



ORAL HISTORY COLLECTIONS

INTERVIEWEE: Geoff Wyatt

INTERVIEWER: Jo Kijas

PLACE: Sydney Observatory

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TRANSCRIPT

0.00 **JK:** This is an interview with Geoff Wyatt and Jo Kijas on the 3rd of May 2012 at the Sydney Observatory for the Shared Terrain Oral History Project on behalf of the City of Sydney History Unit.

And just to start, Geoff, could I have your full name and year of birth?

GW: Certainly, Jo. Geoffrey Wyatt, and I was born in 1961. According to the Chinese Zodiac that was the year of the ox and according to Wikipedia I think I'm the last of the baby boomers.

JK: Right, thank you. Now, you're senior astronomy educator - - -

GW: Astronomy educator, yes, that's right.

JK: - - - at the Sydney Observatory.

GW: Just Sydney Observatory, no "the".

JK: Right, O.K.

GW: We're a bit fussy about that.

JK: All right. No "the". Well, that's good to know. Just to start to give a bit of context to who you are and who I'm talking to, could

I have a bit of your personal background, where you came from

GW: Sure.

JK: - - - and what are some of those early influences that have led you here?

GW: O.K. I know this will sound corny but my earliest memory of being interested in astronomy came when my brother was given a telescope for his birthday. I think I was about six at the time. We lived at Belmore and we had a typical red brick home and a brick fence around it. So one cold night he sat out on the brick fence and he set up his telescope and, of course, made me go along with him. He pointed his telescope at the planet Saturn and showed me. Now, I was pretty underwhelmed by the view we got through his telescope but I was impressed with the effort that he put into trying to find it. So I started thinking more about that sort of thing and from there it just seemed to blossom, coupled with the fact that my darling dad was a livestock buyer and he used to travel through the countryside, New South Wales, quite a lot and of course during the school holidays I'd get up and go with him.

2.04

That often meant getting up at what I would consider now to be silly times, 1 AM, getting in the car and driving, say, to Moree to get to a sale by 9 AM, things like that. So it would be fair to say in those years gone by we were hooning quite quickly along the dark country roads and I'd sit in the passenger seat and look out and see the Clouds of Magellan and the Milky Way and things like that. So a combination of my brother's telescope and my father's country driving at night are what set me off on this path. Incidentally, my brother became a lawyer for the navy, so he didn't follow science but I did. Now, my particular passion was in science education. I never wanted to specialise in just one particular aspect, so I went to the University of Sydney and became a teacher and while I was studying there I learnt about Sydney Observatory. So basically I came along, harassed them until they finally gave in and gave me a job. That was quite some time ago now.

JK: When was that?

GW: Well, I started here in 1986. Now, originally that was as a casual and I had various positions as a casual, as a temporary, full time, then I left. I've run away every now and then for a bit of a break. I've gone out to Uluru for eighteen months, spent some time out there, and I've been to Japan for quite some time as well so when I came back,

fortunately I was able to get my toe back in the door and now I've become the education officer or senior astronomy educator. I'm very happy where I am and it'll be quite some time before they get me out. I think the only thing that would get me out would be if someone were to offer me a position as a Ferrari or Lamborghini test driver. Other than that, I'm not going anywhere.

JK: Right, fair enough. Now, do you have formal training in astronomy?

4.07 GW: Yes. So, I studied to be a physics teacher, so my background there was physics and chemistry education and then I did some postgraduate study at University of Technology Swinburne. So I've got bits and pieces. I don't have a PhD. Now, some people would say that's what you need to be an astronomer – I disagree. So I do have qualifications. I've got six, I think, all up in various fields but, yes, I have studied astronomy and physics at university.

JK: And I suppose the reason I ask that is I'd like to know what does being an astronomer entail? Help me with that one.

GW: Yes, that's fine. Now, the thing is, of course, I'm not doing research. Sydney Observatory closed in 1982 as a research facility and we just moved from one New South Wales government department to another and we became what was called the Ministry of the Arts and we became a museum of astronomy. That's what I do, so I don't do any research, I'm here purely for astronomical education and entertainment. As a result, as I mentioned, at the moment about a hundred and eighty thousand people come through per year, day and night. Quite a few of the staff here are still undergraduate or postdoctoral students at unis, so they're the ones who are doing research. So quite a few of my colleagues are in South America or they go up to different telescopes around Australia, all over the world, but I don't do any of that here.

JK: We've got a few things to cover but why don't we start with the history of this place then, the Observatory, and we're at the moment sitting in the Russell Room, I think.

GW: Yes, named after the third government astronomer and perhaps the most famous of them all. Right, so the earliest building on this hill goes back to 1806. [break in recording]

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6.11 The earliest building on this hill was indeed Fort Phillip and that goes back to – beg your pardon, that's not correct, I'd forgotten – the

earliest structure goes back to about 1796 or thereabouts but there is some argument over that and that's the first government windmill that was built just outside on the lawn between what is now the Observatory and what was to become Fort Phillip. The colony, as we all know, was pretty well unprepared for such a severe, harsh life down here in the southern hemisphere and such a dry environment and one of the things they had was grain but no facility to process that so the government started a windmill fairly soon after they got here. So 1796 wasn't all that good and the sails were covered in canvass. Now, for a young colony, canvas was an incredibly valuable commodity, so it wasn't long before the canvas was stolen. So a windmill without sails, I don't know what you call it - stick, I don't know - but it was pretty well useless and then commercial windmills opened up not too far away from here so that then stayed here as a derelict building for quite some time. Now, the next major structure to come along was 1806 and that was Fort Phillip. Now, at the time there was a fairly strong fear amongst the colony that there would be an Irish Death or Liberty Boy uprising and they wanted to build a citadel that they could retreat to once that uprising did occur and sort of fight from here. The thing is, of course, that the uprising at Castle Hill took place, I think, about six weeks after they started building the fort. People involved in that were executed or sent wherever.

8.01

So the impetus to continue to build what was an extraordinarily expensive building, the fort, was lost and then with the change of governor pretty much work came to a halt and it was never completed, so only three sides of the fort were ever completed. The next structures to come along, I think by about 1814, was they were starting to send signals, flag signals, from on top of the fort wall, then they built a little cottage on top of that. Then in the 1840s they built a larger cottage that the signal master would live in, who'd developed quite an extensive signal system to communicate with South Head and then on to Pennant Hills and then down to Government house at Parramatta. So they had a fairly extensive signal network, so they built a signal master's cottage on top of Fort Phillip. Next major step, 1858, Sydney Observatory was built. Now, to do that they demolished part of the fort and lost – we appear to have lost anyway – the exact location of Greenway's first non-convict building, which was a magazine. There's a few drawings which tell us roughly where it is but so far the digs to find that have not been successful. So it's out there somewhere but we just haven't been able to find it. So they built the Observatory in 1858 and we've been here ever since, obviously doing astronomy, we've had a very long history. And I think perhaps the most famous of our astronomers – some would argue

about this – was Henry Chamberlain Russell. He was our third government astronomer and he was employed here as a computer - . I'm not sure if he was chancellor but he did take up a fairly significant position at the University of Sydney as well. So he was the first Australian to really do some serious science and we're very proud of what he did. He was a fairly stern man, apparently, and so much to the point that in 1877 he was the target of what the *Sydney Morning Herald* declared as "Australia's first terrorism attack" when he found a parcel on his desk addressed to him; tried to have a look at it, it wouldn't open, so a bit suspicious, checked it very carefully and found out that it was a homemade bomb.

10.23 And he and the gardener/carpenter had got on very, very poorly and that chap was arrested and charged with making the bomb. He defended himself in court but got off. Sadly, it was an unrecorded trial so there are no official court documents on that but the *Sydney Morning Herald* reported on it. So that was from 1877, so we think that's kind of cute that that happened. Fortunately, no one was hurt, of course – it wouldn't be cute otherwise. So since then we've done a lot of work. We've participated in several big sky surveys, mapping the stars, and in 1982 we finished the portion of what we were trying to do and then, as I say, we transferred over to become the Museum of Applied Arts and Sciences, so later this year we actually celebrate thirty years as being an astronomical museum.

JK: And what did the government astronomer do?

GW: Primarily measuring the positions of stars to then calculate the time. Our raison d'être to some extent is the big yellow ball on top of the tower. If you look at the Observatory, it's a magnificent structure and there is a name for the particular type of architecture but that escapes me and on top of the tower there's a large yellow ball. Now, that yellow ball, we crank up the post every day – well, most days – at five to one. It takes about three minutes to get to the top, sits there, and then at one o'clock precisely we just throw a switch and the ball drops.

12.03 Now, that was vital for navigation at sea, going back a long, long time, hundreds of years. Sailors would sort of know the local conditions. They'd sort of sail up and down the coast till they got to a favourable current or wind, turn left or right, whatever. By the way, when I'm talking nautical traditions I quite often talk about the front of the boat, the back of the boat, left and right. That comes of a habit. As I mentioned earlier, my brother's a naval officer, so it is my genetic duty to get every nautical term wrong just to upset him, which I love

doing in a nice way. So sailors knew the currents well but finding your position at sea, north or south, your latitude, is relatively easy. Finding your position east or west is really, really difficult and in 1707 the British government lost in one night something like six ships, two thousand sailors and, more importantly, one admiral, Admiral Sir Cloudesley Shovell, and as a result of this horrendous loss they had the 1714 Longitude Act which they put up a massive prize – I think it was something like twenty thousand pounds in 1714 – for someone that could work out how to find position at sea. This was ultimately solved by a chap by the name of Harrison, that used the idea of keeping accurate time at sea in a chronometer. Now, that's fairly easy to understand. If you've got a good clock and it doesn't lose time, it doesn't gain time, and you know that there's three hundred and sixty degrees in a circle and there's twenty four hours in a day, it doesn't take too much geometry to work out that one hour is equal to fifteen degrees of longitude and you can use that basically to work out how far east or west you are. The problem is that they would very, very accurate chronometers. It doesn't mean that they were perfect.

14.08

What would happen is they might gain one second per day or one and a half seconds per day or they might lose one second per day. That's not a problem as long as it's consistent. If it gains a second one day and loses two seconds the next day, throw it overboard, it's a piece of junk. So after a long voyage from say London to Sydney your chronometer would be out and you needed to reset it and the best way to do that was to have an observatory with a transit telescope like we have to measure the positions of the stars to then calculate the positions of the stars and work out the time but then you've got to communicate that time. So the Observatory was built here on the highest hill in the Sydney Cove area because we had a commanding view of the harbour. So the ships would all be looking up here, they'd see the ball go up the post at five to one, sit there a few minutes and then (snaps fingers) precisely one o'clock the ball would drop.

JK: And that was done manually, obviously by somebody?

GW: Yes.

JK: Would it be done by Mr Russell or one of his helpers?

GW: I'm not actually sure if Russell actually climbed up the stairs or not, to be honest, I don't know. At later stages we did have very accurate clocks in the building connected via an electro magnet to actually

throw the switch but I don't know who it was who actually climbed up there. Now, we've always done it, we do it manually, and to drop the ball we do it very scientifically using the sixth pip on the ABC Radio.

JK: So you really do do it every day?

GW: Yes.

JK: You did it today?

GW: We did, yes. I didn't do it today but, yes, we did it today. We do it probably eighty per cent of the time now because sometimes, to be honest, we can be swamped with work and you look at your watch and it's three minutes to one and you don't have time to race up the tower.

JK: And why do you still do it?

GW: Well, because our purpose, if you like, is we are a museum of astronomy and everything that goes with it in the heart of a twenty-first century city, but we are a nineteenth century building and I think this is a tradition that's well worth keeping.

16.18 Now, when I first started, if we didn't drop the time ball the phone would run hot: people would say "You didn't drop the time ball". "Oh, look, I'm terribly sorry" for whatever reason we didn't do it. I think, sadly, a lot of those keen people have perhaps shuffled onto another plane of existence and people don't ring up any more but we have the tradition and we want to keep that tradition going. The Observatory's been here a hundred and fifty four years and we hope to be here hundreds more years and as long as that time ball is still operational then we will drop it.

JK: And what do you think motivated those people in the past at least - and we're talking about the 1980s and 1990s – those city people, why did they think it was important?

GW: Look, as we all get older we like our traditions, we like our traditions, we like things the way they are; nobody likes change. It was always dropped at 1 PM. People may not have even really known why it was dropped at 1 PM, they just knew it was dropped at 1 PM, so if it's not dropped at 1 PM what's gone wrong? I think we all like our comfort zone. From my point of view, I'm thrilled that we do it and that people notice it because we've got a harbour bridge fifty metres away, the lead up to it just over to the east from where we are. Tens of thousands of people go across there per day. How many of them

take the time to look over and see this magnificent fort, the flagstaff that's on top of it.

17.55

Now, that flagstaff that I'm looking at out the window at the moment is a recreation thanks to the Joy and Bruce Reid Foundation. Now, they built that for us for the sesquicentenary. That tree was chopped down from near Grafton, the Pickaninny Forest. It was given permission by the local indigenous community to bring it down as a message stick and it's a recreation but it's handcrafted. It was put up by traditional craftsmen, all handcrafted, they did the rigging themselves, and what we have there is a spectacular bit of – well, it's a message stick, if you like. And we tell people about not only do we fly our state national flags, indigenous and Torres Strait Islander flag, we have our flags that tell us what's happening in the harbour, what ships were coming in, foreign ships of war, foreign brigs, colonial cutters, all that sort of stuff, and we commemorate arrivals of convict ships with those, we have flags that communicate the phases of the moon, we have flags that tell us today's maximum expected temperature, what constellations, what planets are visible, of course massive special events like eclipses or Transit of Venus which is happening in June of this year, so we communicate from that and it really is our job to keep that tradition going and provide a service. If ninety nine per cent of people going over the Harbour Bridge don't see it, well that makes me sad but the one per cent of people that do see it, yay, I'm there for them and we're backed by the government of New South Wales to keep doing it and that is important. There are cultural institutions all around this country of ours, we've got just over two hundred years of, if you like, European heritage, which is absolutely fabulous, but we've got something like twenty to forty thousand years of indigenous history that we've got to communicate as well and that's what we're trying to do and that's our job and we will never give up on that.

20.06

JK: What sort of evidence and stories do you have of indigenous understandings of the sky and the constellations and how do you build that in?

GW: Yes. Well, there is, if you like – and I don't know if this is the right word – a renaissance of interest in indigenous astronomy. When we think of astronomy we think of Galileo or whoever invented the telescope – probably Hans Lippershey but Galileo did the hard yards so he gets the credit – we think of things like that and then we think of massive radio telescopes like we see out at Parkes or up at Tidbinbilla Tracking Stations, things like that, but that's not the only way of doing things. The western juggernaut that we have – and we

can trace that back, if you like, to that spectacular region between the Euphrates and the Tigris several thousand years ago – gosh, I've gone completely blank – Mesopotamia, silly me – anyway, western thinking can go back that far. It doesn't mean it's the only way to look at things and indigenous people have been living here continuously, passing stories and information down from one generation to the next longer than any other community on this planet, yet how many of us know anything about it? Well, sadly, very, very few. Now, however, we've got people like the indigenous curator at the Powerhouse Museum, James Wilson Miller, and we've got people like Duane Hamacher, who's just completed a PhD at Macquarie University, who were looking at all this knowledge that's out there and trying to bring it to the fore so we can learn about it, share it and keep it because if you have a secret and you don't share it, it's going to be lost. And I'm not saying that all secrets have to be shared. There are certain things, and certainly in indigenous culture, that aren't to be shared unless with the correct people but where possible we want that sharing to occur and thanks to people like James and Duane that is occurring.

22.16

And I'm not a historian and I don't know it all, I've just picked up a few bits and pieces. As we know, the indigenous people in the Sydney area have been through just *horrendous* two hundred years and as a result we don't appear to have a very good understanding of what the local community thought about the sky. There are some rock carvings in the Ku-ring-gai Chase National Park on the Elvina Track and there's some speculation about the astronomical significance of that, but there are other communities around, within several hundred kilometres, that are well studied and are well-known and well-documented. So, for example, the [Wergaia?] people from northern Victoria, we know quite a bit about their astronomy because they were happy to share it; it's been documented and now it's been shared. So, during our programmes here, we endeavour to share some of those stories and we've also got another story from the Murri[?] people up in the southeast of Queensland, for example about the Southern Cross. So in all of our school tours part of our tour goes into our small planetarium. We'll talk about the constellations, the zodiac constellations, because we all know about our zodiacs, you know, "I'm born under the star sign of Virgo" or whatever, we know those, even though from my point of view astrology, they're the bad guys; we parted company several thousand years ago, but they still have a relevance for us in using the stars as a signpost, so we talk about those in the planetarium but then wherever possible we talk about the indigenous perspective as well.

24.08 So there are stories about the Southern Cross. To some indigenous communities it represents the footprint of an eagle. To the Murri people from the very top of New South Wales, the southeast of Queensland, as I mentioned, it represents the eyes of the first man ever to have died and to be carried into the sky by the yowie [mythical creature of Australian outback], so you're looking at the eyes of the first person and the yowie that make up the Southern Cross; the two bright pointers nearby represent cockatoos that lived in the tree that the yowie carried the man's body up into the sky in. So there are hundreds of different interpretations across this land and part of the thing that we're trying to stop is people saying "Oh, what's the Aboriginal story for or word for -?" "No, dude, you've got to understand there's five hundred different communities, they're all different. You can't do that". So we've got stories that we're trying to collect from everywhere and we're trying to tell as many as we culturally and responsibly can. So we get permission for those and if someone says "No, don't tell it", then we don't tell it. So we do that in our planetarium. We have a small indigenous exhibition downstairs as well that talks about Cadi Eora birrung, 'Under Sydney Skies' and we've got some spectacular astronomy related cartoons that talk about the formation of the Milky Way, the phases of the moon and things like that. So wherever possible we include an indigenous perspective and I think people are very happy to learn a little bit about that but they also have that slight "Oh, how come I didn't know about any of this in the past? We know so much about Ancient Greek stories and mythologies but how much do we know?" And that's part of our role: we want to change that.

26.00 **JK:** **And I suppose part of your role, being here still in the middle of this big city, how much do you find that people know about our scientific understanding of the sky and the stars?**

GW: It's a really hard question because astronomy rates very, very highly on most people's radar, not in terms of they don't want to sit down and work out the mass deviations or anything like that or some particular aspect of astrophysics, but most people have some form of genuine curiosity about what's going on in their immediate environment. And the sky's one of the environments that we look at sadly; we're having a negative effect on it. There's no doubt about that and we're trying to sort of make people aware of that as well but people are genuinely curious. Now, for example whenever something unusual happens, our phones and email run hot. The media wants to know about it, the general public wants to know about it. Once it gets onto that intermaweb thing it's there forever and that

can be a bad thing but we're trying to figure out how to use that as a good thing as well. To give you an idea: in 2003, the Planet Mars was the closest it has been – actually, I've forgotten – for thousands of years by just a small percentage but technically it was the closest it had been for a very long period of time or will be for sixty thousand years or something like that. So Mars came closer to us in August 2003 than it's been for something like fifty or sixty thousand years. It comes close every fifteen years – which we call a “favourable opposition” – so we were splitting hairs.

28.02

So what happened was on the internet it came up “Mars will be at its closest for sixty thousand, fifty thousand years” – I forget – “on August 28th” and now somehow somebody put that onto the internet and made up a slide, saying it will be as big as a full moon, which of course is complete nonsense. But you know what? Every August since then that mail travels around the world and we get swamped at the start of every August “Mars is going to be as big as the full moon on the 28th”. Well, a) if it ever is as big as the full moon, start worrying because something has seriously gone wrong with either our orbit or Mars' orbit, and b) no, it was the favourable opposition in 2003. But to get back to that, normally we have something like sixty to a hundred and twenty people come through per night. In a week of favourable viewing in 2003 I think we had something like fifteen thousand people come through. Everybody wants to know what's going on and they want to have a look. They're aware of their environment in the sky but when something sets off that little bit more of an interest above the background hum they really do want to know because it is invariably something that can be explained without too much jargon or too much complexity and it's like “O.K, that's fine”. We see that occurring at the moment. In the next few days there's going to be what we call a “perigee moon”. It simply means that the moon will be full when it's actually at its technical closest distance to the earth, so that means it's going to be something like fourteen per cent bigger than the smallest full moon we see this year and thirty per cent brighter so we're now getting lots of calls and emails about that, so people are aware of these things and they want information and, of course, in some countries there is a cultural aspect to it as well.

30.01

Later this year there'll be a total solar eclipse as seen from northern Australia. In some parts of India, apparently, women are not supposed to go outside during an eclipse. I don't know why but it's a cultural belief and that's fine; as long as no one's being hurt by that then that's great. So we have a cultural interest in what's happening in the sky, we have a general interest in what's going on. A) it can be

beautiful as well, b) it's not too complicated and quite often it's free, so, yes, people love looking up into the sky but the main thing is as long as – I don't know if I'm allowed to say this – as long as we don't bugger it up and in a lot of places around the world that's exactly what's been done.

30.48 **JK:** **O.K, so tell me how that's being done and what's happening in Sydney specifically.**

GW: Yes. I mentioned before that I actually run off to Japan quite a bit in the past and I still do. I just adore Japan: it's in my blood, it's in my DNA, I just love going there. But what breaks my heart every time I go there is their absolute passion for astronomy. You can walk down the street in Tokyo and see observatories on top of schools, on top of private buildings, that put many places in Australia to shame but they don't have the sky for it because it's so horribly polluted. Now, I can walk along the street in the Ginza on a clear night and look up and see one or two stars and that's really disappointing. Out in the countryside, yes, you can always see more but you've got a combination: you're an island, a small island so you're going to have atmospheric conditions work against you anyway but the amount of pollution, whether it be particulate pollution or light pollution or a combination of both, means that there are generations of people growing up there that don't get to see the stars.

32.05 I also mentioned earlier that I went to Uluru for quite some time and I can remember on many occasion young Japanese honeymoon couples crying, looking at the Milky Way for the first time. They could not believe that the sky could look like that and they were that overjoyed they would cry. Now, here in Sydney we're not quite as bad as that. We can still see quite a few stars but it's getting harder and harder: the Southern Cross is looking more like a southern triangle because the fifth brightest star is getting harder to see and the fourth one is getting harder to see as well. So there is a lot of pollution in Sydney but fortunately there are people who are willing to listen and there is the group SOLIS, Sydney Outdoor Light Improvement Society, I think it is – no, I've got that wrong – but they work with councils and so when a new development comes along and they put in "Look, we want to put a fifty million megawatt light at the bottom of this tower to make a beacon shine up into the sky so everyone can see our building", well, a) from an environmental point of view why would you waste that much electricity, b) why would you shine a light up to the sky? If I was to go and say to people "Look, I want to go build a racetrack. Let's face it, I'm a V8 racing car freak", if I wanted to build a V8 racetrack around Kakadu I'd be lynched,

rightfully so. It's there; it's got to be protected for everybody. Well, the night sky is just as important a resource as, in my opinion, Kakadu or any other natural resource that we have in this land. I suggested that to the National Trust several years ago and I think they actually then tried or have done something about that and classified the night sky as a national resource.

34.05

So the stars, they're useful. I mean, we've been using them for thousands of years to work out the length of the year and the Egyptians did this four thousand years ago and they got it to within eleven minutes, which is pretty awesome. We've been using them to navigate by but the indigenous people, again, of this land have been using them for far longer than anybody else to work out the changing of the seasons, when to look for particular stock that's coming into breeding season, you know, dingo pups, tasty young pups, Malleefowl, whatever. So they've been using these as seasonal markers for thousands of years, so for us to come along and shine some stupidly bright light up into the night sky, it's irresponsible. It's wrong, it's irresponsible, it's a waste of energy and it shouldn't be done. So we're trying to get people to say "Hey, look, that's a really good idea you want to light up your building but if you tilt those lights at the base by three or five degrees that horrendous beam of light – if you want to spend the money on it, well that's your business and you want to carbon offset it, that's great – but if you must shine that light up, if you tilt that light by just a few degrees, that beam will stop at the top of your building instead of shining into the sky and ruining the view". And so we are very, very active in doing that and consulting with councils around Sydney, particularly the City of Sydney, to get people to be aware of lighting.

JK: And are there other lighting things that can be done?

GW: Yes. I mean, obviously there's a whole bunch of sensible light fittings that people can use.

JK: I guess I was thinking of outdoor lighting. Is it only outdoor lighting that becomes the issue?

GW: Yes. Well, outdoor lighting is the main thing. For example, if you walk around some parks you'll see these very decorative posts that have got, if you like, a globe on top which is shining light up as much as it is shining down. Why?

36.10

Why not put a reflector on the top of that which will improve the lighting so that people don't trip or fall or whatever at ground level but you don't waste it going up? Now, there are two things that you can

do by that. Well, a) again you can reduce the amount of energy that you need because you're reflecting it down, shining light where you need it and you're not wasting energy by just shooting it up into the atmosphere. So, yes, there are outdoor lighting alternatives, smart thinking, smart lighting if you like that you can employ that's not going to ruin the night view.

JK: And you do see some hope of changing perspectives?

GW: Yes.

JK: Of, yes, both councils as well as developers and that sort of thing?

GW: Absolutely, because once councils, once we approach councils and say "Listen, can we think about this, can we talk about this?" and people go "O.K. Well, that makes sense". So, yes, there have been several building applications in the immediate area that have had to sort of go "O.K. We need to tweak that just a little bit because of the awareness of light pollution", so we're very happy about that.

JK: And what can you see here from the Observatory on a good night?

GW: Yes, on a good night. Yes, well thanks to La Niña we haven't had so many clear nights as we'd like, which is a bit of a disappointment, but let me tell you, on a clear night, even though we're in the middle of four million people, with the telescopes that we have here, the view will take your breath away. Obviously, we're not going to see the faint distant galaxies that are billions of light years away, things like that. People come here because they want an experience.

38.00

It's a magnificent building, we've got very good telescopes, we've got the oldest working telescope in Australia here and when we look through our new telescope in particular the view of Saturn, I guarantee you that a common response is "You've stuck a picture on the end of the telescope" and that's one of the nicest things someone could say to me other than "Here's the keys to my Lamborghini". So the view through the telescope of the moon is awesome, the detail that we can see, the craters, the mountain ranges, the faults, rills, collapsed lava tubes, all sorts of spectacular detail. We can't see where Neil [Armstrong?] walked around and all that sort of stuff, even though we get asked about that a lot to sort of prove that it actually occurred and, of course, the vast majority of us think that's beyond question but people ask and they want to know if it happened or not. Now, we can't see that but we can see all the other stuff on the moon.

The view of Saturn, as I mentioned, breathtaking, the view of Jupiter, awesome, Venus at the right time. Then we've got things like star clusters: young stars, young baby stars just being born. We have other groups where they've just been born but one of them is at the edge of its death already, for example the Jewel Box in the Southern Cross. Then we have the incredibly old stars of globular clusters: just wow. It's like looking at a fine spider web of an early winter's morning, with spots of dew all over it and they're all just glistening in the sunlight. If you can picture that, that's what a globular cluster can look like. Then we have nebulae, where stars are born and where stars die and to think that you're looking at a cloud of gas and dust that's thousands of times bigger than the solar system and at this very instant there are new stars being formed in that cloud and we can see where that's happening, really, it's pretty good and that's a hard thing to beat as far as a job for our staff here, getting to see that and share that with people, and for the general public because you don't have to drive over the mountains or go to Hawaii or wherever.

40.10

You can go to Wynyard or Circular Quay and walk up here and you have a look. It's great on a clear night. On a cloudy night, well, we've done some lateral thinking. We've got our small planetarium so we can show a very nice simulation of what the night sky looks like and then we can talk about, as I mentioned earlier, the indigenous stories and traditional Greek and Arabic stories and then, of course, we've got a 3D space theatre and the space theatre, it's a hoot. We can fly through a nearby portion of our universe and see it very, very accurately in 3D; it's pretty cool.

JK: That does sound cool. You're making me want to come. This project is, as we talked about off tape, about the natural environment in the City of Sydney and the relationship to it. So could you tell me what you think nature is in this context and how people can experience it in the city?

GW: Yes. Well, look, strictly speaking Observatory Hill is not the natural environment that was here in the past, it's very different to what it was like when the First Fleeters got here. The hill has been levelled and flattened and extended a little bit out to the side that the Observatory sits on. Our third government astronomer, as much as I love him, if I had a time machine I'd go back and punch him in the nose because if you look out pretty much any window or if you sail by on the harbour and look up at this beautiful hill you see gorgeous, huge, I think, *macrophylla ficus* or *ficus macrophylla*, Moreton Bay Figs, whatever they're called, huge trees that block our view in almost every direction

but they weren't here originally. We were here first and the third government astronomer went and planted them.

42.03

Yes, they've been there a long time and they deserve to stay there now but he altered the natural environment by planting those. Probably seemed like a good idea at the time and he probably thought "Well, who cares what happens in a hundred years from now?" but that's precisely the sort of thinking that we've got to stop; we've got to think about what will happen in a hundred years from now. But this hill in the middle of Sydney is an oasis and the thing is I don't think many people really know about it. Certainly the exercise people do. I get here of a morning and all I can hear is (claps) as they're punching their punching bags and being yelled at by their drill sergeant or whatever but, hey, the hill's being used. And you see people sitting out there, sunbaking, reading books, we have lots of couples come for lunchtime trysts in our gardens. So the environment is changed a lot for the hundred and fifty four years that the Observatory's been here, and even longer, going back to the windmill which is gone and Fort Phillip, but it's an environment that's altered but it's been like this for a long time and I think therefore it's got its toehold and it should be preserved and it is a beautiful area for the people of Sydney to come and enjoy.

JK: And it has its heritage, both its natural and built heritages you're talking about. I was also wondering about the environment as being perhaps beyond where we put our feet and I think I was reading something about the discussion of the natural heritage of the planet. Is that something that you can talk about, perhaps take me on a journey – well, you have been, really – about what's beyond our land.

GW: All right, O.K. So the big picture. The big picture is that the part of the universe that we can see contains something like a hundred and thirty thousand million galaxies, a hundred and thirty billion.

44.16

From side to side as we look at it it's a hundred and fifty something billion light years across. Now, that's the observable universe that we can see and there are, as I've mentioned, a hundred and thirty billion galaxies within that observable universe. Within our galaxy, the Milky Way, there's two hundred thousand million stars, give or take. At the heart of the Milky Way Galaxy there's a black hole with somewhere between four and eight million times the mass of the sun. There are perhaps as many as twenty thousand stars in the Milky Way Galaxy just like the sun. How many of those stars have a planet just like the earth, where it's not too close to the sun where it's too hot for liquid

water or not too far away from the sun where it's too cold and the water freezes? In other words, this little planet is a very, very, very special place and at this particular point in time we are its custodians. Don't break it. So we do have to look after it. But the other thing is too, what I like is that people can come here and get a sense for just how small we are in the big picture. Yes, O.K, so we've done incredible things, like we've invented Ferraris and Lamborghinis, we've invented telescopes, we've invented frozen meals that we can put in a little box and push a button and a minute later it's ready to eat. Big deal. In the overall scheme of the universe it's nothing, we're nothing.

46.04 However, I think it's pretty cool that we as small, as young, as remote as we are, have got a reasonably good idea of what's going on out there. We don't understand everything and we probably never will and to some extent – and I'm not sure if I've got this right, so if I step on any toes I'm prepared to be smacked around the head – I like the Islamic idea that you can't ever have perfection. I think to know everything perfectly would be heartbreakingly sad, I think it'd be enough to sort of push you over the edge. You can't have perfection. So I don't want to know everything, I don't think we should ever know everything but we do a pretty good job. And we've got a lot to learn, obviously, because we still don't even understand fundamental things like the nature of light. Is it a wave, is it a particle, is it something completely different? Then we have problems explaining the existence of the sun but it's there. So there's a long way to go and an observatory like this one, which is not just doing research – and that's why I really wanted to come here in the first place – I love sitting around, looking through telescopes, talking to people about these general sorts of things. There are a gazillion people out there that are far smarter than I and can explain the Higgs boson particle - which we haven't found – far better than I ever could but I like to talk about the general things, the big picture, where we are, what we can do, what we're looking at and that's the beauty of this Observatory in the middle of this beautiful city. So to me I'm not sure if that answers your question but that's kind of I think where we are. We're pretty small but we do a darn good job of looking out and sort of thinking "Wow, that is a seriously big universe and this is a seriously small, delicate little toehold we've got onto".

48.03 **JK: That is we humans?**

GW: Yes.

JK: Right, absolutely. One of the things that I have read that the Observatory did do from early days was the weather.

GW: Yes.

JK: That's another big thing, isn't it, that people are aware of?

GW: Yes. Look, as we all know, on a first date don't talk about politics or religion. What can you talk about? The weather. Everybody talks about the weather, we're obsessed with the weather. We get weather reports in the middle of the news bulletin and you don't even have to wait till the end of the news to get the weather. I don't understand why we're so obsessed with it, apart from the fact that, hey, what we do is influenced by it and where we live is influence by it and I've got friends that have just moved from Queensland to Tasmania because it's too hot and humid up there. So, yes, it is very important but the Observatory has a very long history of meteorology. To give you an idea, the First Fleet got it underway. So Lieutenant Dawes set up his observatory within, I think, two weeks of arriving down at Dawes Point under the southern end of the Harbour Bridge at the moment and was doing observations not only of the night sky but of the weather. The weather has always been so important to this colony, a young colony struggling with the lack of water. They knew they were in trouble from pretty early on with the lack of water and we still haven't quite seemed to have got that right: our water usage is criminal. So understanding climate and the local environment – therefore the weather – has been one of the big things that we've always done. And in fact this big trophy just over here in the corner of the room - that obviously those listening can't see – was given to Henry Chamberlain Russell in France because of his incredible work on meteorology and we also have some of the first pictures of lightning ever taken around here as well.

50.12

So we've been fascinated with the weather for a long time but one of the shining lights of Australian science, if you like, is the Bureau of Meteorology; their website, web presence, is one of the biggest in the country. Everybody goes to the Bureau of Meteorology for advice on information about the weather. Well, I don't know how many people know this but the Bureau of Meteorology was born about five metres away in the next room here at Sydney Observatory after Federation, so I think about 1908. Then they moved out in 1927 to their purpose-built building just across the top of the hill here and now of course they have offices and instruments all over the place. So from our point of view we look at the Bureau of Meteorology as being like our favourite child that's sort of grown up and eclipsed what we've done,

so we love meteorology and the weather and, of course, these days who isn't talking about it in terms of the bigger picture in terms of climate change. So recently, over the last few years, we've reintroduced a meteorology programme for school students. So we now have quite a few students come here and do up to two hours on collection of weather data, reading the Bureau of Meteorology's weather maps that they produce and making simple interpretations and, if you like, predictions on what the weather is going to do. So we've had, I think, three groups this week alone doing meteorology. So I said earlier on that we're a museum of astronomy. Actually these days we're a museum of astronomy and meteorology.

JK: But that has always had that relationship as you've just been describing.

51.59 GW: Yes, that's right, but for a long time I suppose we just concentrated purely on the astronomy. That's kind of like where our focus has always been but in doing that we've always been very, very interested in the weather. We've had records. If you look at the records for Sydney's weather it goes back to 1858 when Sydney Observatory was built, so we've been collecting the data until the Bureau of Meteorology took over in their own right. So, yes, meteorology and astronomy go hand in hand and it's something that we're very proud of.

JK: And do the historical records of the Observatory talk about the big weather events, the extreme weather events?

GW: Oh, yes, yes, absolutely. There are all sorts of spectacular extremes of weather. We love those because – we don't want to see anyone get hurt, don't get me wrong but we've got models in the room next door of massive hailstones, we've got pictures of the damage that's been done and things like that, so, yes, we have lots of records that indicate the major weather events.

JK: And how as an astronomer, those who are doing the research and things, what do they need to know about the weather or meteorology as it impacts onto their science?

GW: Right. The thing is these days, the main thing is you don't actually spend any time sitting at a telescope, looking through it. So in terms of research we don't look up the Bureau of Meteorology website and say "Oh, my goodness, tonight's going to be cloudy. We're not going to be able to measure" this or that, whatever parameter. Most work is done remotely. So you'll have observatories built on very high mountains, away from as much light as possible, not too far away

from a supporting university, so somewhere it's dark and clear and, yes, absolutely, the weather is going to have an effect there but far less likely than it is somewhere like here in Sydney, just a few nautical miles from the coast; we're much more susceptible to weather here.

54.15 So, for example, observatories on top of Mauna Kea in Hawaii, they might have something like three hundred clear nights per year; far better than what we've got. So weather is still really important, not only in terms of cloud but in terms of the seeing conditions, humidity, things like that. So, yes, we've always got one eye on the weather and one eye on the telescope.

JK: And how did the astronomers manage to stay here until – was it 1982?

GW: 1982, yes.

JK: And then what were the reasons for that eventual shift? Because it's not that long ago, really.

GW: No, no, it's only thirty years in July, I think. We had projects, we had projects that we were working on and mapping the stars. Once you start a project you've got a reason to keep going and we were mapping the stars and our last major project was the Sydney Southern Star Catalogue and we managed to chart the positions of something like twenty eight thousand stars so far but we've got a lot of plates that we never finished to do more measurements from. So I think at the time government decided "Look, the Observatory's in the middle of the city. You can't do your observing from here". So effectively all they did was transfer us from one government department to another and I don't really know why and I don't necessarily want to go into the reasoning behind that. As it turns out, for us it was the best choice because we just adore what we do these days. But in terms of research it was probably at that point in time where you did still spend a lot of time away from cities at observatories, doing your work, which you didn't do it remotely, you didn't have the internet and everything that goes with it.

56.13 And these days, well, you could do your research from my office over here if you wanted to, really. You'd collect your data from a telescope other side of the world, you might go there if you're lucky, get a grant to go over and have a peek, do some work there, but then you'd come back here and spend six months doing the data reduction and looking through the results. So these days you don't have to be at

your telescope and probably back then they still thought that you had to. So "It's too bright in the middle of a big city. Let's change it".

JK: Yes. And in your role here as educators, as in the Observatory, what about something like climate change? Does that get discussed, is that something that you see as important in your role or is it not necessarily relevant?

GW: Oh, no, it's relevant. It's relevant but it's not necessarily my role. My role is even though we talk about meteorology programmes we're doing fairly simple stuff here these days for school students. Climate change, for something like that, then we'd rely, if you like, on the Bureau of Meteorology and the chief scientist, Australia's chief scientist. So again, as I mentioned earlier, there are a lot smarter people out there than I. So we rely on the experts and that's the way science works: if it's not your area then you shouldn't really get involved too much and say too much because there are people out there who have better information, better data, better models. We can certainly question things. I'm not saying that, so don't get me wrong, but we would tend to go down the path of the chief scientist and the Bureau of Meteorology.

58.02 **JK: I suppose I was partly wondering what the impact or influence will be or how it might be discussed in your actual real astronomy and the impact on the broader planet, what we can see.**

GW: Yes, sure. I mean, a lot of the talk about climate change and the greenhouse effect and everything like that came about by looking at what's happening on the planet Venus, so we certainly talk about it at that point in time. And, of course, Venus is kind of like our ugly twin: a little bit too close to the sun, it has a runaway greenhouse effect where energy is able to get in through the cloud layers and absorbed and reemitted but it gets, if you like, stuck within the atmosphere and heats it up. So the atmosphere on Venus is ninety times more dense than it is here. Now, that's pretty uncomfortable. Those classic old war movies you see where the submarine starts to spring a leak and valves start bursting and then it crumples up like a tin can, I think that happens at something like six atmospheres or whatever but the pressure on Venus is up to ninety atmospheres. So, you know, if we were there unprotected, well, splat, all over the ground like strawberry jam.

JK: I bet the kids love that.

GW: They do, yes. I mean, anywhere you can sort of get in that sort of thing or a few of the gases that may be present on other planets, if you catch my drift, they love that sort of stuff. But as a result of this, Venus gets astoundingly hot; it's something like four hundred and fifty degrees, hot enough to melt lead, and it would be fairly obvious, I think, to everybody that we don't want to go down the same path as Venus. Now, naturally we never would because we're far enough away from the sun. I suppose the big question is is the effect that we are having on climate tilt us towards a much milder version of that sort of thing happening and then what's that going to do to global weather patterns. Don't know. So, yes, it is important for us to be aware of and it comes up a lot, in particular when we're talking about Venus.

60.20 **JK: Right. Are there some other things that you think are important to talk about that we haven't covered?**

GW: I think I've probably been on my soapbox long enough. What I want to see happen with Sydney Observatory and the people of Sydney, I want them to be more aware that the night sky is a natural resource. Yes, we do have responsibility to provide lighting on sporting facilities and around the home so people don't trip and everything like that but it must be a balance between what is safe, what is environmentally sound in terms of energy consumption but also protecting that natural resource, the stars. I don't want to see Australians crying when they go out into the bush for the first time and see "Holy smokes, what's that? Is that the Milky Way? I didn't know it existed". I don't want to see that happen to people around here and fortunately, I think because of people like SOLIS and the ability – the enthusiasm, I should say – of councils to listen to SOLIS and the Observatory and people like Dr Nick Lomb who is one of the guiding lights – unintended – of SOLIS, I don't think we're going to get to that stage. But it's like everything: we've got to be vigilant. So I want to see people be aware of the night sky as a resource, I want people to be aware of the indigenous perspective and that the sky's a shared resource. People look up at the sky and say "Oh, yeah, yeah, I know about Virgo. But what do I know about Virgo? I don't know".

62.06 And they might say things like "Well, I've got a heavy heart today" for whatever reason and that for example is a story that relates to the constellation of Libra which dates back to the Ancient Egyptians and where the Egyptians got it from we don't really know. The sky is, in my opinion, one of the greatest multicultural resources that this planet has but we don't know it. Now, you walk down the road and at the

right time of year have a look towards the north into the constellation of Taurus the Bull.

JK: Torch?

GW: Taurus, Taurus the Bull.

JK: Yes.

GW: Now, Taurus is perhaps the oldest of all the constellations. It marked the start of the year in March with the equinox thousands of years ago and again it goes back to Mesopotamia. Well, in that particular part of the sky there's a little cluster of stars that pretty much everybody can see, they're really famous as an open cluster. These days we typically call it M45, the Pleiades, the Seven Sisters. It's one of the most beautiful sights in the sky but it's truly odd. You see, people from all over, around the world give it different names, different stories but typically it comes back to being a story about seven sisters. And we've got an indigenous story downstairs about the Seven Sisters but we've got similar stories from all over the world. Some are slightly different but there seems to be this continuous idea of being seven sister and we don't know why. And I just love the fact that people from all over the world have looked at this group of stars and gone "Oh, yeah, seven sisters". But the weird thing is, if you've got good eyesight, you can typically see nine.

64.00

If you've got average eyesight you see six. Very, very few people that I've ever met look at that group of stars and say "They're seven" but they're called the Seven Sisters, so where does this come from? We don't really know and it's like a bit of a mystery, so I love that sort of thing. And incidentally I think you'll find that most people haven't got a clue that there's a Japanese car driving around that's got a logo on the front; its badge is seven stars, Subaru; Subaru is Japanese for this particular group of stars. So again we've got people from all over the world looking at the stars. We've got stories from indigenous cultures that I've mentioned earlier, we've got the Greeks, we've got the Egyptians, we've got the Romans and we've got the Japanese. Throughout Asia in July there's a lovely story about the stars Vega and Altair where they're born a young girls on opposite sides of the Milky Way River. So everybody on this planet looks up at the stars and tells stories and that is just such a wonderful thing. Why don't we spend more time learning about that? I reckon it's a hoot.

JK: And so that's the shared?

GW: Yes, that's the share, we all share it.

JK: And the right to darkness, that's part of it too, because you can't see them unless - - -

GW: Yes, that's right. And as I mentioned earlier, the right to darkness, I think, it's a nice way of putting it. As I've said, the night sky is a natural resource, it should be preserved. Even if I don't necessarily want it, I can't make that decision for my children and my children's children. They might say for whatever reason – which I can't think of at the moment – they might have an epiphany and say “I must see the Milky Way from the city. Otherwise my life is not complete”. What happens if that becomes a general way of thinking but we've bugged it up for whatever reason?

65.59 So, no, we've got to be very careful – and I don't want to sound like I'm on my soapbox but I suppose I am – I want the night sky preserved. I don't want it preserved to the detriment of society, there's always got to be a balance, but as I mentioned earlier, putting stupendously bright lights at the base of a building and making a beacon in the sky is environmental vandalism and cultural vandalism as far as I'm concerned.

JK: And that's a great discussion to be having right in the middle of this big city where we can still see the night sky.

GW: Yes, yes. So with a little bit of effort – it's always harder to claw things back – I think it's easier to protect the environment before we ruin it.

JK: Yes.

GW: So if people are aware of this now – and they are, fortunately, thanks to several councils – then we can perhaps stop it before it gets too much worse. It will get worse. The city's got to grow and there's going to be some light pollution – you can't avoid that – but as long as people use lighting responsibly you're protecting the environment, the natural environment of the stars, and you're protecting our resources without wasting it.

JK: Thank you. I think that's been quite fascinating.

GW: You're welcome.

Interview ends