



## ROYAL AUSTRALIAN AIR FORCE

### Podcast Transcript

#### *Conversations on The Runway* – Space Series Episode 3 – ‘History of Australia’s Involvement in Space’

**Host: Michael Veitch**

**Guests: Kerrie Dougherty and Roger Franzen**

#### **Michael Veitch**

So, at the height of the Space Race of the 1950s and '60s, besides Cape Canaveral, where do you reckon the world's busiest rocket range was? No? Or how about this one? Which country was one the earliest to send satellites into space?

The same country which for years, had the world's largest land-based rocket and weapons test range perhaps? Well, you may be surprised to learn that the answer to all of the above is Australia. Yes, us. We've all seen the movie. We know what the little New South Wales town of Parkes is famous for. Yes, that's right, its annual Elvis festival, but also of course, its mighty radio telescope - AKA ‘the Dish’ - instrumental, as we learned, in the moon landings of 1969. But that's just part of Australia's space involvement, and it goes way back, much further than that, to the earliest NASA missions and even beyond.

What about that big expanse of South Australian desert, where our space story began just a couple of years after World War II called Woomera? But what makes this good place for space? Our brilliant engineers, one of whom I'll be talking to in a little bit? Our excellent facilities? Our geography? Our culture? Or just our laid-back Aussie attitude? "Putting up another launch vehicle, are we, Trev?" "Yeah, that's right, Len." "Any problems?" "No, she'll be right. I mean, it's not rocket science." Well actually, it is. Big time.

In the future, well the potential is enormous, but do we have what it takes to realize it? Australia and space. We've been part of it since almost the very beginning, we just don't brag about it. Well, maybe it's about time we did. So, let's start doing that on today's *Conversations on the Runway*. We have two eminent guests today. Roger Franzen is one of Australia's most acknowledged space experts. He has worked all over the world at the highest levels of space engineering. He headed up Auspace, premier space test facilities at the Advanced

Instrumentation and Technology Centre (AITC). Roger has been admitted as an honorary fellow to the Engineering Australia Hall of Fame, so to speak, and is a life member of the Space Industry Association of Australia.

Roger's joined today by space historian, Kerrie Dougherty, writer and educator with more than 30 years' experience in the space field. Formerly curator of Space Technology at the Powerhouse Museum in Sydney, Kerrie wrote the book literally on our space involvement, and it's called Australia in Space. Kerrie is a member of the faculty of the International Space University, a member of the International Academy of Astronautics, honestly the list of Kerrie's accolades and achievements goes on and on, but (and this is beyond cool), Kerrie has also co-authored, get this, three Star Wars books and a Doctor Who guide book, Kerrie, respect.

Kerrie, Roger, welcome to the Runway.

**Roger Franzen**

Thank you.

**Kerrie Dougherty**

Thank you.

**Roger Franzen**

Well done, Kerrie.

**Kerrie Dougherty**

My secret identity is out. Now I'm in trouble.

**Michael Veitch**

I'm afraid it is, and in fact, I'd love to start off and continue the discussion solely about the books, Kerrie. So, if you will, take us back to how Australia got started in space, and I believe it goes back a lot further than most people think.

**Kerrie Dougherty**

This is right, although I'll start by saying that Woomera, when it was first founded, had nothing to do with space. Nobody was thinking about space when Woomera was first established. What they were thinking about was launching Super V2-type missiles across the Australian desert for testing purposes. But it just happened that Woomera was in the right place at the right time when

the space age was getting started. Because when the United States was planning to launch its first satellite for the [International Geophysical Year](#), they needed to develop tracking stations.

**Kerrie Dougherty**

Woomera was just in the right spot to host two tracking stations for this original satellite program, because anything launched from Canaveral is going to pass very close to Australia on its first orbit - some of its early orbits. So tracking stations at Woomera were a good way to check on whether or not the satellite had achieved orbit initially.

**Michael Veitch**

What surprised me about Woomera was learning about the sheer scale of it. Described as the largest land-based test range in the world. At its height, it was over I think 270,000 square kilometres. It had 7,000 people working there. You look on a map in its heyday, it almost takes up half of South Australia, doesn't it?

**Kerrie Dougherty**

Large chunk of Western Australia as well.

**Michael Veitch**

Is that right? Okay.

**Kerrie Dougherty**

Actually, bigger than the land area of the United Kingdom. I had to work this out once for a paper.

**Michael Veitch**

Did Woomera, and we'll just get to what actually happened at Woomera in a sec, but did it make Australia more of a Cold War player than most people assume?

**Kerrie Dougherty**

Yes and no. Yes in the sense that Britain was certainly developing a lot of missiles here in Australia. Yes, because obviously the United States established [Pine Gap](#) and the [Nurrungar stations](#) in Australia. But Australia in a sense was supporting these rather than, how can I put it? And you might want to chip in on this, Roger, directly participating in some of this work.

**Roger Franzen**

We were simply collaborating. Providing the land mass. But the actual technology at that time was sourced primarily from the UK.

**Kerrie Dougherty**

Yes, it was all overseas.

**Michael Veitch**

We designed and tested some truly exciting sounding weapons systems at Woomera, some with some really wonderful names. I've got a list. There was the Sea Wolf, the Sea Slug, the Rapier, the Sea Dart, the [Bloodhound service to air missile](#), but the one that I really like the sound of is the Black Knight research Rocket. What was that? Either of you can chip in for that one.

**Kerrie Dougherty**

I love the Black Knight, but before I tell you about that, let me just very quickly mention the Bloodhound, because it has a rather unusual claim to fame. It was the first missile that was actually tested using computer simulation.

**Michael Veitch**

What era are we talking about?

**Kerrie Dougherty**

Late 1950s. And the computers that were simulating it, doing the simulation testing, were developed in Australia, and the technology, the techniques for doing that were invented at the [Weapons Research Establishment](#).

**Michael Veitch**

We forget that this was all historically significant for us, but we forget that it was such a cutthroat competition, and a competition of ideologies, and Australia was tangled up in it, weren't we?

**Kerrie Dougherty**

Sorry. I thought Roger was going to say something then.

**Roger Franzen**

No, no. No, indeed we were, indeed we were tangled up with it. Of course, Australia was also the testing ground for Britain's nuclear deterrents, and the extension into Western Australia that

was mentioned by Kerrie actually was part of the [Gunbarrel Highway](#). The distance from the launch site within Woomera to the drop zone over on the northwest cape of Australia was the same distance as London to Moscow, so it was a convenient measurement.

**Michael Veitch**

Goodness me.

**Kerrie Dougherty**

Yeah, that was the basic idea, that the missile that was developed for ultimately the [Blue Streak](#), was intended to be an intermediate ballistic missile that would have been Britain's nuclear deterrent, so capable of striking into the USSR from the UK.

**Michael Veitch**

As Australians, and sorry? Go on, Kerrie.

**Kerrie Dougherty**

I was just going to say that yes, it was very convenient that Australia had a large enough overland area that you could test that missile overland, because if it malfunctioned or came down somewhere, you could go out and collect the bits and find out what went wrong. If you have a test range over the sea, you can't do that.

**Michael Veitch**

Or indeed, I mean, there are very few places in crowded Europe that you could have had anything like this. That's why, I guess, the Russians were at an advantage, then, because they had vast tracks of virtually empty expanses of land that they could do it. Did we, at Woomera, actually have much control over what was happening there? Or were we, as I was alluding to before, pawns in a Cold War game?

**Kerrie Dougherty**

Again, in terms of the work that was being done in conjunction with Britain, technically speaking it was called the [Joint Project](#). But essentially, it was Britain that decided what weapons were going to be developed, what weapons were going to be tested. Australia had a much smaller weapons development program of its own, but it certainly took second place to the major activity that was going on with the British.

**Michael Veitch**

We of course though, did have our very own [Government Aircraft Factory Jindivik](#), target aircraft, one of the first drones from my reading. Is that a fair assessment?

**Kerrie Dougherty**

Yeah, pretty much. It was quite advanced in its day. In fact, Australia sold Jindivik to a number of countries overseas, including the United States.

**Michael Veitch**

Would that have been one of our first weapons exports?

**Kerrie Dougherty**

No, I think we were exporting guns long before that, weren't we?

**Michael Veitch**

Weapons of that calibre.

**Kerrie Dougherty**

I'm not an expert in that area. But certainly, of post-World War II weapons, yes, that would be our first export. Remembering that the Jindivik itself wasn't a weapon, it was a target towing vehicle, so you could test the other weapons on the targets.

**Michael Veitch**

I believe that there was a manned version as well at some stage, is that correct?

**Kerrie Dougherty**

Yeah, that was a thing called the Pika. But it was actually, that's P-I-K-A, not P-I-K-E-R.

**Michael Veitch**

Oh, you rotten Piker!

**Kerrie Dougherty**

That's it. But that was actually developed as the test vehicle for the Jindivik, so it wasn't like it was developed as a manned vehicle that somebody could fly as a weapon or from any other aircraft use. It was actually developed as a test vehicle to make sure that the Jindivik design was aerodynamically stable enough to actually be a remotely controlled vehicle.

**Roger Franzen**

It would have been an amazing OH&S issue if there was a pilot.

**Michael Veitch**

Tell us, I'd love to know, what is your opinion just looking historically at Woomera, what did we learn from it? What was the Australian experience that we took away from Woomera in terms of our self-esteem as a modern industrial nation and our industry?

**Roger Franzen**

Do you want me to answer that one, Kerrie?

**Michael Veitch**

Please, Roger.

**Kerrie Dougherty**

You can go ahead. I'll chip in after you've done your bit.

**Roger Franzen**

Okay. So I think what Woomera showed us is that we were able to coordinate the construction of such a site, but I'm not sure that we learned that much from the weapons development side, which was a bit unfortunate, because if we had, we probably would have retained the full function of Woomera after the British and the rest of the Europeans departed from there. Otherwise, it demonstrated that we were able to operate such a complex site, and today, it's still in old miles about 350 by 450 miles, so you know, it's a big area to manage in spite of the mines.

**Michael Veitch**

And it's not a part of history quite yet. In fact, in the 1990s, it was reassessed as being the only land-based test range left in the western world capable of testing fifth generation weapons systems. Does that still hold true today?

**Roger Franzen**

Yes. It's a massive area, and it is a very busy area for that very reason. It's also therefore unsuitable for space launching today, simply because it is so busy with military functions.

**Kerrie Dougherty**

I was actually going to add to what Roger was saying. Not only did Woomera show that we were capable of managing a facility of that size, Australia actually learned a lot of technologies

through participating in the programs that were going on at Woomera. And we actually developed the capabilities that we could have going on, and developed a modest space program, for example, had the government of the day wanted to do that. It was actually a lot of different technologies that were developed within the weapons research establishment, and its successor, the Defence Science and Technology Organization, that a number of points along the way in our history could have been harnessed to either go into more extensive weapons development systems if government had chosen to go that way, or into space projects.

Something that does have to be remembered about Woomera - and I'll just pick up on your point, Roger (about it's got so much Defence work going on today that there's no time really for space work there) is also that, in fact, Woomera's not well suited for a lot of certain types of space launches. And that's another reason that the European Launch and Development Organization actually finally moved away from Woomera.

**Michael Veitch**

Why is that, Kerrie? It would seem to me, if they can launch rockets in Uzbekistan, why can't they launch them in the middle of South Australia?

**Kerrie Dougherty**

Well, you can.

**Kerrie Dougherty**

It depends where you want to launch them. If you want to launch a rocket into polar orbit, theoretically you can do it from Woomera, although overflight in a polar orbit going north is going to pass over countries that may not take very kindly to Australia flying something over them. So, you can effectively only launch a polar orbit to the south, but it's also too far south to be an effective launch site for equatorial launch. Particularly from the '70s or the end of the '60s into the '70s, satellite communications and a lot of the satellite applications were planning to use satellites in geostationary orbit, equatorial orbit, and to get there in the most efficient manner, you've got to have your launch facility fairly close to the equator so that you can take advantage of the spin of the Earth to give your rocket an extra pull.

**Michael Veitch**

Okay, okay. Roger, do you want to add to that?

**Roger Franzen**

No, that's absolutely correct. The actual capacity of the vehicles in the day meant that they wanted to have that extra velocity. Yes, you can actually launch into geostationary from anywhere on the planet if you've got a big enough rocket, but you lose a lot of capacity.

**Kerrie Dougherty**

Yeah, that's right.

**Kerrie Dougherty**

I'm sorry, go on, Roger.

**Roger Franzen**

Yeah. Interesting point about Woomera. Going back to the comments about London to Moscow, if anybody had tried to test a vehicle of that nature in Europe, it almost certainly would have sent up red flags.

**Kerrie Dougherty**

World War III would have been under way.

**Roger Franzen**

On the adversary side. Launching them in Australia and landing them in Australia of course meant that that wasn't an issue.

**Kerrie Dougherty**

Yeah.

**Roger Franzen**

But today, there is also another aspect that development and growth in Australia's population means that there are too many populated sites down range from suitable launch azimuths from that site, meaning that now, there's too higher risk of us dropping debris on humans and other infrastructure, so it's not suitable any longer.

**Kerrie Dougherty**

Yeah, that's true. Even if you wanted to launch to the south now, Adelaide and the development spreading out from there in South Australia also creates the same problems for a southern polar launch, which is why the Southern Launch Group have now proposed a polar launch facility at Whalers Way on the Eyre Peninsula launching polar launches but in a southerly direction from a

point where it's not going to be passing over any human habitation or any infrastructure that could be at risk.

**Michael Veitch**

I know I'm conflating our space history with our rocket history, but I think they're pretty much linked. What made Australia, back then, a good place for rocket and space research? Was it that geography?

**Roger Franzen**

Yes.

**Michael Veitch**

The fact that we're a western liberal democracy with a stable population and stable governments? Attractive to our bigger allies, United States and Great Britain back then, were we?

**Roger Franzen**

Absolutely. We are a Commonwealth member, so stable government, owned by Britain in effect, and a friend of the US, so it was a logical use of a much emptier landmass in those days. Just to add to the last comment chain as well. Today, we've got Whalers Way going into polar, but also on the north side of the country in Gove, we have Equatorial Launch Australia that is going to be launching into the equatorial belt, and can do polar there. And the interesting point of that one is that the French actually did propose and discuss the notion of moving from Woomera to Gove before they moved to Kourou. And Kerrie probably has a great deal more research on the precise reasons and such like, but for the very simple purpose of catching some of that spin, Gove in those days was a good idea. Today, we have ELA in the north, and Southern Launch in the south.

**Kerrie Dougherty**

They're doing the things that Woomera in a sense can't do now. It's an interesting one, the point about the ELDO, the European Launch and Development Organization wanting to move up to Gove or somewhere in the vicinity of Darwin. Because even as early as 1962, when France developed its own space agency, and they knew that they would have to move out of the French Sahara, as it had become Algeria, and were looking for a new launch site. And Darwin and Broome were actually high on their list of consideration, even though they finally moved to Kourou. So, in fact I think Darwin was number two after Kourou on the list of options.

**Michael Veitch**

Back in those days, was there any tousel over us between the United States and Britain? Because there was some jealousy between those two nations post-war. Did they both have their eyes on Australia for this kind of research in different ways?

**Kerrie Dougherty**

I don't think you could say there was a tousel between them. The British interest in Australia was in the long-range missile testing and other weapons testing. Whereas America had its own ranges to do that, it didn't need to come to Australia to do that kind of testing.

**Michael Veitch**

I just had this nice idea about Australia being the pretty belle of the ball, with the two big boys fighting over her, but perhaps it wasn't like that, we decided we were going with the United Kingdom.

**Roger Franzen**

No, it wasn't quite.

**Kerrie Dougherty**

No, the Americans were more interested in us for our geography, but for different reasons.

**Michael Veitch**

Okay, okay.

**Roger Franzen**

They were also a bit concerned. The Americans were also a bit concerned because of the nuclear technology that was being developed and tested in Australia by the British, which had been shared in part between Britain and the US. The US was actually a bit worried that we might have been porous in the sense of the technology being leached. So they did have an eye on us at that time. A friendly eye, but an eye nonetheless.

**Michael Veitch**

This is not long after the year of Guy Burgess and Kim Philby, et cetera, and I know that there was deep suspicion and hostility between the secret service and security services of Great Britain and the United States. I'm just wondering how much of that spilled out to us. But pivoting to our

space interest, the tracking of the Mercury and the Gemini missions, how did that come about? I'll throw that one open to either of you.

**Kerrie Dougherty**

Well, just go back to what I was talking about early on, when America wanted to develop its first satellite, it put its first tracking facilities in Australia. They were actually managed here in Australia by locals, although the United States paid for them, they were constructed primarily in Australia and managed by Australians. We were doing a good job with them. So, when NASA was created, and don't forget, it didn't exist until October of 1958, it took over a lot of the facilities, which included the tracking stations.

So as it wanted to develop its own programs, the Human Space Flight program, [Mercury](#), [Gemini](#), and [Apollo](#), the Deep Space program, so the first probes to the moon, and out to the planets, and of course, satellites in orbit, a lot of early experimental scientific and application satellites. It needed tracking stations for those different functions. And Australia was geographically placed to work as a location for all of those networks. We'd already demonstrated to NASA that we could do the job by operating these first tracking stations so that when it came time for Mercury and the Gemini, the Human Space Flight programs, Australia was again, it was in the right place geographically, it was in the right place politically, and it was in the right place technically with NASA. They knew we could do the job.

**Roger Franzen**

Australia was mostly friendly as well. For everything that Kerrie has said, Australia was a friendly nation, and we of course had the geography, there was complete technical sense for the location of those tracking sites within Australia. Friendly and the ANZUS Agreement really made it a no brainer to do so.

**Michael Veitch**

Politically and diplomatically, how did the relationship come about? Did America approach us or did we approach them? What was going to be in it for us?

**Kerrie Dougherty**

In the tracking stations? America approached us. Even at the beginning, because America realized Australia was in the right place. So, they approached us: "Would you allow us to put a tracking station in your country?" That was the original contact in 1957. Of course, Australia wanted to be a good ANZUS partner, and secure the relationship by having US assets locally

established in Australia, was actually very happy to have them. Especially when the United States was paying for pretty well all the set up, but Australia was getting the advantage of local people working in the facilities. So there was an expectation of skills transfer, technology transfer, and we got the kudos as well of being involved in space activities.

**Roger Franzen**

Indeed, and that happens still today. Even today, we've expanded those types of agreements, and we have, US have assets hosted on Australian soil in a number of cases and it's a good relationship. It's a positive interaction, and Australia benefits technologically from it. And also, in capability.

**Michael Veitch**

I assume it's not just the ANZUS Agreement that is the glue that keeps this relationship together. There must be more complicated trade, and governmental and diplomatic agreements to this, I would think. Is that correct?

**Roger Franzen**

Yeah absolutely. Yes, in the public domain, Australia has a bilateral agreement with the United States to perform a Space Situational Awareness, and assist that function by hosting sensors within Australia, US sensors within Australia, over on the west coast. It's a very good system.

**Kerrie Dougherty**

And in the same way, since 1960, we've had an ongoing bilateral relationship with NASA for the hosting of NASA's stations. We've also had since 1979 an agreement with ESA, and we've been hosting tracking facilities for the European Space Agency since that time.

**Michael Veitch**

And, of course, spurned to some extent our own industry, and in 1967, we were I believe Kerrie you told me one of the first half dozen or so countries to put up a satellite.

**Kerrie Dougherty**

Yes, that's right. Exactly where you want to place us on the list depends on how you want to categorize who was first doing what particular thing, but yes. We were among the first say half dozen or so countries that launched a national satellite. In our case, we launched it from Australia, but we did do that with the generous gift from the United States of the launch vehicle itself. But the satellite was completely Australian developed, and in fact, it was a bit of an

offshoot of the [Sounding Rocket Program](#) that had been going out of Woomera since 1958. '57, '58.

**Roger Franzen**

Yeah, if I'm not mistaken, we were the third nation to launch...

**Kerrie Dougherty**

No, I will argue you into the ground on that.

**Roger Franzen**

I'm sure you will, Kerrie. But it sounds really good. And the satellite name was WRESAT.

**Kerrie Dougherty**

The French will simply dismiss you with a 'fst' sound. But the name of the satellite itself was WRESAT. That's W-R-E-S-A-T. The W-R-E stands for Weapons Research Establishment, and I do want to say that its official name was WRESAT 1, because the weapons research establishment was hoping that there would be more of them. Because the United States had actually said, "Look, we can give you a lot of these rockets, these particular Redstone rockets. We're not using them anymore. We can sell you a whole lot of them at a really cheap price if you want to start your own space program." So, they were sort of hoping that there would be WRESAT 2 and so on.

But what did it do? Like most early satellites, it was a basic scientific satellite. As I was saying, it came out of the [Sounding Rocket Program](#), which was doing a lot of scientific research of the characteristics of the upper atmosphere. So, what WRESAT did, it had very similar instruments on board, so that from orbit it could take a set of measurements that would compliment the data that had already been obtained through the Sounding Rocket Program in the upper atmosphere.

WRESAT, got to say, didn't last very long. Because of the circumstances of how it came about, they didn't have time to develop solar arrays, so it was only battery powered. The batteries only lasted about five or six days. But in that period, it demonstrated that we could build a satellite that worked, it gathered data that was useful as a comparison with that data that was being obtained from the Sounding Rockets, so it showed that we had that capability to build a satellite. In fact, not just build one, but build one, in what was considered even then a pretty quick time frame, because it was only 11 months.

**Michael Veitch**

And it's up there still somewhere?

**Kerrie Dougherty**

No, I'm afraid it came down.

**Roger Franzen**

No, it will have re-orbited.

**Kerrie Dougherty**

At two months, two and a half months after launch, it came down. I love the thing, there was a doco about it that Weapons Research Establishment created. They said it came down somewhere between Ireland and Iceland. Between the two.

**Roger Franzen**

Yeah, it's important to remember that time within the space industry or space development we were still yeah go ahead. It's important to remember that that time within the space industry or the space development, we were still gathering a lot of scientific information about the space environment, as Kerrie was saying. So, anything that could actually collect information about that environment was of use, the more the better.

**Kerrie Dougherty**

And it's worth pointing out too that that data was dual use data. This goes right back to 1957 and the International Geophysical Year, the very first, Sounding Rockets that both Britain and Australia developed were developed to characterize the upper atmosphere because when you're testing an intermediate range ballistic missile, it's going to cross into the fringes of the space environment. So, you want to be sure that there's nothing in that space environment that's going to cause problems for your missile, and if you happen to have one operationally flying with a nuclear warhead, you want to be sure there's nothing in the upper atmosphere that's going to interfere with that nuclear warhead.

So, there was right from the start, this dual use interest in the data from Sounding Rockets. It had an obvious Defence research purpose but it also had that scientific research purpose, because we literally didn't know above, I think it was about 20 kilometres. That was about as high as you could get a weather balloon before, up to about the Second World War. Anything above that, we

really had no direct data. Sounding Rockets really helped us get that information, that direct information about what the upper atmosphere, the fringes of the space environment were like.

**Michael Veitch**

I love the story, I wonder if it's apocryphal or not, the story of John Glenn passing over Western Australia and the people of Perth. On what was one of the Gemini missions?

**Kerrie Dougherty**

It was on his Mercury flight, the first [crosstalk 00:34:21] Mercury mission.

**Michael Veitch**

And turning on the lights of Earth. Or turning off or on, I'm not quite sure.

**Kerrie Dougherty**

It's not apocryphal, that story is absolutely true, and in fact, the thing I find funny about that story is that when it was first proposed, you know, when they knew that Glenn was going to be passing over Perth at what would be night local time, I'm not sure who put the original proposal forward, but somebody suggested, "Let's turn on all the lights for Glenn," because don't forget the Mercury tracking station was about 60 miles north of Perth, so they felt very attached to the Mercury missions. So, they said, "Let's turn on all our lights for Glenn so he'll see us when he goes over."

And apparently, the mayor of Perth actually thought this was a really dumb idea, because it would cost too much in electricity. However, after Glenn after said from orbit, "I can see these lights down there," and was told by, I think it was Gordon Cooper, the Mercury astronaut who was the CAPCOM at the Muecha Station near Perth. And he said, "Oh, that's the lights of Perth there. They've turned on all their lights for you." And Glenn thanked them from orbit, but then later, he asked for the mayor of Perth to be invited to his victory parade through New York. Apparently, he said to him, "I hope I didn't run up the light bill."

**Roger Franzen**

I have to tell you that I was a young lad living in Perth at that time, and I remember when those lights were turned on.

**Michael Veitch**

No way!

**Roger Franzen**

I'm dating myself there. There was another thing about Perth that probably rankled the mayor. Is that Perth used to turn off the lights, all of the street lights, at one o'clock in the morning for the whole city to go dark.

**Michael Veitch**

I believe the favour was repeated for Andy Thomas years later when he flew over his home town of Adelaide, so there's a nice symmetry there. Roger, we're talking about the past. Going forward, though, is Australia likely to have the same kind of currency, the same importance in large space programs going forward?

**Roger Franzen**

We've got the technological capability to do so, but it hasn't been aggregated into a focused way for too many years. We've been very happy to buy other people's technology and not meet our own requirements. Now, we're in a situation where we have a realization that we need to develop. We've got a lot of running to do to catch up. Perhaps 40 years of sitting on the bench buying other people's kit. That's not to say we can't get there. It just means that we have to take a very much more focused approach. And remember, space technology today is so ubiquitous in its delivery of service to us that people don't ask where it comes from, they just expect it to be there. Like water in the tap, you don't ask where it comes from until it stops.

**Kerrie Dougherty**

Yeah, exactly. Space is really part of the infrastructure. In fact, I like to call it infrastructure in orbit, because the amount of use we make of satellite applications these days, as you say, Roger, it's ubiquitous in daily life. How many people pick up their phone now to get their directions with GPS without thinking in the slightest that that GPS comes from all those satellites that are overhead?

**Michael Veitch**

And in all sorts of areas, and particularly pertaining to a country as large as Australia, are we situated to benefit from all the benefits of what we can do in space? Search and rescue, security, flow, agricultural monitoring. [crosstalk 00:38:13]. Tracking pandemics, bush fires, even things like water basins and dam levels. The list goes on, doesn't it?

**Roger Franzen**

Yes, it does, and the technology today is available for us to be exploiting sensors in orbit mixed with sensors on the ground to provide us a more complete information picture. Exactly as what you said about water. We can measure our water resources and manage them more effectively. We're missing a trillion litres from the Murray-Darling basin. [crosstalk 00:38:48]. Somebody's got it. We'll find that person who's got it. Today, weather, all of our weather comes from satellites, and we don't own those satellites.

**Kerrie Dougherty**

Japanese satellites actually. Well most of them come from Japan or I think even some Chinese satellites we use as well.

**Roger Franzen**

We do. [Fengyun 2](#), the Chinese, the [Himawari 8](#), which is the Japanese, and we still do have the American Go satellites as well that are in a low Earth orbit. We're using everybody else's technology but we have to actually step up and become...

**Kerrie Dougherty**

Another thing which is interesting in that too, people don't realize in a lot of ways, particularly in the remote sensing area - we're using satellites that have been developed overseas, and the sensors that they carry optimized for the kind of conditions in the US or the UK or Europe. They're not optimized for the particular geographical and environmental conditions that we have in Australia. Whereas if we have our own remote sensing satellites, they can be specifically, you know, they can carry instruments that are specifically designed for detecting the spectral signatures of the Australian landscape.

**Michael Veitch**

How does satellite tech aid the ADF in conducting human assistance disaster relief ops and things like that?

**Roger Franzen**

Satellites do this by providing information about where, for example, if there's been a tsunami, that's a good example of a tsunami, understanding where the tsunami has struck over wide areas, doing damage assessment of those areas, and queuing the resources that can be directed to

maximize their utility. That's one classic example of how to use satellite imagery to provide humanitarian aid and disaster relief.

**Kerrie Dougherty**

Similarly, for floods, bush fires as well. You know, we're hoping in the future to really maximize the effectiveness of satellite imagery in bush fire-fighting and prevention as well.

**Michael Veitch**

How does that work exactly? Picks up hot spots? Is it as simple as that?

**Roger Franzen**

Yes, exactly. That's exactly what it does. What you are using is infrared cameras that are in orbit, they can [detect the hotspots](#). Really, it's providing us with a more rapid way of understanding where a fire has started so, again, we can direct resources to put out that fire. That's really the issue. You've got fires that are burning and you need to know where the fire fronts are, so you can see through the smoke with shortwave infrared, but ideally, you'd want to detect the fires before they get out of control and be able to [put them out](#) sooner. So, satellite technology can do that for us.

**Michael Veitch**

Since July 2018, Australia has had an organization dedicated to developing our own commercial space industry, the [Australian Space Agency](#). Now, in every country that we've looked at, in this series actually that has a significant investment in space, the necessity of a strong and a symbiotic partnership between government and industry is essential. Is this how you both see the primary role of the ASA?

**Kerrie Dougherty**

Well, the Australian Space Agency's stated purpose is to grow a respected Australian space industry that increases the national capability, increases high technology jobs, brings other benefits into the community because of the offshoots from space activity as well. And of course, having a space program is inspiring to a country. Seriously, that may not be the number one reason you have one, but it is something that does inspire people to know that their country is up there with the other space faring nations.

**Michael Veitch**

Both of you work in the academic field. Are Australia's institutions doing enough? Doing anything or doing enough to get young people interested in the future of space?

**Roger Franzen**

Can I be controversial?

**Michael Veitch**

Be as controversial as you like, Roger.

**Roger Franzen**

No is the answer. We're trying. We're trying to, but the universities, there's a problem that you need to have experience to be able to teach effectively, and what we don't have, because we haven't done enough of it in country, is enough experienced people to teach. To teach in context rather than just textbook. As Kerrie says, space is so inspiring. If you have kids, you know that kids love dinosaurs, and they love space, and those are the two things just motivate them without constraint. If we want our kids to aspire to the hard STEM type courses that will grow our nation's capability, we have to inspire them with activities that they can aspire to perform.

**Kerrie Dougherty**

Yeah, and in fact not just inspire them to be interested in those fields, but then have careers in those fields that they can move into. There are so many, as you know Roger, so many Australians overseas in the space sector outside the country, and it would be wonderful to bring more of them back home to Australia, to actually bring their experience and expertise.

**Michael Veitch**

Hopefully this is one of the directions the ADF is moving into. ADF in general and Air Force in particular are investing in space, both in terms of technology and particularly education. Sponsoring various fields of space study at such institutions as UNSW. You might know, Roger, perhaps more than anyone, how is Air Force expanding into space? With technology? Preparing our people?

**Roger Franzen**

The most important thing is that [Air Force has been assigned within Defence as the Space Domain lead](#). First of all, there is now a single, much of the US's force, the US Space Force and people have a giggle when they think about the next Netflix program, but it's a very real

requirement. It is a very real environment. The fact is that now that we have a Space Domain leadership within the Australian Defence Force, we can build up the programs to provide career paths for personnel of all uniforms, not just Air Force, and it means that we can start to grip up the variety of different issues that drive our dependency on space, and when you have a dependency, you have vulnerability. So you have to address those vulnerabilities as part of the process.

**Michael Veitch**

Shape, deter, and respond is our Australian Defence model. How does space fit into that?

**Roger Franzen**

First of all, it fits exactly. It's been recently described as the fifth warfighting domain, space. It is contested, congested, and potentially degraded environment. As we put more and more spacecraft in orbit, the systems that we are dependent on in orbit become at greater risk of what's called conjunction events, where literally you've got other space craft bumping into each other.

So, it will get to a potentially overcrowded state and we have to first of all understand what is happening in space therefore. We have to look at what assets we depend on in space. We need to protect those assets, and we need to change policies that will optimize the use of space. Frankly, a space full of debris is a risk to both adversary and friend alike, and all of our civilian services as well. The shape is part of a process of understanding the environment, and then making the decisions on how to optimize our continued use of that environment.

**Michael Veitch**

Being optimistic, what do we do well in space?

**Roger Franzen**

We have some of the world's best image processing and ground-based technology in the world for using, unfortunately, other people's satellite imagery. We are well respected from the perspective of how we use that data and produce something. Going back to Kerrie's earlier comment, that means we're also probably the best qualified to determine what the requirements of future sensors should be that go into space. We are really good at that. And astronomy. Astronomy is space. We are world renowned astronomers.

**Michael Veitch**

We haven't even mentioned what happens at Tidbinbilla, have we? Going back, I was going to ask this before, but we moved on. I'd love to know what happened at [Deep Space Station 41](#)?

**Kerrie Dougherty**

Ah, DSS, or DSIF 41. It had a couple of different designations. It was actually the very first deep space tracking station that NASA established outside the United States. That was established just outside of Woomera. It was the third tracking facility at Woomera. As I was saying earlier about the fact that when NASA was formed, it took over various programs that already existed, and among those programs was some early plans for moon probes that the US Air Force had developed for example. NASA took all of these over and then began its programs to explore the moon. This is even before Apollo of course. And it also had plans to explore, send spacecraft out to the planets. But the kinds of tracking stations that you use for things that are orbiting the Earth, won't actually do the job for tracking something which is going out into deep space. So something that's going to the moon, or into what we refer to as interplanetary space. Or going to Venus or Mars, or somewhere else. Essentially, to track those sorts of objects, you need a network of three tracking stations around the Earth, so that as the Earth turns, at least one of those stations will always be looking in the direction of where that spacecraft is going. Because America's original facility for deep space tracking was at Goldstone in California, it meant that you then had to get two other stations that were a third way round the world east, and a third of the way round the world west. So Australia just happened to fit the job. It needed to be 120 degrees west of Goldstone and that more or less went through the middle of Australia.

**Michael Veitch**

I'm not even going to ask you what the dish got wrong or even the dish got right. Roger, [crosstalk 00:51:22], I know that we missed quite a few significant boats back in the day. You were telling me about the Southern Vehicle Launch program, and what might have been back in the day. But things like the [68th Annual International Astronautical Congress](#), held in Adelaide a couple of years back, that's a sign of optimism, surely?

**Roger Franzen**

It was, it was a huge sign of optimism. It was amazing to be present there, to hear the standing ovation that was given to the announcement that there would be an Australian Space Agency.

**Kerrie Dougherty**

Oh yes, that was just an amazing thing in itself. It was worth the price of admission just for that.

**Roger Franzen**

Which wasn't cheap.

**Michael Veitch**

They should have let you two in free, surely. I'm outraged. I'll be sending a very strongly worded letter.

**Kerrie Dougherty**

I was actually going to say in terms of that too, people forget that we had an International Astronautical Congress in Melbourne in '98. And we had it there for the same reason in fact, that at that time, when Australia had bid for that congress, there was also plans to grow an Australian space presence through the late '80s, early '90s. That congress in Melbourne in '98 was intended to be an expression of Australia coming back into the space fold, but of course unfortunately, things pulled back again not long before that congress actually took place.

**Michael Veitch**

Well, it's a good sign that if you're young and interested, there could be a future. Both Roger and Kerrie, what should anyone interested in becoming a leader in space power operations be looking to be studying today?

**Roger Franzen**

From that perspective, you need to have a reasonable understanding of just the space environment. You don't have to be an engineer or a scientist, but you do need to get the fact that there are atmospheric conditions that you have to be there, that orbits have particular characteristics, you can't just stop satellite over a particular area and have a look. There's a lot of Hollywood physics that sometimes clouds reality. That fundamental understanding is important. And that's provided by universities.

**Kerrie Dougherty**

I was going to say, you need those basic STEM understandings, so that, as you say, you've got that grounding to move into a number of different areas in the space field. Let's not forget, there's also a lot of other fields, like medicine, various fields like psychology, surveying, a lot of other

areas that you could also have a grounding in that can contribute to Defence's involvement in the space sector.

**Roger Franzen**

Indeed. A little bit more on that. Two public programs that Defence is working on are [Project 799](#), and [Project 9102](#). 799 will look to provide Australia its first sovereign surveillance capability from space, and 9102 will help to provide us with our own controlled-by-ourselves satellite communications for military purposes. It's a really great horizon to look at. There's going to be a lot of activity moving on, and right now is the time to start positioning for a role in that industry. Whether it's civilian or whether it's military.

**Michael Veitch**

What do we need to do to meet those challenges?

**Roger Franzen**

What do we need to do to meet those challenges? We need to become internationally equivalent, or at least internationally cognizant of space. When we look in the international market, potentially those companies that are going to provide the assets that we're buying under those projects, they've been at it for a lot longer than we have. They have all of the infrastructure that their government's invested in, and are now being used for commercial purposes. We're not going to try and replicate all of that. But there are definitely niches of activity in Australia that we do need to focus on, and do need to exploit. Artificial intelligence, optical systems, because our astronomy community builds some of the world's best instruments and that can be turned around.

**Kerrie Dougherty**

Optical communication too.

**Roger Franzen**

Yes. Absolutely. We can't do everything. And we shouldn't be trying to do everything, but we do need to focus on some specific areas. The Space Situational Awareness, which is now called Space Domain Awareness, is also an area where we have some excellent technology emerging, and we will be exploiting them.

**Kerrie Dougherty**

And we have great expertise in remote asset operation, which is another area that we hope to take into space in conjunction, for example, with Australia's plan to become involved in NASA's Artemis Program. And actually, get Australian capabilities and hopefully Australian technology into the supply chain and into, operationally as part of the Artemis Program.

**Michael Veitch**

Let's see if Australian industry can grasp the nettle that so often it hasn't done in the past going into the future. Kerrie, the time has come, I'm sorry but I've been putting it off, I've got to give you a minute to talk about the Star Wars books, because oh my goodness. What wonderful cachet you have.

**Kerrie Dougherty**

Oh, they were so much fun to do. I don't know if you know what they specifically were.

**Michael Veitch**

It's the cutaway drawing books. So, you've actually got all this...

**Kerrie Dougherty**

The first two were the cutaway [books](#). One was Complete Locations, which of course brought together all the cutaways of all the best or most interesting locations in the original trilogy and the prequel trilogy, and then the other one was Complete Vehicles, which did the same thing for all the vehicle tech.

**Michael Veitch**

And have you secretly built in your backyard, Kerrie, a working model of the walker? You know, that's what I want to know.

**Kerrie Dougherty**

I will not confirm or deny.

**Michael Veitch**

Terrific, both of you. It's been so wonderful to talk to you about space, Australia, our history and our future. **Roger Franzen** and **Kerrie Dougherty**, thank you so much for joining us on Conversations on the Runway today.

**Kerrie Dougherty**

My pleasure.

**Roger Franzen**

Thanks, Michael, been great.

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