Submission on *New Zealand Space Policy Review*
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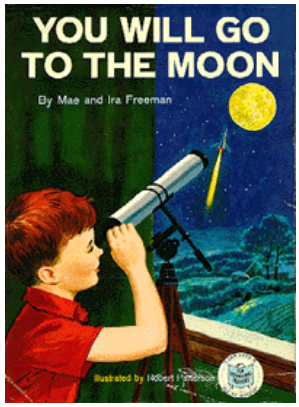
Why is space important to you? Why are you interested in space?

I was born in Christchurch in 1964. I watched the moon landings on television. One of my early readers was “You Will Go To The Moon”. Oh, how I loved that book. I studied mathematics and physics at Canterbury and, later, at Caltech, where I met my heroes, Richard Feynman and Freeman Dyson. (I also studied remote sensing with Charles Elachi, later the director of JPL.) My work in scientific computing is used in orbital calculations including the long-term evolution of the solar system and novel routes to the moon. So by rights I should be all-in on space.



But as the decades have passed I have realized that the extreme risks of the present global ecological crisis call into question the entire program of accelerating technological change and resource use. Climate change, biodiversity loss, and pollution are three prominent aspects of the crisis, and resource overuse and poor governance two significant contributing factors.

This review comes at time of rapid change in our use of space. Its use is rapidly increasing and commercialising; more and more countries are engaged in the space industry; and space is becoming more and more militarised. In fact we can watch ongoing space-controlled, semiautonomous drone warfare every day on the internet.

In my view the description in the consultation document exaggerates the benefits of space and underestimates the risks. Probably, the benefits are exaggerated because of the ‘high paying jobs’ in the industry and the awe associated with extremely advanced new technology. The risks are underestimated because of a failure to engage with the intense militarisation of space and the unavoidable uncertainties of a rapid expansion into new territory and technology.

The single most publicly-debated questions on space in New Zealand, namely 'Should New Zealand launch secret military satellites for foreign states?', and 'Would this increase or decrease the nuclear threat to New Zealand?', are not even asked in the consultation. It is not mentioned that Rocket Lab launches satellites for the US National Reconnaissance (i.e. space spying) Office and designs and builds hardware for the US Space Force.

The space age began eighty years ago with the launch of a V2 missile into space, and continues with vast fleets of space-travelling and space-controlled ICBMs ready to launch. The nuclear threat is higher than at any time since 1962. The *Bulletin of the Atomic Scientists* Doomsday Clock stands at 100 seconds to midnight – and that was set before Russia's invasion of Ukraine. Many believe that the United States is determined to gain complete dominance of space through the development of space weapons:

> …the rapid expansion in space use and the difficulty of determining the true intent of some satellite systems are leading many analysts to the conclusion that the next steps in the militarisation of space will be the development, deployment and eventual use of space weapons. [Dave Webb, The Ethical Use of Outer Space, in Ethical Engineering for International Development and Environmental Sustainability, Springer 2015.]

The consultation mentions the value of Starlink to Ukraine. Even in the few weeks since it was written, Elon Musk (the world's richest person and the most controversial business-person in the world, and the dominant owner of SpaceX and Starlink) has further weaponised and politicised Starlink in dangerous ways. SpaceX has rapidly become so dominant in the US space industry that any ties to that industry inevitably create links to Musk. What with the near collisions, the pollution of the night sky, the risk of debris, and the climate impacts of the enormous number of launches needed to maintain the constellation, its politicisation and weaponization in an *actual war,* Starlink is a disaster in which the worst is yet to come.

These considerations throw the opening sentences of the consultation into a different light.

> New Zealand's association with space goes back centuries: the first Māori explorers navigated by the stars to Aotearoa New Zealand, and centuries later they were followed by European navigators whose instruments also looked to the stars. Today, our modern navigation systems are still guided from space.

Yes, Māori explorers used advanced sailing technology and navigation to settle Aotearoa, but also to greatly alter it. European colonisation led to violence, appropriation, destruction, and extinction (amongst other things). The new space race is likely to accelerate the inroads of violence into space.

Space is sometimes described as a 'global commons'. But does that mean it is ours to use as we see fit? It is already crowded, polluted, and dangerous. Our track record in governing other global commons such as the atmosphere and ocean is not good.

The aviation industry provides a model for one possible future for the space and aerospace industries, in the event that they succeed technically while avoiding e.g. nuclear war and debris problems. Aviation has shown marvellous technical progress, especially in comfort, price, and safety – not so much in efficiency or pollution. But it has also led to a huge increase in emissions and in transport and emissions inequality. Most trips are not essential or even necessary. The industry has grown so large that it has become politically ungovernable – most climate impacts of aviation remain completely unregulated. The global bodies (ICAO, UNWTO) are subject to industry capture. The aviation industry is completely unsustainable and likely to become worse in the future if growth projections are allowed to materialise. Yes, it's nice for the passengers, but considering the existential risks to humanity and the biosphere, is it worth it?

Daniel Deudney, in *Dark Skies: Space Expansionism, Planetary Geopolitics, and the Ends of Humanity* (2020) writes

> Three interrelated efforts—lowering costs of accessing space, space tourism, and privatization—are currently viewed by space advocates as useful steps to the eventual realization of the larger space expansionist program. They are actually a mix of trouble and trivia leading to danger precisely because of their potential to open the larger door to extensive space activities. Everything space expansionists want to do in space depends upon accessing space more cheaply. But substantially lowering access costs is very much a double-edged sword. If it is cheaper and easier to get to orbit, then all space activities become cheaper and easier to accomplish, whether or not their effects are desirable.
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> Ambitious space expansion proposals also rest on dubious assumptions about human control of nature and technology and governance of superpotent new technologies. When these deficiencies are identified and corrected, space activities, actual and prospective, look very different, and space expansion loses much of its appeal.

The American rocket pioneer David Lasser wrote in "The rocket and the next war", 1931, anticipating widespread bombing of cities by rockets:

> Whether the man of the future, looking back to 1931 will wish that the rocket had never been invented, no one knows. It seems to me that the rocket is one of the creations of the human mind, that serves as a test of our right to inherit the earth. Its powers of good and evil are so equal and opposite. [http://epizodyspace.ru/bibl/inostr-yazyki/bais/1931/bais_no_013.pdf]

Unfortunately, we still don't know.

Space-based solar power was on the cover of last week's *Listener*, promoting a New Zealand wireless power transmission startup. This, together with space mining, are two of the biggest applications promoted by enthusiasts. Tom Murphy, a physics professor at UCSD and my colleague in the Planetary Limits Academic Network, took this apart in 2012 at https://dothemath.ucsd.edu/2012/03/space-based-solar-power/. It's another dangerous fantasy: extremely unlikely to work or to compete with other solutions if it did work, and exposing us to new risks (maintenance in space and weaponization) if successful.

To what extent do you agree with the space values and policies which currently guide New Zealand's activities and engagements on space?

The values listed on page 6 are fine as far as they go but suffer from two problems. They assume that we are operating in a generally fair, stable, and progressive environment, not one facing existential risks; and they fly in the face of reality, thus leaving us open to charges of hypocrisy. For example, we are not at all sustainable. We are to 'develop norms and standards with like-minded countries', but we have thrown our lot in with the United States. It is not clear to me how conflicts between the values will be managed – quite likely, economic considerations will outweigh social, environmental and even security matters.

The issues with the United States are

1. They routinely vote against the *Prevention of an Arms Race in Outer Space* and *Transparency and Confidence-Building Measures* resolutions at the UN, being the only country in the world to do so.
2. Despite a long-standing lack of clarity in the non-appropriation clause of the Outer Space Treaty and its relation to space mining, they unilaterally asserted their right to space mining, and then attempted to get other countries to follow their interpretation, via the Artemis Accords – with the economic inducement of collaboration in the Artemis program.
3. They are behind the most intense and accelerating militarisation of space, while also investing in a huge new nuclear developments. The line between nuclear and non-nuclear military uses is increasingly blurred, and even the dividing line with commercial and scientific use is getting harder to discern, as the same companies are involved in all of them, the technologies are transferable, and the satellites multi-use and re-configurable.

'Sustainability' is mentioned repeatedly in the consultation document. However, I am still not quite sure what is meant by this term in this context. In my view this aspect would need a much more detailed and deeper study. To take one example, the UN Sustainable Development Goals are mentioned. These are laudable, but the unfortunate truth is that New Zealand has not made any net progress on the SDGs in 30 years. Since 2000 we have slipped well back in the SDG rankings. Many space activities are detrimental to sustainable development. An approach based on the SDGs (or a specific handful of the more than 100 sub-targets) would mean looking at the overall strategy for addressing that goal. Quite likely we would then find that expensive, high-tech space-based solutions are not the most effective approach. There is a risk of 'sustainability' and the SDGs being mere window-dressing or, worse, being subverted by industry, as the aviation industry has done: the IATA claims that aviation contributes positively to every single one of the SDGs, despite the reality that the whole industry is disastrously unsustainable.

'Kaitiakitanga' is mentioned. But the example of Project Tāwhaki I find alarming. "This unique partnership will protect and rejuvenate the Kaitōrete whenua", the publicity material says. This is a project right next to Te Waihora, a textbook case of the effects of unbridled growth, externalised costs, cumulative and cascading consequences of pollution, tipping points, and a powerful industry continuing to resist regulation. Despite a claimed

“cooperative, trust-building” model adopted in the Canterbury Water Management Strategy, it has failed on all of its environmental goals, and the water quality of Te Waihora continues to decline. Not only is this exactly the kind of thing that we should be anticipating and guarding against, it is a nonsense to sense that building a spaceport and planting some native plants can “rejuvenate the whenua”. Social, environmental, and economic goals are all important and we should try to avoid trading them off against one another. At the moment I cannot take MBIE’s approach to kaitiakitanga seriously. Whakamā.

‘Inclusivity’ is mentioned. But growing the space sector is likely to worsen inclusivity. At the moment there are very few female engineers. It appears that about 11% of practising engineers are female, i.e. we would need 8 times as many to achieve gender balance. Actually, it’s worse than that, because the specialties most favoured by female students are biomedical and environmental engineering – not aerospace and electrical engineering, which is what will be needed. UC recently started a biomedical engineering minor specifically to attract female students. It’s the same story in physics and computer science (where female participation has actually declined recently). Therefore, expanding this sector, with its high-paying jobs, will act to increase gender inequality and the gender pay gap. Significant progress on female participation would be needed just to stand still. But how are we going to do that? Many studies and initiatives have been tested and launched for several decades now. The lack of progress suggests that it is not that easy to fix – or perhaps not nearly enough resources have been put into the area. More generally, a growing tech sector has been found to increase the gender pay gap (Cortes, G. M., Oliveira, A., & Salomons, A. (2020). Do technological advances reduce the gender wage gap?. Oxford Review of Economic Policy, 36(4), 903-924.)

The aerospace industry globally is suffering from dishonesty in the network created by venture capital, startups, and the media. (See, e.g., R Aboulafia. 2022. The eVTOL bubble? Aerospace Magazine, Feb 2022, pp. 14–19. https://www.aerosociety.com/media/17742/aerospace-magazine-february-2022.pdf) The space industry is also subject to bizarre and even lunatic fringe fantasies (e.g., space colonisation), but so far these have not crossed over to the actual engineering side. Let’s hope we never cross that line.

‘Transparency’ is not mentioned as a value. It should be made more prominent. I find the processes around launch approvals opaque. There does not seem to be any provision for judicial, parliamentary, or public oversight of what is in the ‘national interest’. What processes were followed to determine the impact of launching US military satellites on the risk of nuclear war on or off New Zealand, of increasing tensions in New Zealand or elsewhere? New Zealand’s nuclear free policy is long established, and has been the subject of intense public debate at times. Now that the nuclear situation is deteriorating it is time for it to be interrogated and reinvigorated.

I wonder if MBIE’s role in business development gives it a conflict of interest in the oversight of the space program. It raises concerns that commercial demands might trump everything. Perhaps it should be given to a more independent body like the Royal Society Te Apārangi (given that most of the hoped-for benefits are scientific) or consideration given to the creation of an independent oversight body.

What space activities and engagements should New Zealand be inviting and/or promoting?

Earth observation.

Activities that reduce, rather than increase, tensions on Earth.

Full climate impact and environmental reporting by space companies. (None of the NZ companies I checked report their emissions.)

For more on the direct impact of rocketry, see:

Durrieu, S., & Nelson, R. F. (2013). Earth observation from space–The issue of environmental sustainability. Space Policy, 29(4), 238-250.

and

Martin Ross and James Vedda, The Policy and Science of Rocket Emissions, 2018, https://dechrononauten.nl/wp-content/uploads/2021/09/RocketEmissions_0.pdf, who write that the impact of rocket launches on the atmosphere are not well known, and that "At some future increased launch rate, the global impacts from launch emissions will collide with international imperatives to manage the global atmosphere":

> *Fool Me Twice, Shame on Me:* Concerns about atmospheric rocket emissions are analogous to early recognition of space debris, which continues to be a policy challenge today. Debris accumulation in valuable orbits is widely acknowledged to present an existential risk to continuing space operations and industry growth. Nevertheless, policy and practice to decisively deal with the problem are still in the formative stages, even as technology to reduce the risk via active disposal is on the horizon. If the potential magnitude of the space debris problem had been recognized early in the space age, and coordinated international actions had been taken at the time to address it, space debris may not have become the significant risk we face today.

We should also **discourage** some activities:

1. Launch of foreign military or covert surveillance satellites.
2. Military or intelligence funding of New Zealand universities; close oversight of commercial links between companies operating in New Zealand and companies overseas that also hold with military or intelligence contracts.
3. Human spaceflight. This is enormously wasteful and fails all cost-benefit analyses by a stupendous margin. Even within the pro-space community it is extremely controversial. The advent of space tourism makes it even worse. We should work to regulate and eventually end human spaceflight.
4. Work to halt the ongoing weaponization of space. Support 'Stop Killer Robots'. Work to end ballistic missiles via a Zero Ballistic Missile treaty, or even all missiles as

> suggested by Dan Plesch at SOAS ("Zero Missiles: building on the precedent that helps Ukraine today", 21 Oct 2022)

For more on human spaceflight, see

Peeters, P. (2018). Why space tourism will not be part of sustainable tourism. Tourism Recreation Research, 43(4), 540-543.

Scott, M. (2022). A space tourism destination: Environmental, geopolitical and tourism branding considerations for New Zealand as a 'launch state'. Journal of Sustainable Tourism, 30(9), 2240-2253:

> Unlike any other type of new or emerging tourism, space tourism is uniquely entwined with the fossil fuels industries, climate change and the global climate emergency, national security and surveillance, military domination and the weaponisation of space.

Spector, S., Higham, J. E., & Gössling, S. (2020). Extraterrestrial transitions: Desirable transport futures on earth and in outer space. Energy Research & Social Science, 68, 101541:

> …the New Zealand government also granted Rocket Lab consent to launch every 72 h for the next 30 years, despite a lack of clear understanding of the implications such launches will have on the global climate. The prevalent global attitude towards spaceflight is marked by an untenable form of cognitive dissonance. Governments and international organisations have enacted and committed to decarbonisation via various international agreements, most notably the Paris Climate Accord of 2015, whilst conveniently ignoring or actively facilitating the development of the highly carbon-intensive space industry.

Who should the New Zealand government be engaging with on space?

Experts in peace, disarmament, and sustainability.

How do you want to be engaged on space issues?

In a more balanced way that does not exaggerate the benefits or minimize the risks.