly."

Lunar longing, along with a superpowered space race and 4% of the US federal budget, fuelled Armstrong and Aldrin's journey. Despite the American flag waving windlessly, the two astronauts were meant to be ambassadors of humanity and left behind a plaque announcing they came "in peace for all mankind". After all, the Moon, the solar system – the cosmos – belong to none and to all. Right?

It's complicated. Back in 1969, Aldrin surveyed the Moon and saw "magnificent desolation", but there's much more in them thar hills than that. In fact, all of outer space has gone from an apparent wasteland to a treasure trove, much as Afghanistan assumed a fresh sparkle once a trillion dollars' worth of mineral deposits were discovered beneath its ravaged skin.

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For one, the Moon is an elemental sing-along. There's hydrogen and oxygen, yttrium and gadolinium, titanium, uranium, magnesium and calcium. Solar wind delivers helium-3 directly to the surface. This is a potential clean energy source and can run to $2000 a litre. Russia, India, China and the US are itching to get to the lunar south pole, where water ice that could be used for fuel has been discovered.

Riches lie beyond the Moon, too. An asteroid the size of a rugby pitch might contain $80 billion worth of platinum. Not for nothing did astrophysicist Neil deGrasse Tyson predict the world's first trillionaire will be the astro-miner who excavates asteroids. The US aerospace company AstroForge was created in 2022 to make this a reality.

Then, there are the nascent commercial space businesses, including tourism, which according to a Citigroup projection, will

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reach a trillion dollars by 2040. Elon Musk, Richard Branson and Jeff Bezos are all keen to send tourists into space. Aerospace company Space Development Corporation aims to open Voyager Station in 2027, the visible universe's first space hotel.

DUMPING GROUND

All this interest in space means it has become cluttered since the Soviet Union launched Sputnik 1, the first artificial satellite, in 1957. We've sent more than 5000 large objects into space since then, making the road to infinity and beyond an obstacle course. More than half a million bits of debris are whizzing around at 28,000km/h, from chunks of rocket to screws, flecks of paint and urine. ("One of the most beautiful sights is a urine dump at sunset," declared astronaut Russell Schweickart). If a satellite belonging to, say, China slams into an American craft, this suddenly becomes a terrestrial liability problem.

Still, we just keep flinging stuff up there. In 2019, an Israeli spacecraft crashed into the Moon with a payload of a few thousand tardigrades (tiny, near-microscopic critters), and this year artist Jeff Koons, courtesy of the company Intuitive Machines, sent 125 sculptures to the lunar south pole.

Celestis was established to send cremated human remains to the Moon, igniting protests from Māori and members of the Navajo Nation in the US, which argued human burial on the Moon would be "tantamount to desecration of this sacred space".

On the flipside, when does the human crapification of outer space become worthy of preservation? Should we think of the golf balls Alan Shepard struck on the Moon as archaeological relics worth saving? What about the family photo Charlie Duke left behind in 1972? The US Congress seems to think some of this is culturally significant. In 2021, the "One Small Step to Protect Human Heritage in Space Act" became law. It requires Nasa to avoid any future disturbance of Apollo landing sites through the creation of "keep-out zones".

Understanding that questions regarding who can do what in outer space would not resolve themselves in low gravity, the United Nations created the Outer Space Treaty in 1967. This document draws heavily from the Antarctic Treaty, which designates that continent as a sovereign-free region of peace, co-operation and science. The Outer Space Treaty says space is "not subject to national appropriation" and is to be used "exclusively for peaceful purposes". Signatories to the treaty cannot claim a swathe of the cosmos the way, say, Spain planted a flag in Central America and called it *Nueva España*.

Until now. Though subsequent agreements and conventions – such as the Moon Agreement of 1979 forbidding military bases and weapons on the Moon – clarified basic international rules to play by, a new space race is underway and the terms and conditions of exploration and exploitation are even murkier than they once were.

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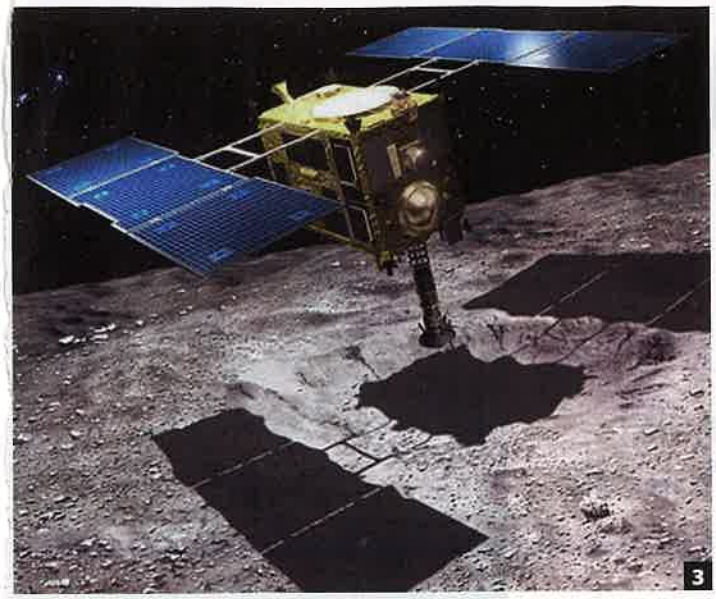
In 2015, the US Congress passed the Space Act, which gives US companies the right to own and sell resources they mine from celestial bodies. Gbenga Oduntan, an expert in space law at the University of Kent, says the "audacity of greed" drove this legislation, which "goes against a number of treaties and international customary law, which already apply to the entire cosmos".

Then in 2020, Donald Trump issued an executive order denying outer space its status as a global commons, or *res communis*, and encouraging Americans to "engage in commercial exploration, recovery, and use of resources in outer space". Trump introduced his unique view of astro-geography via Twitter, urging Nasa to focus on "bigger things" including "Mars (of which the Moon is a part)".

How to fill the legal void and head off star wars? Space lawyers, of course. It may seem cheap to sully the night's pale fire with lawyerly quiddities and quillets. However, now that a new space race has begun with a lot more competitors than before, it's past time to lay down some new ground rules and to figure out how we are going to share all that space.

One lawyer helping to shape the rules governing acceptable uses of outer space is Maria Pozza. She is the director of Gravity Lawyers in Wellington and the editor, most recently, of *Ascending to Space*. These days, she's very busy.



1. Nasa's Near Earth Asteroid Rendezvous (NEAR) Shoemaker spacecraft mapped 70% of the surface of asteroid Eros. 2. Philae, the lander module from European Space Agency probe Rosetta, landed on Comet 67P, a Jupiter comet, and analysed the composition of its surface. 3. An artist's concept of Japanese spacecraft Hayabusa, the first to return a sample of material from an asteroid. 4. US spacecraft Osiris-Rex, which collected samples from asteroid Bennu.

"Space law is a bit like corporate law, just space-related. I'm looking at things like licensing agreements and payload permits."

Pozza says refreshing the legal framework is necessary, especially as New Zealand launches itself into the space industry.

"Technology waits for no law," she says. "Emerging technologies are changing our relationship with space. Now that more and more countries are ready to travel into space, we need to be very clear about parameters and guidelines."

Though the New Zealand Space Agency was established only in 2016, a 2019 report estimated the space sector's worth to the country at $1.69 billion, with 5000 people directly employed. NZ company Rocket Lab's Māhia complex hosted seven launches last year, the fourth-most in the world, and a further 10 so far this year. Its Electron rocket is the third-most frequently launched rocket globally, behind SpaceX and China.

We are literally well placed for space. The recently opened Tāwhaki National Aerospace Centre on Banks Peninsula, for example, is regarded as one of the best launch sites in the world – little air traffic, water on both sides, and at a latitude that makes it relatively easy to put satellites into specific orbits. However, the centre has failed to attract international investors and the government has rejected a request for further funding. Tāwhaki remains an important place for advanced aviation, but rocket launches have been put on hold. But Pozza sees a role for New Zealand in other ways, too. "New Zealand is a good international citizen," she says. "I think we can lead the way in sustainability and peaceful uses of the cosmos so that we preserve space as a common resource for generations to come."

Pozza is especially proud of our 2017 Outer Space and High-altitude Activities Act. This legislation represents a framework for regulating launches into space, payloads, and launch facilities.

"An important aspect of this act is its orbital debris mitigation policy," she says.

The act specifically calls for spacefarers to dispose of debris in a way that minimises risks to Earth and space environments. This may come as some relief to Point Nemo, the "spacecraft cemetery" at the oceanic pole of inaccessibility (the farthest point from any landmass on Earth) midway between New Zealand and South America in the Pacific Ocean. So far, more than 250 spacecraft have sunk beneath Point Nemo's waves, and what's left of the International Space Station after re-entry will splash down there, too.

LUNAR RIGHTS

And what about our spectral satellite? Can we expect mines, along with schools, churches and saloons, to dot its surface in a lunar version of the mining towns of Nottinghamshire?

"The law is not clear around mining. Legally speaking, it may be permissible to mine the Moon or an asteroid," says Pozza. She says the Outer Space Treaty was drafted at a time when commerce in space was not a consideration. Since no one owns outer space, it seems to follow that anyone with the means should be able to convert space minerals and elements into money, just as the high seas on Earth are free for all.

One legal avenue that has received a smattering of attention from such scholars as space archaeologist Alice Gorman at Adelaide's Flinders University is the granting of legal personhood to protect our Moon. A legal person is not the same as a human being. It is an entity the legal system regards as having interests and the capacity for rights. In 2017, the Whanganui River was granted legal personhood to ensure its restoration and protection. Taranaki Maunga received it in 2023. The Magpie River in Canada is a legal person: it has the right to flow, be unpolluted, and to sue. Legal personhood is a way of announcing this river, this chimpanzee, this moon has worth in and of itself, and we are its trustees.

The Moon, hovering in darkness and distance for millennia, needed no defence against us, legal or otherwise. Things are different now. As we blast and strip and sink shafts into our planet, snuffling for minerals and elements, we've also turned one voracious eye to the Moon.

Perhaps it's time for us to give our neighbour, that "lozenge of love", that "key to madness", the most human of gifts: the right to have rights. ▮