



## ROYAL AUSTRALIAN AIR FORCE

### Podcast Transcript

*Conversations on The Runway – Space Series Episode 2 – ‘Space Legal Framework’*

**Host: SQNLDR Michael Veitch**

**Guests: Dr Cassandra Steer (ANU) and Mr Duncan Blake (UNSW)**

#### **Michael Veitch:**

So there's this place out in the middle of Bass Strait. Bass Strait - that's the bit of water between Victoria and our southernmost state of Tasmania. 250 K's wide, give or take, rough seas, shipwrecks, whales, penguins, that sort of thing. But also, and a lot of people don't know this, a whole bunch of islands. A couple quite big, most pretty small, all of them fascinating and beautiful, but one of them particularly interesting for a very specific reason.

You see, the state border between Tasmania and Victoria, i.e. the rest of Australia, has historically been a bit, well, rubbery. Back in the day it was set right on the Tasmanian shoreline meaning that all of Bass Strait resulted in, from northwards, from the Tassie beach going to Victoria. Tasmania quite rightly was a bit miffed about this, so they moved it all the way over to the Victorian side, which made the Victorians cranky. So in the spirit of compromise they shifted it yet again to somewhere in the middle of Bass Strait though a bit more towards the northern end. This of course made nobody happy, but at least Tassie got the big islands like King and Flinders, and the Victorians got all the good fishing rights or something like that.

Now, all of this palaver resulted in something kind of weird, because according to the map, and you have to look for the map, look for it on the map, out there somewhere in Bass Strait there's this rock. 80 meters long, low, kind of flat, boring really, uninhabitable except for a few sea birds, quite a lot of sea birds actually, but it directly straddles the legal border of Victoria and Tasmania.

By a pure chance, when they redid the map 150 or so years ago the line went right across the middle of this rock. It's so insignificant a place it doesn't even register as a proper island, but instead it's called an islet. Boundary Islet to be exact, to give it its proper name, but what it does is make it possible to walk, in theory, from Victoria on the mainland to our island state of Tasmania. I know this because I've done it. Fisherman dropped me there years ago. Bit of a lark, long story, another time. But what it enabled me to do is to walk from one side of Boundary Islet in one state to the other side, in another state. I even did it twice.

Clever me, punched the air a couple of times with a "Woo! Woo!" then got back on the boat, drove away, end of story. But I love telling this to lawyers because they're intrigued by the legalities of it. You should see them, they go all quiet and wistful like they've been hypnotised, and I hit them with questions like, "So what would happen QC," it was a QC actually I asked this to, "If I were to commit say an offence on one side of this island, islet, that was not an offence on the other?" The lawyers love this sort of stuff, and at one time after some consideration one of them said to me, "Gee, no one could determine what the jurisdiction is, I mean not exactly. It'd be a bit like committing a crime in space." It could play out for years. Then he started drooling about the prospect of all those fees.

But it got me thinking about that other fascinating legal area, space. And as for crime in space, well, wow! But for that to be possible there has to be law in space and what's that about?

From forgotten islands to outer space my name is Michael Veitch and this is Conversations on the Runway where today we'll be looking at law in space. Does it exist? Who makes it up? Who makes it happen? Who enforces it? And what are the consequences of there being no law in space? Heads up, a bit scary actually, and what would the rules of military engagement look like if ever heaven forbid it was all to get nasty up there? Space, it's the ultimate high ground. Stay with us because we're taking you right there.

We have two brilliant guests for you today, [Dr Cassandra Steer](#) is Senior Consultant and Lecturer specialising in space law and space policy at the Australian National University, College of Law and Mission Specialist, that sounds exciting, with the [ANU Institute for Space](#), aka 'InSpace'.

For 22 years Wing Commander [Duncan Blake](#) was an RAAF Legal Officer working at the very highest level contributing to government and Defence policy on many aspects of law, but particularly in space. But the capacity in which Duncan is joining us today is as Senior Research Associate at the University of New South Wales, Canberra. He is also currently Managing Editor of something called the [Woomera Manual](#) and we'll be hearing about that a little bit later. Cassandra, Duncan, welcome to Conversations on the Runway.

**Cassandra Steer:**

Hi, thank you.

**Duncan Blake:**

Thank you very much. Great to be here.

**Michael Veitch:**

Thank you very much, great to have you both in this fascinating area that not many people know about, but I'm so glad you do. But I want to throw another analogy at you, this will be far shorter than the previous one, I promise you. But reading about it, I read a lot of history, and please feel free to shoot me down in flames over this, but learning about what we're doing in space, mankind that is, and as you know that's more and more all the time, it struck me a little bit like the early days of the United States where people were advancing west from the eastern seaboard and just occupying these vast areas of wilderness and making use of them, extensive use of them, building towns, and roads, and mining, and all sorts of things.

Before they were states, before they were even territories or anything, and certainly before any laws or regulations were in place, they just marched out and put fences up and said, "Well, this is where we are." And if you've ever watched the TV show Deadwood it was chaos for a while. Space seems to be to me a little bit like that at the moment. Duncan is there any validity to this ramble of mine?

**Duncan Blake:**

It's a wonderful analogy, it's a very good analogy in fact and senior military leaders and national leaders have sometimes referred to space as a new wild west. For my part I think the use of the phrase "wild west" is unfortunate and troubling. You will know the history better than me I suspect, but part of the rationale for the expansion westward in the United States was this sense that it was the manifest destiny of the United States, and perhaps that's the case, perhaps that is the case for the United States in respect of their activities in outer space.

But the other aspect of the analogy is that it's unruly, that it's a lawless area, and that's what wild west movies are about right? Being relatively lawless. But I'm sure as we will talk about in this episode, there are laws that apply to space and it's important to be clear about those.

**Michael Veitch:**

I'll throw to Cassandra, what's your take on space as the Wild West?

**Cassandra Steer:**

Yeah. It is troubling as an analogy, and I guess it's a way that captures people's imagination, but one of the reasons I find it troubling is because it's so caught up in this whole idea of colonisation. So colonising space, colonising mars is the big buzz thing right now, and colonisation brings with it a history of violence, competition, environmental destruction, displacement of indigenous people. So I don't necessarily argue that there's indigenous people in space, but there's the ideology and the history coupled with that - that really does bother me. The fact that...

**Michael Veitch:**

I'm very happy to have disagreement first up on Conversations on the Runway, in fact I relish it. Go on Cassandra.

**Cassandra Steer:**

No, I think also the history of colonisation really is also caught up, in that sense it is a correct analogy even though it's troubling. Colonisation and expansions of empires, land grabs throughout history have always been led by commercial entities. If you think of the Dutch East India Company seeing all these opportunities for trade and wanting to dominate the sea routes, and then seeking justification and legalisation of what they were doing. So partnering with the government or the King of the Netherlands and saying, "We want you to give us laws to protect what we're doing, we want to have the state to protect what we're doing, and we want to have the right of first access, we want to have protection of certain routes, and in return we will claim land for this kingdom."

The Portuguese did it, the British did it, the Americans did it, that's how empires have operated, and it's always been the commercial actors at the forefront saying, "Put laws in place to protect what we're doing and we'll partner with you." And that's kind of what we're seeing happening in space right now, so although it's a troubling analogy it's actually, in troubling ways, a very accurate one.

**Michael Veitch:**

I think one of the most interesting descriptions I've come across, our current use of space, is from an American general who quite obliquely just said that "Space is no longer benign. A domain more military and commercial users are contesting every day." Commerce, banking, communication - if space was a country you'd have to regulate it surely?

**Duncan Blake:**

Absolutely, yes. There is a purported nation related to outer space, Asgardia, which is, for those people who can't see us we're banging our heads at the moment. It's an interesting project that seeks to gather citizens to this virtual entity but it doesn't fulfil the criterion law for being a state,

but there is this concept that there would be a state in outer space. But as a matter of law there can be no states in outer space.

**Michael Veitch:**

Nonetheless though, are we, if our continued use of it continues as it does, can you foresee a time when we'll need to reclassify space from that place above the world where satellites, new and old whiz around, to a place of an entirely new jurisdiction with its own legal autonomy, is that where we're heading?

**Cassandra Steer:**

I mean, in some ways it already has a certain legal autonomy, right? We have a framework, we have an international law framework, and then we also have domestic laws that apply, so national laws that apply. And the international law framework is based first and foremost on the [1967 Outer Space Treaty, and Article 3](#) of that treaty says that all activities that take place in space must be in accordance with international law.

And so, we have this whole body of international law that applies. It tells us things like you can't use force unless you're using force in self-defence. That's the body of law that we have for many decades now with centuries of customary law that we base it on. Laws around conflict would apply, human rights applies, environmental law applies, the law of treaties applies which tells us how states need to arrange their relations with treaties, and then once they've signed a treaty they're obliged to fulfil those.

We have potentially international trade law that will apply if we start seeing trade actually taking place through space, so we have a whole body of international law that already does apply, and then we have some very specific laws for space that apply. And obviously that will have to continue to be developed as our activities will get more complex. And once we see more human habitation in space we'll need to think about putting more regimes in place as well. But I guess that's the answer to the question of whether it's lawless or not. It's not lawless, we already have a lot of law that tells us a lot about human activity in space.

**Duncan Blake:**

But in response to the idea that in many years from now there might be settlements on other celestial bodies and that that could change the law, well I think that's conceivable, and science fiction helps us to think about these sorts of scenarios, and I'm not sure if you're familiar with the TV series called The Expanse, but it involves a well-established settlement on Mars. If you can imagine, say, the United States sending a mission to Mars, on the way to Mars it's going to take at least six months to get there. Once they're there, even to speak to them, in the best case scenario one way communication will take 14 minutes.

So if you say you're going to be subject to United States law that seems kind of odd, and certain countries including Australia have had experience with being governed by a foreign state, at the end of the day we decided that there are elements of that that we did not like, and that we decided we wanted a different legal regime. So it's very conceivable that the Martians would say, "Your conception of space law is very earth-centric, we think it needs to evolve."

**Michael Veitch:**

Well, this leads me to my next point, and I wanted to get just, for a minute or so, just slightly philosophical because it seems that the notion of law in space could be interpreted as a strange fusion between science, and law, and philosophy even, touching to the essence of what law

actually is, I mean, and some would say a hubris perhaps. I mean, the notion of mankind extending their legal regimen into an environment where we can't live and we can't even breathe.

**Duncan Blake:**

Yes. Yes, well I think it is a really interesting fusion of those sorts of things, and one of the manifestations of that fusion is some of the aspirational principles that you find in the Outer Space Treaty that are not there, are not present in other legal regimes, or not in the same way. So one example of that is this idea that outer space, the use and exploration of outer space is the province of humanity. It actually refers to mankind, but in a future episode I think there'll be some discussion about gendered language in law and in space.

But, anyway, the use and exploration of outer space is the province of humanity. And the question is, who represents humanity? We have an international legal system where states are represented within national legal systems, citizens can vote, but how is humanity represented? If humanity has an interest in outer space, which is distinct from states, then what is that interest? So there are some very interesting philosophical questions that arise.

**Cassandra Steer:**

Yeah. One of the ways that I try and explain what I do to primary school-aged kids if I want to talk about what space law is, I often start with, well why do you think we have laws? Why do we have traffic laws? Why do we have laws about how you behave at school, or about not being able to steal things? The answer is, well, we need to put rules in place to govern human behaviour where we can't really trust humans to do it by themselves, right?

**Michael Veitch:**

I'm so glad you said that because that actually runs to the absolute bedrock of ... and yeah it's completely necessary too that humans can't be trusted to do the right thing so they've got to have rules, that's it, isn't it really?

**Cassandra Steer:**

It is. I mean, we can be trusted to a certain extent.

**Michael Veitch:**

Indeed.

**Cassandra Steer:**

I think we can be trusted if we make it explicit, "This is what we want to say." Again, so I'm an educator, so I often think in those terms, but even at the level of university I'll often come up with what are our ground rules of how we're going to operate together throughout the semester in terms of our discussion of contentious issues, where we're going to listen respectfully to each other and we're going to collaborate on issues, and we're going to try and resolve things even if we disagree.

Once you put down those kind of ground rules I think we can be trusted, it's just that we have to put them down, and we have to put them down for traffic because we have lots of fast-moving cars and we need to make sure people don't crash into each other, and it's the same in space, particularly in our near-earth environment which is where most human activity is, where we've got satellites, a couple of thousand active satellites, and then well over a million pieces of debris whizzing around our planet at seven kilometres a second. Well, we need to have...

**Michael Veitch:**

Wow!

**Cassandra Steer:**

...some traffic rules in place.

**Michael Veitch:**

Yes.

**Cassandra Steer:**

Now that we're seeing more complex activities, you know, we've said in the Outer Space Treaty that all activities are going to be for the benefit of all states regardless of their level of development, and their economic status, and that space indeed is the province of all humankind. Well then, what other regimes do we need to put in place? Because you're right, we can't be trusted just to do the good thing for each other, but once we put those rules in place we actually are pretty good at sticking to them.

**Michael Veitch:**

By and large, indeed. Humanity would fall to pieces if that were not the case. Is there just a purely practical, so it just occurred to me, is there a kind of an upper legal threshold where laws start to peter out? Is it the lower earth orbit or is there a mankind law borderline up there somewhere? Or does it just keep on going to Jupiter and beyond?

**Duncan Blake:**

Well, the law extends ad infinitum. The more difficult question is perhaps where it starts. But putting that aside for the moment there, the law extends ad infinitum, and I was referring before about the possibility of space law being regarded as earth-centric. It does seem somewhat hubristic as you said before to say that this earth-based law extends throughout the entire universe, but that's our concept.

**Cassandra Steer:**

Sorry Duncan, I was going to say what it does is it regulates human activity, so we're not regulating space, we're not telling celestial bodies what they can and can't do, right? All we put in place is regulating human activity in space. Although there is some push now, and I think this is fascinating, in New Zealand for instance there's a law that's been recognised through case law that gives legal personality to certain rivers and certain, I believe there's a hill or a mountain that has legal personality. And that has to do with the Maori notion of custodianship and recognising the inherent value to certain areas.

So by granting legal personality to a river you've thereby given it certain protections under the law, certain rights that can never be breached. And there is a bit of a movement, it's called For All Moon-kind, to give legal personality to the Moon. So if we were to grant legal personality to the Moon we would be doing something other than just regulating human activity on the Moon, which is really quite contentious right now and it's going to get super contentious in the next couple of decades. There's a race to the Moon right now. The US has its Artemis program, it wants to not only put humans back on the Moon by 2024 but it actually is looking to human habitation because they want to start mining the Moon.

And, you know, China is also interested and there's really contentious questions around the legal framework of those activities. But if we were to grant the Moon itself legal personality then perhaps there would be certain rights that the Moon would have under our human law which we would have to apply because it's our human activity. And I think that's a really interesting route to go down.

**Michael Veitch:**

I do want to talk about the Moon a little bit later. As you say Cassandra, it's coming back from the wilderness really in terms of human interaction from its heyday back in the late '60s. When the Outer Space Treaty was written, how did it come about? Did this treaty come about because of Man's exploration of the Moon in the 1960s?

**Duncan Blake:**

Well, I guess there was a lot of shock around the world, and especially in the United States, at the successful orbit of Sputnik in October 1957. And at that time, in the context of the United Nations, there was a interim, at that time, committee on the peaceful uses of outer space, that interim committee subsequently became a more formalised committee. And one of its first tasks was to draft the Outer Space Treaty, and so States got together in the context of this committee on the peaceful uses of outer space.

In the duration between December 1966 and December 1979 they drafted five treaties specifically on space, which is just a remarkable pace of treaty making in international law. But it's not to say that the committee on the peaceful uses of outer space is the only context in which international space law can be made. Like a lot of areas of international law, if you talk about international space law, law of armed conflict, or international environmental law, or a bunch of other subjects, it's not necessarily one set of treaties. It's all of the laws that you can find that are applicable to space.

So, there are things in the International Telecommunications Union Constitution and Convention that apply to space. There's things in the Environmental Modification Treaty that specifically apply to space, and then there's a whole lot of other treaties that although they don't overtly apply to space incidentally apply to space. So there's a lot of different contexts in this space -

**Michael Veitch:**

How did this '67 Outer Space Treaty, which is a great name by the way, I'm sure they got it off the show-runner for Star Trek or something - the Outer Space Treaty. In your opinion, did it actually successfully envisage our current use of space? I mean, did it have any notion of how many satellites would be up there or having a permanent space station, explorations to the space shuttle, all sorts of things. Was it a prescient document or has it remained locked in its time during the cold war in the mid '60s?

**Cassandra Steer:**

I think it's fairly prescient. We had its 50th anniversary just three years ago in 2017 and there were huge discussions around the world, do we need to update it, do we need to replace it, and I think most international lawyers or most space lawyers would say, "No, there's no need to at all". What you have is a constitution, and just like a constitution, just like Australia's constitution it's a framework and it doesn't attempt to regulate every single behaviour or every transaction that's going to happen in Australian society for the next couple hundred years. It puts in place the most important framework for how we want to operate. That's what the Outer Space Treaty does.

It's definitely a product of its time. The Soviets and the Americans were competing in every single arena, technologically, politically, ideologically to be the bigger power, and then space suddenly became the next domain in which that was taking place. So they were both testing nuclear weapons in space, they were both trying to figure out how to gain the high ground I guess you could say, and then very quickly they realised that these tests for instance were impacting not only each other's satellites or trying to impact each other's satellites, but also impacting by the time we had a few communication satellites or military satellites that were up there in a very short time those were also impacted.

You can't contain the effects of those kind of weapons tests in space. And so very quickly they both realised if they wanted to have continued access to space they needed to put down certain rules which might seem contrary to the competition between them, but agreeing things like no state can claim sovereignty in space. So no one can claim this is their sovereign territory in space. Agreeing things like outer space should be used for peaceful purposes. Agreeing these amazing aspirational statements like space is for the providence of all humankind, all mankind. So they seem kind of contrary to the competition between the states, but both states realised, and then all the other countries that supported this and signed on to it very quickly, realised that we needed to have these very strong ground rules in place if we wanted to keep accessing space.

So I don't think they could have imagined what technology looked like in the 21st century, but they certainly realised that space was going to become more and more important. There's even an article that says that all activities, whether they be governmental or non-governmental, so commercial activities, fall under the responsibility of the state under whose jurisdiction they take place, and that state and that country can be held responsible. So the US is responsible for what SpaceX does in space, Australia is responsible for what Gilmour is going to be doing in space. So they didn't see the extent, I don't think they could have seen the extent to which technology has taken us so far, but they certainly saw the importance of space at the time.

**Michael Veitch:**

The [UN likes making laws and treaties](#). A treaty is of course not binding. They've been trying to impose some kind of peaceful order on the Middle East for 70 odd years without a lot of success. Just what is the difference, remind us you two lawyers, of a law and a treaty?

**Duncan Blake:**

Just a correction there, I mean a treaty is absolutely binding as a matter of law on the states who are parties to the treaty, but it's not binding on anyone else. If you're not a party to the treaty then you're not bound by it, and that would be quite relevant for example to the fifth of the space treaties, [the Moon Agreement](#). There are 18 state parties to the Moon Agreement, Australia happens to be one of them. But it doesn't include any of the major space fairing states, so they would say it has no application for them whatsoever.

So treaties are definitely part of the law. There is another form of law which is more universal in nature that in that sense it's binding on all states no matter what and that is [customary international law](#). But whereas you can go to a website and find a treaty written in black and white or you can actually find the book or even the original text and go through the words, with customary international law it's a little more difficult. You need to identify what states have done and what states have said. It's important you have both, what they've said and what they've done. In terms of what they've said that they regard what they're doing as legally binding, and if you have both of those then you have customary international law. So those are probably the two major sources of international law.



**Michael Veitch:**

Cassandra, it's hard to imagine any other environment where government interests and commercial interests are so intertwined and mutually dependent as space. Is this mutual dependence on each other, the path through to mutual cooperation?

**Cassandra Steer:**

The optimist in me says, "Yes, of course it is." I mean, I think we do have some regimes on earth which people often point to as being analogous, so the Antarctic for instance. We have an Antarctic Treaty. Well there are claims that have been made to certain areas in the Antarctic but the Antarctic Treaty froze those claims and said "even though certain countries, including Australia, have staked out areas which they would like to claim for themselves, the treaty says actually not". We're just agreeing that no one can actually claim that as their territory and that scientific experimentation and research is very much welcome there. But it tries to put a brake on any kind of commercial activity that might have environmentally questionable or damaging effects.

The same with the high seas. So there are large areas of ocean which are not part of any nation's territory, and we have international law that also regulates that and says you can't claim sovereignty there, it's a [global commons](#). So there is a regime, for instance, for the deep seabed which says that if commercial entities want to go and mine the deep seabed or fish in these areas, they have to do so under an international regime, which tries to, sorry, they have to do so under an international regime the intention of which is that the benefits of those activities should be shared. So the US has not signed up to that particular regime in the deep seabed regime, interestingly.

They also, as Duncan pointed out, have not signed up to the Moon Agreement. One of the intentions of which was looking to the possibility of commercial activities on the Moon with a similar idea to set up a regime which would ensure the benefits are shared for all humankind. And the US has not only not signed up to that, it's made very explicit that it wants no part in it. So I guess, will this co-dependency lead to cooperation? I would hope so in the sense that what the [Australian Space Agency](#) is doing for instance, so it's only been in existence for two years, its main mandate is to support industry, Australian space industry. So there's definitely a co-dependency there and the Australian space industry in order to be competitive wants a lot more clarity on the laws.

So Australia wants to support its own industry, but it also has to look as a country to its obligations under the Outer Space Treaty and to things like long-term sustainability, and protecting space for future generations. So hopefully that dependency will lead to cooperation in the sense that we need to have laws in place, we want to support industry, but we also have greater responsibilities. The question I guess is, is that cooperation benign or is it along the lines of that kind of colonialist history that we talked about at the beginning?

**Michael Veitch:**

Duncan, you can feel free to come in as the pessimist if you like. Governments and industry might say they want strong legal presence in space but do they really in their heart of hearts? I mean, is there a chance that government and state interest becomes subject to, or let's face it quashed by commercial interest? It's not as if we haven't seen that happen before.

**Duncan Blake:**

Well, everybody wants their cake and eat it too if they possibly can. In terms of certainty and regulation, commercial entities would say that's fantastic as long as it affects everybody else and doesn't restrict me. And so it's absolutely necessary because if I'm a commercial entity and I'm going to go to the Moon and I'm going to extract materials on the Moon then I'm going to be very responsible, of course, but I can't trust other people to be very responsible so you better have laws for them.

So we should approach that with a degree of cynicism, but commercial entities do want regulation for certainty, and that is in fact the major reason behind the push by the United States government and NASA for certainty about property rights over extracted materials and minerals from celestial bodies. Because if you are a commercial entity you're going to invest an enormous amount of money to go to a celestial body and extract these resources, then you want some certainty that you would be able to benefit from that. So, from their perspective regulation is absolutely essential.

**Michael Veitch:**

I'm going to ask you both to be as dystopian as you wish in this next question. What are the worst consequences, the most drastic consequences, of complete deregulation of space going forward?

**Duncan Blake:**

Well, so the worst consequences? Would be that we wouldn't be able to get into outer space. So the [Kessler syndrome](#) and probably in other episodes there has been some discussion of the Kessler syndrome. That's a situation in which congestion gets so bad that one collision between space objects and space debris cascades into other ones and it may get to a situation where there is no safe orbit. And if there is no safe orbit then we can't operate in those orbits, we wouldn't be able to use space. So that's a fairly dystopian future, but there's also not only congestion, there's a possibility of conflict in outer space as well, and that has had pretty bad consequences on earth from time to time, in fact almost constantly.

There are perhaps, there are undoubtedly less human beings in space, so it might have a less direct impact. But quite often in the military context as well as other contexts we often think about second and third and subsequent order effects. So not just what are the effects on the surrounding infrastructure and the people surrounding a military attack for example, but what impact does that have on transportation systems that rely on GPS, on communications systems that enable things like big utilities, electricity, sewerage, water, to operate, and banking systems, and stock markets, and even our iPhones or Samsung devices or whatever they are. There would be a huge amount of inconvenience potentially.

**Cassandra Steer:**

Yeah. I understand they're doing a remake of the movie Dune right now, I think that's the potential scenario is where you have...

**Michael Veitch:**

Frank Herbert.

**Cassandra Steer:**

Yeah. You have commercial interests, so dystopian, right? We can't trust commercial entities to be thinking long-term, their business model depends on profit and preferably short-term profit, or at least rapid profit, and guaranteed profit as best as possible. So they're not thinking about the long-term impacts in terms of their impact on the space environment, or the impact on the earth environment. Rocket launches themselves are pretty damaging events. A race to the bottom in terms of mining on the Moon, and then if we didn't have any law around the peaceful uses of space or the prevention which we do currently have of placing military instalments on the Moon or on celestial bodies, then what we would see would be States using their military arms to protect the commercial interests that benefit their economy, so we would have total chaos.

**Michael Veitch:**

Hasn't science fiction already gone down that path? I mean, I know several stories and good stories and good films talking to a future where private enterprise has completely been the ones to regulate space in terms of mining and colonisation and all sorts of things, and it's that dystopian tyranny of the future, isn't it?

**Duncan Blake:**

Yes. Yes, it is. In fact, you made me think of Star Wars, the beginning of the whole Star Wars trilogy of trilogies starts with I think a galactic trade council is what it's called. It's sort of the galactic government in a sense, so dominated by trade interest presumably in that more-

**Michael Veitch:**

Galactic bureaucracy, it'll happen one day, galactic bureaucracy.

**Duncan Blake:**

Yes.

**Michael Veitch:**

Just to that, are there legal firms existing now that deal specifically with law and space?

**Cassandra Steer:**

I mean, there are in the sense that I think that's going to be something that we see grow very rapidly in the next few years. There are firms or lawyers who specialise in supporting the space industry around things which look like most other industries, so you have to have contracts, you have to have insurance, and you have to make sure that there's been risk assessment done, sometimes in order to get a launch or a permit, especially a permit to launch, you need to have an environmental impact study done. That kind of activity goes with any major transactions particularly if they're involving a lot of different entities, a lot of different companies, and the government.

So there are lawyers who specialise in that kind of thing. There are lawyers who have a lot of knowledge about arbitration, so if you have a problem between, for instance, a satellite company and a launch company there are lawyers who specialise in those kind of things, and that is going to grow as a specialty area in the law very quickly. But I'm not aware of any firms that are a space law firm. I mean, most of what we've talked about so far really is the international legal framework, international space law. So, that happens at the level of states, and so it's the

government, so there are government lawyers doing that kind of thing. But the space law firm, I don't know Duncan, should we start one?

**Duncan Blake:**

So, one of the hats that I found previously-

**Michael Veitch:**

And what do you charge for conveyancing?

**Duncan Blake:**

Yes. That's a very good point. So, one of the hats that I've previously had was Chair of something called the Australia New Zealand Space Law Interest Group, it's now got another name, The Space Law Council of Australia and New Zealand, but it came about because myself and others who were doing quite a lot of space law, there were only a few of us, had a lot of lawyers and other people come to us and say, "We're interested in doing space law, what's the context in which we can do space law?" There are not many contexts in which you can do space law in a dedicated, focused, concentrated way, so that's why we started this group. But the reality is you've got a lot of start-ups in Australia, the Australian space industry is characterized by a lot of start-ups.

That's not to say that there's not big primes that are not doing space activities and have been for some time, but the start-ups outnumber the primes simply in terms of number, although they're far smaller. Those start-ups by nature, their first legal questions are not about space law. Their first legal questions are about "I need to lease a warehouse", or "I need to start a company", "I need to understand the intellectual property", "I need to hire some people and sign employment contracts". And so they will approach a law firm in the context of those perhaps more mundane, and there are lawyers who do that sort of thing, who think that what I've just said is very unfair calling it mundane, but more mundane areas of law.

They might incidentally touch upon space law later. So as the start-up develops and it manufactures its first satellite and launches its first satellite, then it needs to put in applications for permits, it needs to contract with a rocket company for the launch of its satellites, and issues like that.

**Michael Veitch:**

A more serious aspect though, and it did occur to me when we were talking about the story syndrome before. The whole notion of collateral damage in the lower earth orbit. How would military institutions look to that sort of thing, and what kind of flash point would that create in human conflict?

**Duncan Blake:**

It's challenging. That's a very challenging scenario. When military forces deploy on operations they do assess collateral damage and there are tools available to them to assess collateral damage. But it's in a very terrestrial and kinetic sense. So there are bug-splat diagrams, (indistinct). If you drop a bomb here fragmentation will go this far out and will have an effect on these buildings. There is not yet good modelling for what the impact of blowing up a satellite might be and the spread of debris. Although there are companies that model that sort of thing, but I'm told by the space, the astrophysicists, that it's difficult to be precise.

After about two orbits of any space object, whether it's a piece of debris or not or a fragment of something, it's hard to be precise about where that thing is thus the difficulty of modelling the potential collateral damage. But there's also that issue of collateral effects, the broader collateral effects that I referred to earlier. So the second and subsequent order effects, and understanding those.

**Cassandra Steer:**

So we do have, sorry, we do have some experience with the difficulty of modelling what happens with debris after kinetic use of weapons in space. So, in 2007 we had a moment that I think interrupted a sense of confidence that "yeah space could be a problem but we'll be okay". When the Chinese used a direct-ascent weapon, a missile to destroy one of their own defunct satellites, the justification at the time was that they were getting rid of a piece of space debris by destroying the satellite. But in the course of that they created hundreds of thousands of pieces of debris almost all of which is still in orbit. So, we've been able to model a little bit based on what happened to that debris, but it spread into many, many different orbits.

So, the problem is we can't mathematically predict what's going to happen with this kind of debris, but what we do know is it's the worst possible type of weapon that you could use because everybody is impacted. So these second and third order impacts that Duncan has mentioned, everyone is so dependent on space that there's a negative impact for everyone including one's allies, including oneself.

**Michael Veitch:**

Well, this might be a good time to bring in a document with a uniquely Australian name which you are working on Duncan, the Woomera Manual. And I believe that in your Master's - I'm digging here - it's lovely symmetry here. In your Master's it was on the subject on the need for a manual of international law applicable to warfare in space, and by golly you're now working on one.

**Duncan Blake:**

Well, exactly. Exactly. I was incredibly lucky.

**Michael Veitch:**

It became a self-fulfilling prophecy, didn't it?

**Duncan Blake:**

It was somewhat. I was very lucky. The Australian government had something called the Australian Space Research Program, \$40 million for space related projects, and I had put up a case for the Australian government to send some lawyers to McGill University in Montreal in Canada to study space law because it was becoming a significant and big thing. In fact, we didn't win a grant from the Australian Space Research Program. The competing one was to bring the International Space University to Adelaide but the Air Force headquarters decided to send me anyway which was fantastic, and I wrote this thesis.

Interestingly, I titled it 'Manual of International Law Applicable to Warfare in Space', and when we were looking for funding for this I spoke to a philanthropist, a lady called Cynda Arsenault, very nice lady. An American philanthropist. She said, "I can see why this is a great idea, and I want to support it but I can't support something that has warfare and space in the title."

**Michael Veitch:**

That limits your options a bit.

**Duncan Blake:**

Yes. Yes. So we changed the title a little bit, but it was actually a Canadian who suggested that the project have a link to Woomera. And I should just mention that I've had an enduring involvement in the project since the beginning obviously. Cassandra has been very much involved in it throughout this as well, she's currently involved as an associate expert, but even earlier than that we were partnering in the efforts to get funding for the project.

**Cassandra Steer:**

Duncan is being very humble here in saying how lucky he is to be involved in this project. The entire thing is his brainchild. And it really started after his Master's with conversations that he had just trying to rally support amongst experts around the world: experts in the law of conflict, experts in the use of force, experts who probably knew nothing about space at all. And then space law experts as well who knew nothing about military activities, and just rallying support internationally. Really, credit where credit's due, obviously the more people have come on board and the more support has come from institutions it's now much greater than one person's idea, but it really is your brainchild Duncan.

You'd already had the idea for a while, but when we were hosting that first workshop that we had at McGill where we had a bit of a wish list of who we wanted around the table, and we were just canvassing, well what issues would a manual have to deal with? How could it learn from other manuals that have gone before it? How could it deal with, and I think this is still a bit of a continuing conversation, in fact I intend to publish on the matter: How can you deal with the contention between does it look like a handbook instructing militaries how to conduct war in space, which is obviously in contravention of the Outer Space Treaty - which says use of space has to be for peaceful purposes.

Or is this, and this is my take on it, is this actually by providing clarity - because you've got the smartest people around the world have sat down and thought really hard - about how existing laws would apply and existing principles would apply to these new factual situations in space. Thinking through scenarios, thinking through what operators and commanders are possibly going to have to be faced with as decisions, and by providing an internationally determined neutral document. If there is more clarity on these questions, and if there is a bit of international agreement on it, in fact what you've got is something which can either help to de-escalate in situations where, is it a threat or use of force if your satellite sidles up to my military satellite? Does that mean I'm now justified in responding?

So it could help to de-escalate, and it could also help if we do end up with a conflict in space, or through space, that we can hopefully reduce the impact of that conflict. And that's the whole point of the law of armed conflict - is to reduce the impact of it and to restrain behaviour around conflict. As I was saying before, we have those rules because we can't be trusted to operate without them, but we're generally pretty good, humanity in general is pretty good at sticking to them once they're there. So having that clarity, I think, can actually serve a really, perhaps not a peacekeeping, or it could be a peacekeeping outcome, but in any case it serves de-escalation, and greater clarity, and greater agreement on what the rules are.

**Michael Veitch:**

What lineage the Woomera Manual has on the back of the San Remo Manual on International Law Applicable to Armed Conflict at Sea, the Harvard Manual pertaining to Air and Missile Warfare, the Tallinn Manual on Cyber Operations, and now the Woomera Manual. I dare say the only context in which Woomera, San Remo, and Harvard, and Tallinn have ever been mentioned in the same context.

**Duncan Blake:**

Yes.

**Michael Veitch:**

But you remind when we were talking the other day Duncan that the word Woomera and it's such a lovely thing to remember, it's an indigenous Australian word for what?

**Duncan Blake:**

For the implement that is used with a spear to extend the range of the spear. It means that you can throw it even harder, and throw it even further. So, the Weapons Research Establishment that was established at Woomera is about long-range weapons, and rockets in a sense could be long-range weapons as well. So then the name is very appropriate.

**Michael Veitch:**

I just wanted to speak very briefly because we're getting close to time, but a solid object on which laws do apply that is not attached to our earth, the ISS. Just about every clear night we can see the bright white dot of the [ISS](#) passing over here. There are even apps on your phone for obsessive people such as sometimes myself, I admit, to actually follow when it passes overhead at 400 kilometres roughly distant, isn't that correct guys?

**Duncan Blake:**

460-something.

**Michael Veitch:**

Whizzing around.

**Duncan Blake:**

Yes.

**Michael Veitch:**

33,000 kilometres an hour? Now, the legal framework up there is fascinating. Could you speak to that perhaps Cassandra because I believe it stipulates that the five different agencies pertaining to the ISS that's Americans, Canada, Japan, Russia and the Europeans have a strange way of breaking down how law pertains up there?

**Cassandra Steer:**

Yeah. It's actually an example of really great cooperation in space, so although it's not so much cooperation between commercial entities and governments here it really is cooperation between governments. But you see the Russians and the Americans in particular working really closely as partners, and so it's often pointed to us, "Look at what's possible when we seek for science rather

than just political competition." So, in general under international space law the jurisdiction of a state still continues over a space object.

So, if an object or satellite is registered in Australia then Australia's laws still apply over that object, so we can't claim sovereignty in space but our laws still extend over what we're doing in space. It's really the same thing with the International Space Station, each of the agencies has contributed modules or in the case of Canada a robotic arm to this space station, and their laws apply to their module. So if you are in the American part of the International Space Station you fall under US law as if you were in the US, and then if you pass from that module into the Russian or into the European Space Agency's module, then you fall under the laws of those jurisdictions. So, it's kind of-

**Michael Veitch:**

Oh, come on. That's a bit of a cop out...

**Cassandra Steer:**

...like crossing a border.

**Michael Veitch:**

That's a cop out, isn't it? Surely. "Well, we can't decide on one law so we'll all just go around doing our own little laws and our own little ..." Duncan, is it true that various sections of the ISS, if you're in the Russian sector or the, it's like the cold war, isn't it? The Russian sector or the Japanese sector. That nation's laws apply to that bit of the ISS?

**Duncan Blake:**

Exactly. Exactly. So, yeah, it gives rise to potential interesting scenarios. I'm not aware of any complexities that have arisen, but there was the question about whether an astronaut was committing some computer related offenses.

**Michael Veitch:**

I'm glad you brought that up because it's a fascinating story.

**Duncan Blake:**

Yes.

**Michael Veitch:**

Can you remind us of that? It only happened recently.

**Duncan Blake:**

Look, it's not something that I followed in a lot of detail but she was aboard the International Space Station, accessing bank accounts that were operated by herself and her partner. Potentially operating a bank account belonging to her partner but without the consent of her partner, at least that's what the reporting indicated. And doing so might have amounted to an offence in United States law. So it was a relevant question, where exactly was she doing that? Was she doing that in the United States module on the International Space Station as opposed to other modules? I presume it was on the United States module.



**Cassandra Steer:**

It was on the United States module, there was all this media about it's the first space crime, and I have this really boring disappointing answer which is, "No, it's not." If anything it could be maybe a cyber-crime if she was hacking into her partner's account, or if she was just accessing it without permission. It wouldn't matter if she were doing that while visiting Australia and she's an American citizen and she's doing something that's unlawful under US law in her US partner's US bank account. It kind of is a bit like the islet in the Bass Strait, right? If she's on one side of the border she's committing a crime that's under that jurisdiction, and in fact prior to becoming a space lawyer I was a criminal law specialist, and those questions around jurisdiction actually end up with really boring quite simple answers.

So, she was not the first space criminal we've yet to see one. I think the most likely first real space crimes we're going to see are going to be space piracy. Once we have actual mining activities taking place in space, there's going to be piracy the way that there was on the high seas at the beginning of international law in the 17th century.

**Michael Veitch:**

Wow!

**Duncan Blake:**

Absolutely.

**Michael Veitch:**

Well, perhaps then the first crime, I mean, God it's hardly a major crime, isn't it? It's just two people having a bit of a tiff, it happens every day really. But perhaps the first potential crime committed not on this earth perhaps, perhaps we can classify it as that. I just wanted to talk a little bit more about the Moon, and it's fascinating that the Moon is coming back into, well, our orbit if you like, and it's funny I feel sorry for the Moon.

50 years ago the Moon was like a beautiful new bride and we were stomping all over her virginal surface like and then she was forgotten about - I should stop this analogy right there, shouldn't I? But not so now because as you were talking before Cassandra and Duncan, the Moon will feature in our exploration of space and space law going into the future because we have the technology to do things like mining up there. But what's up there, do we know what is up there for us to even mine?

**Duncan Blake:**

Probably the most valuable thing is water. If you have water, if you have hydrogen and oxygen as...

**Michael Veitch:**

Water? Hang on...

**Duncan Blake:**

...elements of water.

**Michael Veitch:**

Mining for water? Haven't we got enough here?

**Duncan Blake:**

Well, it costs a lot, and United Launch Alliance, one of the big national security rocket launch companies in the United States has said that they would offer commercial entities, anyone, around US\$3,000 a kilo for water if it could be delivered to them. That's the sort of value of water because of the cost of getting water into outer space. Whereas if you can find it, if you can extract it in outer space, then you have potential rocket fuel in the form of hydrogen, potential oxygen for us to breathe, and water for a variety of different needs. So, it's a pretty important thing to find.

There's also Helium-3, which is potentially a very valuable source of energy as well. But to be clear, very few people are contemplating that resources extracted in outer space would be brought back to earth in all likelihoods...

**Michael Veitch:**

I see. I see.

**Duncan Blake:**

...they're going to be used in outer space.

**Michael Veitch:**

So it isn't like in Alien the Nostromo mining ship, the mining spaceship which the alien gets on board because that was apparently carrying enormous millions and millions of tons of ore in that story, but that's not likely to happen?

**Cassandra Steer:**

I think it's more there was a really bad science fiction movie I think in the '80s or '90s called Ice Pirates. Total B-budget movie.

**Michael Veitch:**

Really? Really? A movie with the name Ice Pirates is bad? I'll bet against that.

**Cassandra Steer:**

It's really bad, but that's the scenario. They're stealing ice, they're, what's the word I'm looking for? Smuggling. They're smuggling ice, they're stealing it and smuggling it because it is the most precious resource in space, and that's the kind of thing that we're going to see. It's all about human habitation, so the Artemis Project that I mentioned before which the US has in place right now. Artemis of course is the twin sister of Apollo, and Apollo is the project that sent humans to the Moon in the 1960s.

Now we have the Artemis Project, Artemis was also the Goddess of the Moon so very appropriate, and the name of my daughter. Although, she was born before the program so the program is named after her.

**Michael Veitch:**

Oh wonderful.

**Cassandra Steer:**

So that program is about getting the first woman and the next man onto the Moon by 2024. But it's also really about creating a space station that would orbit the Moon, so for human habitation, and eventually the Moon to Mars Project. Because by creating the technologies we need for the step to be closer to the Moon and more permanently around the Moon, and being able to mine it, and perhaps setting up human habitation there, if not in the space station perhaps even on the Moon that is all the stepping stone to get to Mars or indeed to another planet in the future.

**Duncan Blake:**

But this scenario involves potentially the intersection between commercial interest, military interest, law regulation, because the materials that would be mined, ice for example and Helium-3, exist, particularly ice, exist in only very limited areas on the Moon particularly around the poles of the Moon - the south pole, the north pole - and there's more around the south pole. In order to extract that ice there's an enormous amount of energy required, one of the best sources of that energy is the Sun, and above the craters where you might find the ice there are these areas referred to as peaks of eternal light.

**Michael Veitch:**

Wow!

**Duncan Blake:**

So always in the sunshine, and wonderful sources of energy. If you extract anything, if you do any mining on the Moon, Moon dust is very abrasive, and so it's going to cause a lot of abrasion to anything in the near vicinity. Which is one of a number of reasons why the US and others is saying, "If we're going to do mining on the Moon we need to have this concept of safety zones around our mining operations." And if entities, if states' commercial entities, set up safety zones is that some sort of quasi form of claim of sovereignty or jurisdiction over an area, and if it is-

**Michael Veitch:**

Running completely counter to the 1967 treaty of outer space which said you can't own outer space.

**Duncan Blake:**

Right, exactly. And you can see how it could definitely give rise to conflict.

**Michael Veitch:**

Is that what the Israelis were doing recently when they crashed the Beresheet lunar vessel into the Moon, it went very badly, a mission they were doing up there - releasing an organic creature basically called, I'll leave it to you fellows to...

**Cassandra Steer:**

Tardigrades.

**Michael Veitch:**

Tell us, please what is a Tardigrade, and what was it doing on the Moon?

**Cassandra Steer:**

[The Tardigrades](#) are also called water bears, aren't they? They're minuscule little life forms that when you get a microscope over them they actually look like really cute little bears with tiny little centipede-like feet. And apparently, they're absolutely everywhere, they can live in water, they can live where there's almost no oxygen, they're probably on our skin, they're probably in your bed. Apparently they're everywhere, and it was actually an Israeli company, it wasn't the Israeli Space Agency that was attempting to land on the Moon, it was a commercial entity.

So it was a really ambitious and exciting project to see if it was going to work. The landing didn't so much fail, as it crash landed. So the lander wasn't able to fulfil a lot of its missions, but it turns out, so one of the obligations under one of our five core space treaties, the registration convention, is that you have to register both in a national registry and also with the UN in and international registry, every launch that takes place, every object that's being launched into space, register its purpose, its weight, its orbital trajectory if it's going to be in orbit, all these kind of things, so that we can have an understanding of what's out there, and who's doing what where.

Also, when you have to apply for a launch license quite often you have to give even more details to the country, to the state that you're applying for a license. This Israeli company did not disclose that it had organic matter on this launch. So there were these tiny little, I think they were freeze-dried, is that right Duncan?

**Duncan Blake:**

Yes. They were in resin, they were packed in resin, but who's to say that the resin would survive a crash on the Moon?

**Cassandra Steer:**

But the thing is Tardigrades are such, yeah, they're such hardy little creatures that maybe they will have survived.

**Michael Veitch:**

Their physical description is apparently what would happen if a mole mated with a dugong and grew lots of legs. I'm sure science-fiction showrunners on Netflix and Hollywood are rubbing their hands with glee at the prospect of 50 years from now Tardigrades taking over the Moon or something like that. It's been wonderful talking to you, just to finish up, Cassandra one of the areas of your work, and it's a nice optimistic way to end up, just give us an idea of good space citizenship as pertaining to your excellent work in this field.

**Cassandra Steer:**

Yeah. Thank you for giving me an opportunity to talk about it because I don't think we talk about the positive side enough. So I'm just really starting this project. It's called *'Law in the Stars'*, and it's about incorporating Indigenous law and governance into our space governance. So we've talked a little bit about the problem of short-term interests or the co-dependency between commercial companies and governments not necessarily leading to really thinking about the long-term impact of our behaviour. Long-term sustainability is extremely important in terms of managing space debris, managing space traffic, hopefully reducing the risk of conflict. But there's not enough of a sense of what does it require of everyone who's active in space? What is it to be a good space citizen, and why should you care?

Well, you should care. I argue that there should be business models that have long-term sustainability built into them, and intergenerational responsibility built into them. Because if you

want to keep operating in this burgeoning, explosive industry, and if you want to keep operating in a national security sense in space with predictability, then we need to be thinking long-term, we need to be thinking about intergenerational responsibility, the impact of our behaviours. The reason I look to Indigenous law and governance, Australian Indigenous law and governance for that is because here's a people with 60,000 years of experience about managing their environment for, not just for survival but for long-term, for intergenerational purposes.

Also, the way that Indigenous Australians connect their sense of identity to country, and that includes water and that includes land and it also includes skies. So their sense of identity, if something goes wrong in an area of country which they're linked to, they are responsible for that. In fact, I would argue that there is already a sense of space citizenship for some Indigenous communities who can tell us they've walked in the stars, they know about the stars. And I want to learn from that knowledge and see how that can be incorporated into the way that we think about ourselves as 21st century space citizens - that we are a part of our space environment, and we have a responsibility.

My daughter Artemis who's two years old, she's going to be traveling through space just to get to London on a suborbital flight. She's going to be possibly looking at going to the Moon. I have a direct responsibility to her, but I also have a responsibility as a space lawyer and a space environmentalist intergenerationally. Indigenous Australians have a lot to teach us about that, and I think there's also a great knowledge exchange possible in terms of providing those Indigenous clans and communities, where there's space-based infrastructure on Indigenous country in Australia, providing them with more knowledge about space activities, and space law, and all the things that we've talked about today because of their sense of connection and the right that they have to have governance over what's happening on their country.

**Michael Veitch:**

What a wonderful note to wind up the conversation today. Duncan, just quickly go over to you, the Woomera Manual, how's it going? When can we see it published? When will it be ready I should say, or published?

**Duncan Blake:**

It's likely to be published in 2022. It was going to be earlier than that but like a lot of things it's been delayed by COVID-19. It's important that we have a period of state engagement because the people involved in developing the Woomera Manual are expressing what they believe to be the law based on their expert opinions. They're not seeking to represent any particular state, and that's part of the success, we hope, of the manual. But at some point we do need to engage with States and say, "Well, what do you think? This is our draft manual. What do you think about some of the difficult questions that we're not sure about? Or perhaps there isn't an answer yet?"

One example, the law of neutrality. When is a satellite neutral, if at all, as a matter of law and perhaps out of bounds? We need to engage with States about that, so that's an important step in the process of developing the Woomera Manual.

**Michael Veitch:**

It comes back to the essence of law that we started the discussion in to hear more about law. Quickly, Cassandra a quick plug for your other podcast.

**Cassandra Steer:**

Yeah, it's great. So it's just called the '[Space Law Podcast](#)', it does what it says, and it's just launched. You can find it on the ANU website for [InSpace](#) - [inspace.anu.edu.au](https://inspace.anu.edu.au), and Duncan is actually going to be appearing on that very soon. The intention really is to cover a lot of the issues we've talked about today in greater depth, and a lot of other areas of space law, and also of other areas of law that impact on space that you may not necessarily think of. But it really is to delve into exactly all these issues we've been talking about today.

**Michael Veitch:**

It's been wonderful speaking to you. Thank you so much Dr Cassandra Steer, Senior Consultant and Lecturer specialising in Space Law and Space Policy at ANU College of Law and Mission Specialist with the ANU Institute of Space. And Mr. Duncan Blake, Senior Research Associate at University of New South Wales, Canberra, and that's the capacity in which you've been speaking to us today.

Thank you very much, it's been wonderful speaking to you here on Conversations on the Runway. And I envisage sometime in the future there will not only be law, and crime, police in space, but the first parking fine to be issued in space. That's one to look forward to. Thank you so much Cassandra and Duncan for joining us today.

**Cassandra Steer:**

Thanks Michael.

**Duncan Blake:**

Thank you, it's been wonderful.

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**See more of Dr Steer's works:**

- ["Why Outer Space Matters for National and International Security"](#), Report for the Center for Ethics and the Rule of Law, University of Pennsylvania Law School, (2020)
- [Who Has the Power? A Critical Perspective on Space Governance and New Entrants to the Space Sector](#), Georgia Journal of International and Comparative Law 48:3 (2020)
- [Conflicts in Space: International Humanitarian Law and its Application to Space Warfare](#), (co-authored with Dale Stephens) McGill Annals of Air and Space Law, Vol 40, (McGill) (2016)
- [Global Commons, Cosmic Commons: Implications of Military and Security Uses of Outer Space](#), Georgetown Journal of International Affairs 18:1 (2017)
- [Sources and law-making processes relating to space activities](#) in Paul S. Dempsey and Ram S. Jakhu (eds), *Routledge Handbook of Space Law* (Routledge, 2017)
- [The Province of Humankind: A Feminist Analysis of Space Law](#), Stacey Henderson and Melissa de Zwart (ed.s) "Military and Commercial Uses of Outer Space", (forthcoming 2020)
- ["War and Peace in Outer Space: Law, Policy and Ethics"](#), co-editor of a volume due to be published in November: (Oxford University Press, forthcoming 2020)
- Space Law Podcast, which will cover different issues in space law every month: <https://inspace.anu.edu.au/news/space-law-podcast>