

BRIAN GARDINER

Edited transcript of a recording (in 3 parts) of Brian Gardiner interviewed by Chris Eldon Lee at Brian Gardiner's home on the 28th September 2011. BAS Archives AD6/24/1/135. Transcribed by Hillary Bachelder, 16 February 2015; edited (and footnotes added) by Andy Smith, 29 January 2018.

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[Part 1 00:00:00.00] Lee: This is Brian Gardiner, interviewed by Chris Eldon Lee on the 28th of September, 2011. Brian Gardiner, Part One.

[Part 1 00:00:10.06] Gardiner: My name is Brian Gerard Gardiner. I was born in Glasgow on the 18th of February, 1945.

[Part 1 00:00:18.27] Lee: So you are now...

[Part 1 00:00:19.15] Gardiner: 66.

[Part 1 00:00:20.21] Lee: What sort of childhood did you have, where did you go to school?

[Part 1 00:00:24.20] Gardiner: I had a very happy childhood, really. My parents were very good. I was an only child and I went to school in Glasgow, to Hillhead High School, which was an interesting school. If it had been in England it would be called a grammar school in its style. But it was state run but free paying, in the sense that the Corporation of Glasgow, that's the town council, subsidised it. So the fees were one pound nineteen shillings a term in primary school and three pounds nine shillings a term in secondary school, which is probably something like a week's wages for an ordinary working man per term. So it was enough to put a lot of people off.

[Part 1 00:01:04.03] Gardiner: But not the sort of fees you that would pay in a proper fully funded public school. It gave me a very good education, I would say, and I was at the same school from the age of five to the age of eighteen, in the west of Glasgow.

[Part 1 00:01:22.07] Lee: Was university the obvious next step?

[Part 1 00:01:23.25] Gardiner: University was very much the obvious next step. For one thing, my father had worked as a laboratory technician in the anatomy department of the university. So I'd visited him occasionally there, and the university was only a couple hundred yards from the school. So I went to school and university in more or less the same district. And the habit in those days in Scotland was to go to the university in your own town. It seems strange now when every child wants to get away from its parents and travel to distant parts or seek out a good course somewhere else, but in those days the normal procedure was just to go to university in your own town. Why would you leave home when it would cost you more to live elsewhere?

[Part 1 00:02:07.28] Lee: How did you solve the problem of which subject to read at university?

[Part 1 00:02:12.03] Gardiner: Well, I actually applied to do maths. And I simultaneously applied to do, I think, engineering, electrical engineering or something like that. Electrical engineering was a backup in case for some reason I didn't get into the maths course. And what actually happened: the reason that I applied to do maths was because I thought it was the subject I was best at at school, and I had the impression from talking to people that there were plenty of jobs for mathematicians. There probably still are, as much as for anything else, but there certainly were in those days – anything from scientific applications to insurance actuaries and that sort of thing. So I applied to do maths, but when I went to the university careers advisory people they said, 'We won't let you do maths. You've got to do maths and physics or maths and something else.' I could've done maths and astronomy, for example. So I did maths and physics, and then after ... It was a four year course; in ancient Scottish universities they are all four year courses, Glasgow University. And after a couple of years there came a point in which they interviewed you to decide whether you're going to do maths or physics or combined maths and physics.

[Part 1 00:03:21.05] Gardiner: I had sat one of their term exams in which half of it was set by the professor on theoretical physics and half by another guy on more applied physics – theoretical maths rather and applied maths, and I spent most of the exam doing the applied bit. I remember getting 58 out of 60 for that half and I only had time to get 3 out of 60 in the last twenty minutes for the other bit. So when I came to the interview, I wasn't going to be a maths honours graduate so I was told to go ahead and do physics, which I wanted to do anyway. By that time I had become more enamoured of the practical applications of physics and the fact that it allowed me to understand what was going on in the world.

[Part 1 00:04:03.17] Lee: So your first interest in physics came through the university? It wasn't already latent within you from an earlier part of your life?

[Part 1 00:04:09.09] Gardiner: Well it was, too, because at school I was good at maths and science – physics in particular – so I was always half mathematician, half physicist. I mean they're cognate subjects, really.

[Part 1 00:04:23.22] Lee: Were you already showing an interest in the physics of the atmosphere?

[Part 1 00:04:28.08] Gardiner: Well, I was interested in astronomy, more than perhaps the physics of the atmosphere, and I think it was in 1957 I joined the Junior Astronomical Society, which was a British national organisation. Patrick Moore was actually one of the leading lights, even in those days, though.

[Part 1 00:04:47.26] Lee: As a tutor?

[Part 1 00:04:48.26] Gardiner: No, as just a ... It was an amateur organisation of people interested in astronomy. And he was, you know, the secretary or the treasurer or something like that, or possibly president; I can't remember now. But this was before most people had ever heard of Patrick Moore. And I've still got a book by Patrick Moore called *The Moon*, or *Guide to the Moon* or something like that, upstairs, which dates back from those days.

[Part 1 00:05:13.17] Lee: This was before the time that anyone actually got there?

[Part 1 00:05:15.12] Gardiner: Sort of. Well, absolutely, yes. So I was interested in astronomy and things like navigation and ..., which again is a mathematical subject. And positional astronomy, right ascension, declination of stars and so on. I have an old *Norton Star Atlas* dating from my childhood. So it was that sort of interest. So that was not exactly an interest in the atmosphere but an interest in environmental applications of science.

[Part 1 00:05:42.21] Lee: So what was your first inkling that you might have interest in the Antarctic? What was your first brush with the concept of Antarctica?

[Part 1 00:05:50.16] Gardiner: I think my first brush with the concept of Antarctica was through a chap that had applied himself to go South, and that was Jim Jamieson, who was also studying at Glasgow University, probably also a physics student. And he discussed it with me and I began to take an interest in that. And then they have a thing called the milk round, where people like Bill Sloman and later Eric Salmon used to go round the universities giving talks, as other companies and employers did. And I went to, I think it must have been Bill Sloman's talk on BAS, and took an interest in it from then on. And then I had a pal, a colleague, a student who heard that I was interested when I told him about it and to my chagrin he said he was interested in it too, and in fact he doggedly mirrored my every move and applied to BAS as I did. He was helpful in one way in that he knew somebody, or knew somebody who knew somebody, who put us in touch with returned Fid Bill Izatt, who'd been at Halley, and he very kindly laid on a slideshow for us at his home. And I think that was probably where I learnt most about what it was actually like to be on an Antarctic base, and from that moment, I was interested in applying.

[Part 1 00:07:16.02] Lee: So it was a slideshow that turned you onto it, was it?

[Part 1 00:07:18.25] Gardiner: Probably. That was one of the ..., well that and Bill Sloman's talk, I imagine, and of course I went and read some books and so on. I remember when I was interviewed for the job in BAS by Joe Farman and Bill Sloman in the old office in Gillingham Street in Victoria. One of the things that they were interested in was whether you had read up on the Antarctic, because obviously they don't want somebody who's just heard about it yesterday. And the book that I had read was by Béchervaise. Nobody's heard of him now but it's about the Antarctic experiences on the other side of the continent at Mawson and Pointe Géologie and other French places, here it was distinctly windier than it is at any of our bases. So that was, I think that made them think that perhaps I'd bothered to look the thing up.

[Part 1 00:08:10.21] Lee: Was this the part where they asked you about snow on mountain tops?

[Part 1 00:08:13.08] Gardiner: That was a question that I used to ask when I was an interviewer later on, but I don't think they asked me that particular one. They asked me about Earth's magnetic field and how I would measure it and, in particular, they asked me if I'd ..., well I can't remember exactly what they asked me, but we got onto the topic of proton precession magnetometer, they called it a proton vector magnetometer because they were measuring the Earth's magnetic fields, vertical and

horizontal components and so on. And as it happened, my excellent undergraduate course had exposed me to a proton precession magnetometer, which was exactly what they were talking about, so I probably gave a decent answer there. At the same time I applied for two other jobs to show you that I wasn't entirely one hundred percent committed to BAS or perhaps I just thought reasonably I might not get the job, of course. I applied to the Post Office Research Station at Dollis Hill in northwest London, where I would have been studying what they called pulse code modulation, which turned out to be what we would now call digital telephony, which has sort of taken over the world so I would have been in at the beginning of that. And the other job I applied for was with Decca Navigator in what was a precursor to later systems like sat-nav and so on, but it was done with land-based stations, finding your position at sea with a sort of red green and purple signals from three different stations. Interestingly, when I got the job with BAS, I wrote to these other two employers telling them that I wouldn't be accepting their jobs, because they all gave me a job.

[Part 1 00:09:50.13] Gardiner: As tended to happen in those days. That wasn't due to any brilliance on my part. I think if you had the necessary qualifications they were recruiting people. And nobody ever mentioned the duration of the job, apart from BAS of course, who said it was, you know, limited because you went south for two years and came back and wrote up and that was it finished. But the other two, the job was forever, in principle. BAS offered me 997 pounds a year, the Decca Navigator a thousand pounds a year, and the Post Office 871 pounds a year. When I came to retire I joked that they had written back to me and said, 'Thank you for telling us that you're going to the Antarctic. When you have finished your job with the Antarctic, do get in touch with us again and we'll reconsider our offer.' And I thought I might write to them when I retired at the age of 60, but then I realised that all they had to offer me was a job at 871 pound a year.

[Part 1 00:10:47.10] Lee: Do you have any regrets about that decision?

[Part 1 00:10:50.08] Gardiner: Not to take those other jobs?

[Part 1 00:10:51.22] Lee: Mmm.

[Part 1 00:10:52.09] Gardiner: Extremely not, no. I'm very very glad that I joined BAS. What could possibly have been better than the career I had with BAS?

[00:10:59.23] Lee: Apart from the extra three quid, what swung it?

[Part 1 00:11:02.24] Gardiner: I think it was an opportunity of a lifetime. I mean, it sounds like a cliché but it was .... It was what one said in interview when asked why did you want to take this job, is the cliché that it was a way of combining something interesting and adventurous with an application of your qualification. So you weren't giving up your physics as you would have done if you'd just gone to do exciting work in some totally different field. You would still keep your CV going, but you'd have an adventure of a lifetime at the same time. They were very clear in the interview that it was ..., there was a lot of mundane work in it. They said, 'How did you feel about washing dishes?' for example, and I said, 'Well, I think I've had enough academic stuff for a while, I'd be quite happy to wash some dishes.' For all I know, that got me the job.

[Part 1 00:11:53.13] Lee: Did you get the sense that it was a bit of a foregone conclusion, just a gentleman's chat, or was it, were you being interrogated?

[Part 1 00:11:59.18] Gardiner: I was being interrogated, I think. I think they wanted to know, I'm sure they wanted to know because I've sat on interview boards, subsequently, myself. They wanted to know whether the person would, A, be suitable to live on base from a personality point of view, would other people get on with him? And would he be happy in himself? And on the other side of the coin, would he be capable of carrying out the job and repair the instruments and keep them going and be diligent at the work? I mean, that's what you want to know when you're interviewing a Fid. Personality, on the one side, and the technical on the other. We used to say when we were interviewing Fids that, if you had somebody who was pretty good on personality and adequate on technical, that would be fractionally better than somebody who was more than adequate on technical but only barely adequate in personality. In other words, we would put personality slightly ahead of technical, but only just.

[Part 1 00:12:56.17] Lee: What did you make of the chaps on the other side of the table?

[Part 1 00:12:59.20] Gardiner: Well, it was Joe Farman and Bill Sloman. I thought they were competent and mature and shrewd. I didn't have any reason to suspect otherwise. Bill Sloman I could tell was a good people person, in the sense that he understood how to do an interview. I mean, for example, he got me onto something to do with my childhood and my upbringing, and I had said, by way of explanation of something, that my parents were quite old when I was born. And he said, 'How old?' And I said, 'Well, they were both in their forties.' And he said, 'For goodness sake, that's not old.' And he wanted to see if I bridled or had a sense of humour. So I said, 'Well, you know, at least it was older than the parents of my peers as it were,' but I saw the joke. Sounds like a trivial point now, but in an interview, you want to see whether the candidate, how the candidate reacts to being joked with or laughed at or what have you.

[Part 1 00:14:01.00] Lee: Good sense of humour?

[Part 1 00:14:01.28] Gardiner: Good sense of humour, GSOH.

[Part 1 00:14:04.23] Lee: Yeah. So the training ... What was the job you actually applied for? Were you applying specifically for a particular post, or...?

[Part 1 00:14:11.21] Gardiner: It was called a geophysicist, and it was to go to either Halley, Halley Bay it was called then, or Argentine Islands, to do geophysical ..., to make geophysical observations. To be honest, I can't remember now what it said in the advert, but I knew that I was going as a physicist. I mean, Jim Jameson had told me what he was applying for and given me a flavour. Bill Izatt was a physicist I think, at Halley, and had done a similar sort of work so I knew the sorts of work that was going on at Halley and Argentine Islands and what I was likely to be in for. So I applied specifically for the job of geophysicist.

[Part 1 00:14:49.11] Lee: But you needed more training, I guess?

[Part 1 00:14:50.26] Gardiner: Correct.

[Part 1 00:14:52.07] Lee: And you ended up in the Shetlands?

[Part 1 00:14:53.28] Gardiner: Well, the training was based in Edinburgh. We went to the BAS Geophysics Unit as it was then called, which was in a little side building attached to the Physics Department of Edinburgh University in Drummond Street. And from there ... Joe Farman was in charge of that unit then, and he sent us to various places for training, including Shetland. In Shetland, we went to the Lerwick Geophysical Observatory up on the hill. It's just a mile or two, maybe three miles out of Lerwick, up a hill, which is a Met station, meteorological station and geophysical observatory combined. And the superintendent there at the time took us around and showed us the different instruments and gave us detailed ..., gave us the manuals and things to read, but gave us detailed instruction on how to operate the instruments. Joe Farman in Edinburgh gave us the manuals, but he didn't really do the hands on training as I remember, not much anyway. He would ask questions; he would leave you to read for a bit then come and ask you a searching question which you would only know the answer to if you got to page 37. But in Lerwick we had hands on practice at making magnetic observations with traditional instruments where you looked through a telescope at a magnet hanging on the end of a quartz fibre and all that kind of stuff.

[Part 1 00:16:25.07] Gardiner: And we also were shown the Dobson spectrophotometer in Lerwick – they had one there. We were given instruction and practice on that. Then we also went to Kew Observatory, to learn how to work the Angstrom pyrhelimeter, which was another radiation instrument. And we went to Hemsby, near Great Yarmouth, to the Met Office radio-sonde training school, where we went through a formal training in launching radio-sonde balloons for measuring pressure, temperature, and humidity, and all the standard procedures for logging these things. This was long before the days of computers as we know them, so it was all done by hand with charts and rulers and pencils and connecting up lines on a graph and so on.

[Part 1 00:17:11.14] Lee: Was it fun? Or did you have any second thoughts about it?

[Part 1 00:17:14.22] Gardiner: It was fun and I didn't have any second thoughts at all. It was all a bit of laugh. I mean, there were several of us at different stages. There were basically three of us that went around and then we joined up with some others that were labelled as meteorologists going to the same stations.

[Part 1 00:17:31.18] Lee: Well, you trained with Brian Gilbert and Jim Chalmers?

[Part 1 00:17:35.16] Gardiner: That's right. And there was also Lewis Philp, who was a Met man. And I forget who else now, Dave French, perhaps? Pete Mountford? I can't remember which others.

[Part 1 00:17:47.10] Lee: Did any of those stand out as particular memories, those chaps?

[Part 1 00:17:50.26] Gardiner: Well, I remember them all. I remember Lew Philp; he was a little bit older and had been in the Army and he was a very practical, fun sort of guy who could turn his hand to anything, a reliable sort of person. Brian Gilbert of course, I remember a great deal because I wintered two winters with him, and he was my close colleague and companion throughout all of that time. So I remember him very well. I got on fine with him.

[Part 1 00:18:17.16] Lee: What were his qualities?

[Part 1 00:18:19.05] Gardiner: Brian Gilbert's qualities? Similar to my own in some ways I suppose, easy-going person full of fun, a little bit zany, and the same sort of size and weight as me in a sense. So we were the two Brians in a sense, almost like twins sort of. When we were on base, there used to be a graph on the wall of people's weight. We had a big weighing machine; it was a steelyard, you know one of these ones where you slide the little weights along the rack. And the graph on the wall had all, I think there were twelve of us on base. I can't remember if we divided evenly, but there were the Titans and the Diddymen they were labelled because the distribution was bi-modal, to use a statistician's term for it. There were two distinct groups. The six foot six guys who could lift one of the others under each arm as it were, and the small, lightweight ones, of which I was obviously one. I think I was about nine stone four in those days. I'm now more like ten stone seven as it were, but that's just the ravages of age.

[Part 1 00:19:31.06] Lee: So the fact that you had a slight build, I guess even then, that didn't go against you as far as Fids were concerned, because there's a lot of physical work, isn't there?

[Part 1 00:19:38.01] Gardiner: There is quite a lot of physical work, but we were all young and fit. I mean, the physical work, I would say a lot of it was digging snow, and a light man can dig snow just as well as a heavy man. I suppose the time when the heavy men came into their own was in stevedoring, unloading the ship. There were times, certainly, when if we were in one of those cases where they're unloading gravel and sand bags and everyone gets in a line and passes from one to the next one and you're stuck in the middle. I used to find that quite heavy going sometimes. But otherwise, young and fit men are perfectly capable of doing whatever's put in their way.

[Part 1 00:20:18.00] Lee: Where did the radio-sonde training come in?

[Part 1 00:20:21.11] Gardiner: The radio-sonde training came in on base because we launched a radio sound once a day, at quarter past eight in the morning. It was really a twelve GMT flight to be sent into the world network of meteorological observations, and Argentine Islands was what they called kitchen time, was GMT minus three hours. So it was ..., the flight was centred on nine a.m. kitchen time so we launched I think at eight fifteen in the morning, with a hydrogen balloon, in those days. It could be helium now. And when we were trained we thought we were supposed to be ..., the physicists would be maintaining the electronic equipment, which was called a Cintel. It was a valve piece of equipment. We didn't realise we were going to be Met men as well as physicists and we knew we would probably fly the flights because that

was what we had been trained to do, but what it turned out when we got on base was that we were all supposed to do meteorological observations, surface observations, with ... we were reading the Stevenson screen for temperature, and cloud types and heights and all that kind of stuff, which was fine, but nobody had ever trained us in that so we did a crash course by being taken around by one of the existing Met men.

[Part 1 00:21:40.18] Lee: Oh, the handover you mean?

[Part 1 00:21:41.25] Gardiner: At the handover we were taught the difference between stratocumulus and stratus and all that kind of stuff, which was fun. But it was, meant that we were quite busy when we arrived on base – more than we had expected – so that was fun.

[Part 1 00:21:55.11] Lee: We haven't quite got you there yet, because...

[Part 1 00:21:58.03] Gardiner: Of course. We're still in Lerwick or somewhere.

[Part 1 00:21:58.24] Lee: We're still training, aren't we?

[Part 1 00:22:01.02] Gardiner: We are.

[Part 1 00:22:02.02] Lee: And I was just wondering how you found out where you were going to be sent?

[Part 1 00:22:04.26] Gardiner: Where we were to be sent in the Antarctic?

[Part 1 00:22:08.18] Lee: Yes, yeah.

[00:22:09.21] Gardiner: That was quite curious, actually, because Joe Farman has sort of a waggish sense of humour. The plan was that two of us were to go to Argentine Islands and one to Halley Bay because that was what was required to complete the complement at each station. And we were told by Joe Farman coming along with some manuals, some instruction books in his hand. One was a book on aurora, technical description of aurora, and he thumped Jim Chalmers on the head with that. And then he had two copies of an instruction manual on seismographs and he thumped Brian Gilbert and me in the heads with those and didn't say a word and we deduced from that that Brian and I were going to Argentine Islands, because there was no seismograph at Halley, being on an ice shelf. And Jim Chalmers was going to Halley with the aurora which is observed at Halley with an all-sky camera.

[Part 1 00:23:13.07] Lee: So you were beginning to realise that Joe Farman was not the most orthodox of men?

[Part 1 00:23:16.24] Gardiner: Not the most orthodox of men, but then I'm not the most orthodox of boys, either. So we hit it off quite well.

[Part 1 00:23:24.19] Lee: You became friends, you did?

[Part 1 00:23:25.21] Gardiner: Indeed we did, yes. When he retired, as I pointed out in the speech that I gave, I've been trying to solve the problem of Joe for twenty four



years I think at that point, which was forty percent of his life and more than half of mine. So I spent more time as a colleague of Joe's than practically anybody else in the world really.

[Part 1 00:23:52.23] Lee: Tell me about the journey south.

[Part 1 00:23:55.23] Gardiner: The journey south? Well, I sailed from Southampton on the *Perla Dan*, which was a ship chartered from Lauritzen Lines. Traditionally these ships were used for taking cargo to and from Greenland and so on, from Denmark. It was registered in Esbjerg. And when we first joined, as I understand it, you're not allowed to have more than twelve passengers on board a ship or you get yourself into a different insurance class. It costs much more marine insurance. So they had to sign us on as supernumerary seamen. But of course, it was all in Danish and I sometimes said that as I signed on in Danish as a sailor and never signed off again, as far as I can remember, I'm probably still in the Danish merchant navy. But then the same was true of the *Biscoe* and other ships that we sailed on. Everybody had to sign on as a seaman.

[Part 1 00:24:52.29] Lee: How was the voyage?

[Part 1 00:24:54.15] Gardiner: The voyage was very enjoyable. I mean, it was a bit of a holiday in a way because you were sailing through the tropics and there were strange birds landing on the ship and dolphins and flying fish and all that kind of stuff, and not a great deal to do, other than eat and drink and lie about in the sunshine. There used to be a ... The Danish crew were very good. There was a huge bosun, mammoth great man who would come up to you and grab you by the arm in a vice-like grip and say, 'You come drink with me.' And you'd say, 'Yes, I'll come drink with you.' In those days, I don't know if it's quite so true nowadays, the bosun on a ship had to be a powerful man because he ruled more by the threat of fisticuffs than by command, as it were. I remember one time, I think it was on the *Biscoe*, the lamp trimmer, who was ... – that was one of the posts beneath the bosun – appeared one morning with a black eye. And somebody said, 'What happened to him?' 'Well, he sort of fell out with the bosun and the bosun reminded him who was in charge.' I'm hoping it's not like that nowadays, but I don't really know. I think that was how it was yesteryear.

[Part 1 00:26:12.28] Lee: You called at Montevideo, Monte; sorry I can't even say it. You called at Montevideo?

[Part 1 00:26:17.26] Gardiner: We called at Montevideo. Montevideo was called Montevideo because the first person that, from the west that went there saw a little hill, thought it was a mountain, and said, 'I see a mountain. Montevideo.' There are buses to it and even they don't call it a mountain; it's called Cerro, C-E-R-R-O, which is just the hill. I've been up the hill in Montevideo. Yes, we did spend a few days in Montevideo. That was quite an experience in itself.

[Part 1 00:26:48.10] Lee: In what respect?

[Part 1 00:26:49.22] Gardiner: A very different culture. I remember walking off by myself. I don't know how I'd had the temerity to do this – I wouldn't do it now –

walking off into the streets and exploring up the suburbs and whatnot, and just finding out what the place was like. And I remember trying to take a photograph of some guy in a uniform and him wagging a finger and saying, 'You don't take photographs of men in uniform.' But I got into a nice little conversation with him with my primitive Spanish that I'd previously picked up on holiday in Spain. But Montevideo was a fascinating place. We subsequently, well maybe we, I'm trying to remember when it was now actually; it must have been when we came out. Brian Gilbert and I tried to sell some stuff that we didn't need. I had a camera and he had a pair of binoculars and we'd already got better ones from the Falklands. And we get into a little fun game with one of these shysters who wants to buy your camera, and I think I asked for ... He wanted to know how much it was and I asked for two hundred and sixty five dollars or something like that. It was all in American dollars. But he agreed right away, and I thought, 'There's something wrong here, if somebody agrees right away.' So he handed me the money and I counted it and it was two hundred and sixty three dollars which was two dollars short. And I said, straightforwardly, 'It's two dollars short.' He took it back and said, 'Oh, I'm sorry,' and handed me back the correct sum, except that it was only about eighteen dollars when I counted it. He'd managed to stick a couple of hundred or two fifty or something like that into his pocket. And so I think we were lucky to get away with our lives. We still had our cameras at the end of it.

[Part 1 00:28:33.10] Gardiner: Somebody else tried to do the same on the *Biscoe*, they came on board the *Biscoe* and did the same trick and had to run for it, trying to buy somebody's radio off them and so on. So it's a fun place, Montevideo, and anywhere else in South America, but you have to keep your wits about you.

[Part 1 00:28:52.12] Lee: So did Port Stanley seem rather more civilised when you got there?

[Part 1 00:28:54.27] Gardiner: Port Stanley is civilised in a different way. Port Stanley is ..., I don't know if everyone would describe Port Stanley as civilised. In those days, it was a very small place in a way. I mean, there were only two thousand people on the islands: a thousand in Port Stanley and a thousand out in the Camp. They called it the Camp, all the sheep stations out there. I think because it's short for *campesino*<sup>1</sup>, which was the original Spanish word for the bondu, as it were, out there. So it was a lot of buildings with corrugated iron roofs and that sort of thing. So it was another little special place on its own, a very tiny and closed community where everyone know everyone else. And they all knew what each other were up to and so on. So it was far from being civilised in the sense of Paris, say, or something like that. But civilised in some ways, I agree, compared to Montevideo. You were less likely to be mugged in Stanley than you were in Monte, I think.

[Part 1 00:29:58.07] Lee: What happened to you there? You had to prepare yourself even further to go South?

[Part 1 00:30:01.14] Gardiner: In Stanley, in those days, whereas nowadays we kit everyone out in BAS in Cambridge, in those days it was all done in Stanley. There

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<sup>1</sup> *Campesino* in Spanish means peasant. The Camp is named after *campo*, the Spanish for countryside (*Wikipedia*).

was a Stanley Office run by Miriam, the unreplaceable, irreplaceable Miriam Booth, I think her name was.

[Part 1 00:30:18.14] Lee: Booth?

[Part 1 00:30:19.09] Gardiner: Was it Booth?

[Part 1 00:30:20.05] Lee: You tell me.

[Part 1 00:30:21.19] Gardiner: I think it was Miriam Booth. I just know her as Miriam, but I think it was Booth. Everyone knows her anyway. And they had a clothing store there. The thing that I remember about that was that on the list of kit, you were supposed to get three pairs of Army battle-dress trousers – trousers comma battle-dress flannel, as it were, which were warm. My ..., I was asked for my waist measurement which was thirty inches in those days. They said, 'We haven't got any thirties. We've got one pair of thirty twos, and we can give you two pairs of thirty fours.' So I spent the next two years with trousers that had to be tightly held up with a belt, as it were, because they were four inches too big for me, although I did spend quite a bit of my time on base wearing jeans anyway.

[Part 1 00:31:08.20] Lee: And you set off South then, this time on the *Shackleton*. Is that right?

[Part 1 00:31:12.18] Gardiner: That's right. I spent about a weekend in Stanley in the inimitable Ship Hotel. I can never remember whether it started as the Ship and became the Upland Goose or the other way around, but it was that hotel<sup>2</sup>. That was quite fun. You talk about civilised; it was pretty uncivilised in some ways and there were no ..., there was no lock on our bedroom door. And there were people fighting with knives in the corridor in the middle of the night, so they were probably not from the Falklands. I dare say they were just seamen that had landed, but it was a fun place. So I spent a week in the Ship Hotel and then we got on the *Shackleton*, which was eleven hundred tons; it was quite a small ship compared to some of the others, and we set off across the Drake Passage to the Peninsula. We spent a little, I can't remember how long, but probably about a week or so traipsing up and down between Elephant Island and Clarence Island, jocularly referred to as the Elephant and Castle. So you'd look out of the port hole and see Elephant Island and then we'd turn around and look out half an hour later and you'd be going back up to Clarence again, doing geophysical surveying, marine surveying of some kind. And then ...

[Part 1 00:32:28.14] Lee: Were you involved in that, or were you simply a confused passenger?

[Part 1 00:32:31.12] Gardiner: A confused passenger. And then we eventually made our way down to Argentine Islands. I forget, I've got a vague feeling that we called in at one or two places on the way, I think Port Lockroy, but it was uninhabited. These were visits where they sometimes went to an old station to see whether it needed repair or boarding up or that sort of thing.

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<sup>2</sup> The Ship Hotel was renamed the Upland Goose Hotel in 1969 (source Lily Bradshaw weblog).

[Part 1 00:32:52.27] Lee: So you did two seasons at Adelaide? Argentine?

[Part 1 00:32:57.02] Gardiner: Argentine Islands. I did two years at Argentine Islands. I arrived at Argentine Islands I think in mid-January 1968, having sailed from Southampton in November '67. And then I finally left Argentine Islands, it would be in January in 1970 then, two years later.

[Part 1 00:33:16.26] Lee: Was it as good as Bill Izatt's slides had led you to believe?

[Part 1 00:33:20.19] Gardiner: Well, Bill Izatt's slides were of Halley Bay. So it was a very very different place. Halley Bay was your vast expanse of white ice shelf and everything in those days was quite buried. The old base was well down. So that was one form of existence. Argentine Islands was completely different. It was a wooden hut, or several wooden huts, built on rock, and with a beautiful what you might call Alpine scenery looking across to the mainland, with pink sunsets on the glaciers and all that kind of stuff. So Argentine Islands was a beautiful place compared to the boring expanse of Halley. Of course, the Halley people see it a different way and see it as the true south and Argentine Islands as being somewhere up the 'Banana Belt'.

[Part 1 00:34:14.24] Lee: Were you happy there?

[Part 1 00:34:15.06] Gardiner: I was very happy there. Argentine Islands is at sixty five and a quarter degrees south, so it's not quite over the Antarctic Circle. And my, I think it was my first summer there, or maybe it was after a year, I can't remember now I think it was maybe after a year, we had a tourist ship. I think it was possibly the first tourist ship to come down, a Russian ship I think with Americans on board. And I remember them, when they left us saying, 'We're going down to cross the Circle, the Antarctic Circle, at sixty six and a half south.' But they were back within about twelve hours and there was no way they got to the Antarctic Circle, although they were told that they had because the ship's captain had a sceptical view of sea ice and didn't want to go any further than he absolutely needed to.

[Part 1 00:35:02.01] Lee: Was this the *Navarino*?

[Part 1 00:35:03.01] Gardiner: It might well have been the *Navarino*, yes. That would be in the '68, '69 season then<sup>3</sup>.

[Part 1 00:35:12.10] Lee: Were you surprised to see tourists floating around the Antarctic?

[Part 1 00:35:15.14] Gardiner: Well as I said, I think they were the first tourists either to come to the Antarctic or to come to our station, certainly. Probably the first tourists in Antarctica at all, I think, maybe<sup>4</sup>. In that sense, we were surprised. I remember one chap on base, Richie Hesbrook, one of the titans, a six foot six guy from Church Stretton in Shropshire, farmer's son but trained as a polymer chemist. He was surprised in more ways than one because with the number of people on base with some extra people in the changeover, the bunk rooms were full and he'd gone up into

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<sup>3</sup> The *Navarino* visited the Peninsula in February 1968 (see *Chronological List of Antarctic Expeditions* by R. K. Headland).

<sup>4</sup> Tourists went to the Ross Sea a month earlier, January 1968, in the *Magga Dan*.

the loft to sleep, and it was quite hot up there, so he was naked. And he swung down with his great strong muscles out of the hatch only to find himself staring at a woman coming off the ship up the corridor, and had to do an athletic leap back up into the loft again. And I think it was he who said to me that he was slightly disappointed that there were tourists because he'd wanted to be able to say that he hadn't seen a woman for two years. And unfortunately I think she came halfway through his term, or maybe it was in the season when I arrived, actually, in early '68. But it would be halfway through his two years, that's probably right.

[Part 1 00:36:34.07] Lee: So you were even more surprised that these tourists came to your base to have a look round.

[Part 1 00:36:37.26] Gardiner: Well, it was a natural thing for them to do because if you were planning, if you were a shipping company planning tourism, you'd naturally go down the Peninsula because it's beautiful and accessible – more than anywhere else. And you would naturally want to go to a base that was occupied to be able to see what was going on. So it was natural for them to come to Argentine Islands. They had to come down through Lemaire Channel, which is a beautiful place to take photographs of and so on. So I think it was understandable that they came to us, and equal understandable that they didn't want to go any farther south if they could avoid it. I mean, where else could they go if they wanted to come to a British base, say? There were no others. Deception, I suppose. It had its own problems.

[Part 1 00:37:21.16] Lee: You and Brian Gilbert took over from a couple of guys called Morgan and Mitchell.

[Part 1 00:37:27.16] Gardiner: Yes, Dave Morgan and Dave Mitchell.

[Part 1 00:37:30.19] Lee: So it was David and David plays ???[inaudible]...?

[Part 1 00:37:32.22] Gardiner: Or was it Peter? I've forgotten now to be honest. Mitchell and Morgan, yes<sup>5</sup>.

[Part 1 00:37:37.09] Lee: Don't worry. What sort of state was the equipment in?

[Part 1 00:37:38.24] Gardiner: The equipment was in fine repair; no problem there. We had quite a lot of programmes to run: we had the geomagnetic instruments in what we called the magnetic hut, although strictly speaking it's the nonmagnetic hut. That was about a quarter of a mile from base, still on the same island, on Galindez Island. And everything is made out of copper nails instead of iron nails and so on and no metalwork to disturb the magnetic field. We had that to run; we had a seismograph near the base, attached to the base. We had radiation instruments sitting on the Braithwaite fuel tank and others over the snow. We had a tide gauge in a creek. We had to take samples of snow for analysis for radioactive isotopes, and I can't remember what else. We had the whole Met programme of course, the surface and upper air observations. And of course we had the ozone measurements to make five times a day and more on sunny days, and all their calibrations and so on.

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<sup>5</sup> Peter Mitchell and Peter Morgan, according to Stewart (*Antarctica; an Encyclopedia*).

[Part 1 00:38:47.03] Lee: Do you know why you were taking ozone measurements?

[Part 1 00:38:49.22] Gardiner: Well, in those days ozone was being measured not for what you would think of now as looking for chemical pollution or anything like that. The original programme, which started in the International Geophysical Year (IGY, in 1957-58), was there because of the interest in ozone from the atmospheric physics point of view because ozone absorbs not only ultraviolet light, which everybody knows, but it also absorbs a small percentage of visible light as well. Fortunately not too much or we'd be in the dark here, but it does absorb some visible light and UV and it warms the layer of the atmosphere where you find the ozone, which we call the stratosphere. And because it warms the air there, that means that instead of the air getting cooler as you go up, which it does in the lower atmosphere, the troposphere, in the stratosphere it stays steady for a bit and then gets warmer as you go up. And if you have the air at the same temperature as you go up or if it's getting warmer as you go up, it's very stable. It's difficult to get convection going and so the air is stratified in horizontal layers, hence the name the stratosphere. And that kind of puts a lid on top of the troposphere. The troposphere is the lowest layer where you get all of the convective clouds, cumulus and cumulo-nimbus and so on, and all your weather takes place in the troposphere. The troposphere goes up to typically fifteen kilometres in most parts of the world, but rather less, more like ten kilometres, in polar regions. Above that you've got the stratosphere going from that, from the top of the troposphere, up to fifty kilometres (five zero). And the interest in those days was that the stratosphere sat as a sort of limiting layer on top of the troposphere and unless you understood the dynamics of the stratosphere, you couldn't understand the whole of the atmosphere even from the meteorological point of view.

[Part 1 00:40:52.29] Gardiner: So Professor Dobson, the grand old man of ozone measurement from the Atmospheric Physics department in Oxford decided, well he built this instrument, an ultraviolet spectrometer, for measuring ozone. And he built it with the intention of getting measurements from all over the world to understand what we call the climatology of ozone, that is to say how it's distributed in latitude and longitude, if there is as a difference, and in season and how it varied from year to year. And he got instruments installed all over the world and got everyone to send their answers, their measurements back on postcards to his house in Oxford, where he collated them and made graphs of them and began to understand how the ozone varies around the world. Very dedicated man: Gordon Miller Bourne Dobson.

[Part 1 00:41:46.24] Lee: I guess you couldn't send your measurements back by postcard?

[Part 1 00:41:50.04] Gardiner: We sent ours back by telegram and by signal. To begin with of course, communications was, up until the time that I was South in the '60s, were all done by Morse. So it was telegrams where the wireless op was going 'Diddiddidiiddid' on his Morse key, but there was a fantastic innovation, you might say, in 1968 when I arrived at Argentine Islands. We had a chap called Bob Davidson who'd been sent down. He was actually seconded from the Royal Air Force, where I think he'd been a radar mechanic but he was installing new radio equipment, RTTY radio teletype, which was essentially a teleprinter operating through radio. And from that point on, a lot of our numerical data was sent out to Stanley on the radio teletype.

[Part 1 00:42:43.12] Lee: So how were those early measurements taken? You were measuring the thickness of the ozone layer? And you were using balloons, or...?

[Part 1 00:42:50.25] Gardiner: No, no. We were doing it from the ground with this Dobson ozone spectrophotometer.

[Part 1 00:42:55.21] Lee: So you were sending signals?

[Part 1 00:42:57.01] Gardiner: No. It's quite passive. You look at sunlight. So for example, if you've got a nice bright sunny day, you put a tube on top of the instrument with a prism, which acts as a mirror, and get the sunlight to shine straight down the tube into the instrument. The instrument is about five or six feet long; it's a big aluminium box, full of prisms and mirrors and lenses, and it basically takes the sunlight, focuses it, and then puts it through a prism to disperse or to form a spectrum, to disperse the colours. And then it ignores the visible light, which it's not interested in, and selects the ultraviolet portion of the spectrum by shining it through a little slit in a barrier. And you can select different wavelengths of ultraviolet, that's different colours of ultraviolet, and the reason you do that is that ozone absorbs ultraviolet light, but it absorbs the shorter wavelengths of ultraviolet light much more strongly than the longer wavelengths. So for example, at a wavelength of three hundred nanometres, ozone absorbs quite strongly, but at three hundred and forty nanometres, which is longer, it doesn't absorb quite so strongly. So if you look at two different wavelengths, you can tell whether there's a lot of ozone in the atmosphere because the shorter wavelength will be more reduced, more attenuated. And Dobson designed this instrument very cunningly and cleverly so that it would measure ozone and nothing else. He carefully measured pairs of wavelengths and pairs of pairs of wavelengths to eliminate all the other factors that didn't vary with wavelength. And so we would ..., we several times a day we climb a vertical ladder in the corridor up into the ozone loft. It was up in a loft so that it could see the sky clearly without any obstructions. And you had to make a measurement by adjusting the wavelength that you were looking at, the wavelength pair, and recording the amount of ultraviolet that you receive in the instrument.

[Part 1 00:44:56.01] Lee: So there was a hatch in the roof, was there, to ...?

[Part 1 00:44:58.03] Gardiner: There was a hatch in the roof, yes. You can make measurements even when there's no sun. You can make measurements on the zenith cloud, just looking at the cloud directly above you, because on sunny days, when there's sun and cloud, you make a sunny observation and a cloudy observation. And over a period of time, you build up charts that enable you to say what it would have been had it been sunny. The cloudy observations are not quite as good in quality as the sunny ones, because the direct sun observations are calculable; you can actually calculate the amount of ozone because you know what's coming in from the sun, whereas with cloud, you're not quite sure how thick the cloud is and how it's behaving. But the difference in ozone absorption still shows up in the cloud at different wavelengths. So the sun, direct sun observations, are the best and the only really accurate ones, but the cloud observations are a pretty good second best. In fact, in most, or in many stations around the world, there are far more cloudy observations than there are sunny ones, obviously.

[Part 1 00:45:55.02] Lee: And you were simply just ... apart from Morsing them off to Oxford, you were making notes locally; you were writing down charts, noting down the measurements on a chart?

[Part 1 00:46:05.13] Gardiner: We were sending them not to Oxford in those days but to Edinburgh, where Joe Farman was based; we sent them to our BAS unit. Apart from that, we were mostly measuring; we didn't spend much time graphing them. We were ..., our task really was to make good measurements, make them accurately, maintain the instruments, do all the calibrations. There are lots of calibrations you have to do on an ozone instrument: monthly lamp tests to see that the instrument is performing. There were lots of graphs of those but we weren't really charged with studying the atmosphere. That was for the folks back home to do, and so it was for many years, in fact.

[Part 1 00:46:46.25] Lee: Second year, your team was increased to three?

[Part 1 00:46:51.00] Gardiner: Second year, our team was increased to three. I think in the first year we had two physicists and three or four Met men, I can't remember now. And then the second year, our second year, we took on Alan Woods, a third physicist, and I can't remember how many Met men we had. But that meant that our onerous task of being Met men for half the time was shared a little bit more. So that was slightly eased our workload.

[Part 1 00:47:17.20] Lee: And I have to ask you about 'Six Gun Diamond' and hiding behind the stove. What's that all about?

[Part 1 00:47:22.04] Gardiner: Six Gun Diamond? He was the outgoing wireless operator when I first arrived. This was in my first few days, or the first week or two. I was ... I arrived in mid-January and I think the last people probably left in March, so it could be any time in that period. I think the incident that you're referring to was that in those days of course we had dogs on base, mainly for breeding. They weren't really used for field work from Argentine Islands, and we had to shoot seals for the dogs. As I remember, we had to shoot something like four seals per dog per year. So with twelve or fifteen dogs or something like that, we probably had about fifty or sixty seals to shoot in the summer season. And a couple of Fids were out there, one of them being Robin Diamond, one with a rifle and the other for some reason with a revolver, a pistol. I have no idea why; it was probably totally unsuitable and sounds horrifying now. But for some reason they got onto a floe that was turning around, an ice floe and they didn't realise what direction they were pointing in. I found myself in the corridor near the kitchen and the atmospheric room, the beastie room, and you could hear ricochets going 'Whing.' And the outgoing base commander, Brian Swift, who was known as Speedy, who was also a sergeant in the Royal Air Force (seconded), he was crouching down in the beastie room and saying to anyone that would listen, 'Am I in line with the stove?' The stove in the kitchen was one of these huge great metal things. I would call it an Aga but I'm told it is actually an Esse, and he was crouching down behind this, and he said, 'Am I in line with the stove?' because he wanted to avoid these flying rounds. And I thought, 'If it's good enough for an RAF sergeant, it's good enough for me', so I crouched down beside him. It was over quite quickly. So they ..., Robin Diamond was then known as Six Gun Diamond. He used to communicate with



a Japanese station somewhere, who used to respond to his every comment with 'Loger, Loger, Lobin.'

[Part 1 00:49:38.13] Lee: Can I talk to you a bit about Ken Portwine?

[Part 1 00:49:41.00] Gardiner: Ken Portwine, yes.

[Part 1 00:49:42.06] Lee: Who became seriously ill, sadly, once he was with you. What memories do you have of that period?

[Part 1 00:49:50.08] Gardiner: Ken Portwine was slightly older than the rest of us; I think he was about thirty one, whereas most people on base were in their early twenties. So he was the cook in my first year, until he fell ill. He had been a cook at a youth hostel in the Lake District I think, Copper Mines<sup>6</sup> or something like that, and I got on with him fine. Some people didn't get on with him so well because he was a little bit paternalistic, thinking himself as slightly older and more experienced. I didn't mind that. He was older and more experienced than me in some aspects of life so I accepted that. But he had ulcerative colitis or some such disease involving his innards, and he was confined to bed probably from about midwinter, I can't remember exactly, but quite early on anyway. And I think it was said that he had this, some signs of this illness before he went South and hadn't admitted to it but I don't know if that's correct. At any rate, he took out quite a lot of time in the care he needed once he was confined to bed.

[Part 1 00:51:01.19] Lee: Were you on that nursing rota?

[Part 1 00:51:03.10] Gardiner: I wasn't on the nursing rota, no, but of course we all had to take turns at cook because we didn't have a cook anymore. I remember, he was still perfectly *compos mentis* and communicated and you could go into him in his bed and have a chat with him, which we did a lot, to give him company of course because he was sitting on his own there. And he would give me guidance as to what to cook because naturally, cooking for twelve guys on a base you need help. So that was, I got on fine with Ken Portwine. And then of course the story developed because, I think the British authorities approached the Argentines for help, to try and get him evacuated. And the first thing that happened was that a small plane, I think it was a single engine Beaver, came across from Matienzo, Teniente Matienzo. It was an Argentine station on the Larsen Ice Shelf on the other side of the mountain range, the other side of the Peninsula. And it landed on Skua Island, I think, in our group of islands, something that nobody had ever done before. He just flew around a few times and landed. The captain, who was called Julio Lujan, L-U-J-A-N, was one of those, he was probably in his fifties, one of those experienced pilots who drives an aircraft the way you and I would drive a car. You know, you could get it through tight spots and you got used to it, fully in command of the vehicle as it were, and he could land practically anywhere. And he arrived, he eventually shifted the plane onto the sea ice when they determined that the sea ice was thick enough to land on, and this was in, I think probably July or August of 1968, or thereabouts.

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<sup>6</sup> Coniston Copper Mines is a youth hostel.

[Part 1 00:52:52.10] Gardiner: And there were four of them in the plane. There was the captain – we eventually called him Mad Dan Lujan – and his co-pilot, who was about twenty five, Captain as well, no he'd be Lieutenant, José Pose, and an air mechanic called ... Oscar José Pose; was he was called Oscar, that's right, Oscar José Pose. And the air mechanic was called José Diaz. And then the fourth person was the doctor that they brought with them, their own doctor, who, again, was an experienced man, middle aged, called Eliseo Iturietta<sup>7</sup>. I got to know him very well; he was an intelligent and interesting man to talk to. I remember one conversation with him in which, we spoke mostly in his very good English, and a little bit in my very bad Spanish, and we were discussing something to do with the differences between our cultures. And we were talking about identity cards and he was talking about the documentation that you had to carry about everywhere with you. And I said, 'Well, we don't actually have to carry anything about with us in Britain.' And he said, 'Well, you know, whatever it is you have to carry, you may not call it an identity card or a passport, but whatever documentation you have to carry,' said the doctor. And I said, 'We don't have to carry anything.' And it took me most of the evening to persuade him that we didn't carry ID, and he said to me, at one point, 'Well, what if a policeman stops you and wants to know who you are?' And I said, 'Well, he just asks you for your name and address.' And he fell about laughing and seriously couldn't believe me for quite a while. He thought I was pulling his leg or misunderstanding.

[Part 1 00:54:37.06] Lee: Ken's condition didn't improve, did it?

[Part 1 00:54:41.29] Gardiner: It didn't.

[Part 1 00:54:43.03] Lee: Was there a kind of pall that fell over the base?

[Part 1 00:54:45.29] Gardiner: The doctor was very good. He did blood transfusions from people on base and so on.

[Part 1 00:54:49.24] Lee: Including you?

[Part 1 00:54:51.10] Gardiner: Not including me, no. I can't remember why now. I volunteered, but either I was the wrong group or I was the wrong weight or something like that. But he did, I think he did do blood transfusions from somebody on base. And eventually they decided that they'd shift Ken to Esperanza, the more northerly Argentine base, where he could be reached by ship. That was the plan. And so the base commander then, John Dudeney, got in the plane with the two pilots and the doctor. The air mechanic stayed behind, and they were setting off from sea ice and I was standing beside the air mechanic, José Diaz, as the plane took off. And it was foggy, but the fog only went up so high and the pilot was quite sure that he would get out of the fog in a minute. But in fact the fog as I understand it, I think it was probably a petrol driven plane, an avgas plane, and fog got into the carburettor or something like that and he lost power, couldn't gain altitude, and to save himself he went round in a big arc and crash landed the plane in a tide crack but not before he had hit the wing on an iceberg. The plane was painted red, as everything is in the Antarctic and he left red paint on one of the icebergs; you could see it after he'd passed there. He

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<sup>7</sup> Name spellings taken from [www.marambio.aq/primeratransfusion.html](http://www.marambio.aq/primeratransfusion.html), an account in Spanish of Portwine's evacuation.

landed in a tide crack; I think it was in the Three Little Pigs, which are three little islands part, of the Argentine Islands group. And the tide crack was a bit wet, as tide cracks often are, and the young pilot was so anxious that he stretched himself across this wet gap to let Ken Portwine walk across him to safety. And they then all started getting their clothes off and drying themselves over a primus out of the plane while the captain, Mad Dan as we came to know him, radioed, 'Emergencia, emergencia' and so on.

[Part 1 00:56:47.24] Gardiner: And our radio op, of course, was still listening as the plane had been taking off. So everybody then wanted to go out and try and find them and rescue them. At first they were going to turn the rowing boats, they were all upside down for the winter, but then we heard that they were in a tide crack on sea ice. So they went off with a sledge and most of the base went off like that but I stayed behind with Bob Davidson, the radio mechanic, and Tony Feenan, the wireless op. And they set up a portable radio, a rather ancient old, I think it was called a 68 set, and I took that on a sledge and went off some minutes behind the main crowd. But when I was about halfway out, it was so quick, they found them quite easily, brought them all back and I met them coming back, so we all went back together. So we didn't need the radio after all. I was hoping that if they'd got lost and couldn't find them, I could at least make some radio connection to find out where they were because we didn't know if they'd drowned or been killed or anything, you know. All we knew was that Mad Dan was calling on the radio for help. But nobody was injured. They all came back within an hour or so and I remember the captain, Julio Lujan, saying that the young pilot, Oscar, was quite shaken. He said, 'It's his first crash. It's my ninth.' And it turned out that Captain Lujan's nose was largely made of plastic or something like that because of previous crashes he'd been in. He regarded this as just another routine event.

[Part 1 00:58:27.05] Lee: So you still had Ken Portwine?

[Part 1 00:58:29.08] Gardiner: We still had Ken Portwine, that's right. The next thing that happened was that the Argentine government, great credit to them, took their icebreaker, the *Rompehielos General San Martín*, got it out of mothballs in the winter, set it up to sail, and they sailed to Esperanza I think. And then they sent helicopters. I'm not sure; I think they probably sailed further south to some spot in the middle of the ocean, where they met the sea ice. And then they sent a couple of quite large helicopters. And that was quite fun as well because you light flares; this was in daylight, and you send red smoke from one end of a flare. And you could see these two helicopters, these little dots on the horizon, moving slightly sideways across the horizon. As soon as you light the flares, they stopped because they're now coming towards you because the only way they could find us was by spotting these red smoke clouds in the distance. And they came in, and I remember marshalling one of them in. I think I discovered later that that was because Oscar, the young pilot, was marshalling a helicopter in and walking backwards on the snow as he marshalled them in, and he stepped backwards over a cliff. Fortunately we discovered later, none of them knew where he had gone, he emerged safe and sound because he'd landed in deep, soft snow. But I'm ...; I had to marshal one of these helicopters in to our designated landing place, probably the only chance I would ever have got to marshal an Argentine naval helicopter.

[Part 1 01:00:11.25] Lee: So who was it who fell over the ice cliff, Pose?

[Part 1 01:00:13.17] Gardiner: Oscar Pose. Yeah.

[Part 1 01:00:18.02] Lee: Okay. Then Ken of course died shortly afterwards, didn't he, sadly?

[Part 1 01:00:21.21] Gardiner: So then the Argies took him out to BA, to Buenos Aires, where he died in hospital. Details I have no idea about. And that was the end of that sad story.

[Part 1 01:00:36.14] Lee: Apart from that episode, which is a long, prolonged episode, one gets the impression that that was actually quite a good season for you.

[Part 1 01:00:44.03] Gardiner: I would say it was, yes. I mean, it was good in many respects. Actually the Ken Portwine incident, although tragic and disastrous in many ways, probably pulled the base together in a way that nothing else could, because you all had to cooperate and as I say we were all taking turns at being cook and all sorts of things like that, and the events were exciting and stimulating, even if disastrous. And so it was an interesting year, to put it mildly. We also had quite good sea ice that year, and so we got to do one or two trips after this was all over. There was a sense of relief on base of course, when he went; we didn't know he had died until later. And with good sea ice we got some trips to surrounding places.

[Part 1 01:01:32.03] Lee: Mount Scott?

[Part 1 01:01:34.11] Gardiner: Yes, I went on a trip to Petermann Island, which is about six miles north of Argentine Islands, and we spent a day going up Mount Scott. We'd intended to get to the top, but I think halfway up the cloud manked in a bit, and being reasonably prudent, we decided not to push our luck and we came back down again. I ended up ..., we came down on skis with skins on: easier for getting up and slow you down a bit coming down. I remember stopping at one point for a breather and somebody saying, 'I don't want to alarm you, but you've just stopped on a snow bridge over a crevasse.' They'd just seen sideways where there was a crevasse. So I gingerly moved myself gently forward. But that's the sort of thing that happens of course, and the difference between an amusing story and a catastrophe is rather close.

[Part 1 01:02:28.19] Lee: Did you do much travelling, or were you...?

[Part 1 01:02:29.23] Gardiner: No.

[Part 1 01:02:30.22] Lee: Because I guess you ..., a lot of time was spent fulfilling your commitment to do these measurements, these readings.

[Part 1 01:02:35.18] Gardiner: That's right, yes. I think the other place that we, I remember going to, was the penguin colony on the Jalour Islands<sup>8</sup> which is sort of halfway between Argentine Islands and the mainland. But apart from that, everyone took their turn at the occasional forays, but there wasn't an awful lot of travelling

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<sup>8</sup> Usually known as the Yalour Islands.

done. Sea ice has to be pretty good for you to travel on anyway. It's dangerous stuff at the best of time.

[Part 1 01:03:01.26] Lee: You were the fire officer for the base, and fire is always a big worry, isn't it?

[Part 1 01:03:05.01] Gardiner: It is, yes. There hadn't been a fire drill for quite a while, so I felt that I was doing pretty well when I managed to get them to do one fire drill. Nowadays of course you probably ..., with Health & Safety, they quite correctly do them on a much more regular basis. But mostly my duties involved going round all the fire extinguishers, of which we had plenty of three or four different kinds – powder and carbon dioxide and water and what have you – and checking that they were all still functioning properly, basically by weighing them. And the other duty I suppose was to remind people of fire safety and to ... We had a lot of coal fires, and you had to make sure that people didn't over ... build them up so that they would, hot embers would roll out onto the floor and things like that. That's what, that's...

[Part 1 01:03:48.17] Lee: So you had a few close calls?

[Part 1 01:03:49.28] Gardiner: No, we didn't really, I would say, no. I don't think we had any close calls. But as you say, it is a very dangerous business living in wooden huts with bitumastic roofs and so on, and very little opportunity to put a fire out once it gets hold.

[Part 1 01:04:06.05] Lee: Do you get many visits? I think you had... the *Endurance* came through with some helicopters at one point.

[Part 1 01:04:11.24] Gardiner: *Endurance* did, I can't remember much about the helicopters on the *Endurance* at Argentine Islands.

[Part 1 01:04:20.09] Lee: Bringing a new cook for Christmas?

[01:04:22.15] Gardiner: Bringing the new cook for Christmas? Did he come in on a helicopter? You're probably right. He told you that himself, I think. Yes. I remember the *Endurance* coming in.

[Part 1 01:04:32.02] Lee: The new cook was Allan Wearden, was it?

[Part 1 01:04:33.19] Gardiner: The new cook was Allan Wearden, yes. Because Ken Portwine, who died, was the cook, it was understood by the hierarchy that Argentine Islands needed a cook, and of course, just as an army marches on its stomach, Fids do as well and the bosses in London probably realised that it would be prudent to get a cook in as soon as possible. So they arranged for Alan Wearden to come in on the *Endurance*. Allan Wearden, it goes without saying, is one of the best cooks that FIDS had ever had. He was excellent.

[Part 1 01:05:07.07] Lee: No it doesn't go without saying. Explain to me why he was so good.

[Part 1 01:05:09.24] Gardiner: Well, he just was very good. I just remember his food being excellent, and he was very very hardworking. And, I mean, Fids are typically very critical. The old saying, which is probably borrowed from the armed forces, was, it starts with 'Who called the cook a bastard? Who called the bastard a cook?' People are notoriously critical of cooks but nobody was critical of Allan Wearden; he was excellent. I remember one time he, probably a midwinter feast or something like that would be his *pièce de résistance*, and after all the starter and the main course and the pudding or whatnot, he produced what he told us was done in the best hotels: a little savoury after the pudding, which was sauté kidneys turbigo and I haven't forgotten that. But he made wonderful cakes and fascinating bread and everything you could possibly ask for of a cook, and a very nice guy as well.

[Part 1 01:06:09.04] Lee: What's all of this about the new Twin Otter on the Larsen? Some sort of radio communication with that?

[Part 1 01:06:15.05] Gardiner: That, I think, is a reference to Captain Derek Smith. Was that his name now? I can't remember. I think what happened was that his aircraft ... He was setting off from Adelaide probably, to get to Fossil Bluff, and you have got to remember that there are no navigational aids to speak of in those days. And I think what happened was he went south, he couldn't get to Fossil Bluff because it was clouded in or something like that and he had a crosswind. A crosswind of only about ten knots can shift you a long way in a journey of several hours and I think it shifted him sideways on the way south to Fossil Bluff. And it shifted him further sideways, eastwards, on the way back, so that when he came back to Adelaide, he couldn't find Adelaide. And we now know that was because he was on the eastern side of the Peninsula on the Larsen ice shelf. But he didn't know that and Adelaide didn't know that and we were listening on the radio to all this happening and I remember, as he was coming in to land, running short of fuel, he said, 'I'm going to have to land on the sea ice.' And he landed on the sea ice and said ... To conserve battery power, the Adelaide wireless op said to him, 'Tell me,' he said. 'when you get out, how thick is the sea ice?' He said, 'One dit for each foot.'

[Part 1 01:07:33.29] Gardiner: And he went ... You know this is in Morse and you would ..., the way to do this is, you would ask a question and say, 'One dit for yes and two dits for no.' So you say something like, 'Have you landed safely? One dit yes, two dits, no.' Beep. 'Are you on sea ice? One dit yes, two dits no.' Beep. Then: 'How thick is the sea ice? One dit for each foot.' Beep beep beep beep beep beep. Because they couldn't get their chisel through the sea ice because they were on the Larsen ice shelf which was hundreds of feet thick. And I remember – this was a squadron leader I think it was – Squadron Leader Derek Smith, or something Smith. And eventually ... Of course he had run out of fuel. They told him that there was a depot at Cape Agassiz that they'd left there donkeys' years ago, and he managed to make that short journey and find the fuel depot I think. Or maybe he didn't, I can't remember now. But anyway, the *Endurance* was asked to come down and help, and came down and got to Adelaide. And they were going to fly helicopters but the weather ... It's quite difficult having helicopters across a ten thousand foot pass or something like that, across the mountains. And I think they made a couple of attempts that weren't successful because the weather went against them, but the third time, they got across with fuel to Squadron Leader Smith. And we heard them on the radio saying [posh accent] 'Yes, we have fuelled them up now.' It was terribly, terribly

public school, and 'I expect we'll be in time for tea.' To this day, I don't know whether they were putting that on or not. I don't think so.

[Part 1 01:09:11.00] Lee: So did he fly out again? Was he able to take off again?

[Part 1 01:09:13.11] Gardiner: They brought fuel to him and he flew out again and all was well. Otherwise he'd have been marooned there for quite a long while, which would have been embarrassing, to put it mildly.

[Part 1 01:09:22.22] Lee: Gosh. And you were listening to all of that on the radio?

[Part 1 01:09:23.10] Gardiner: We were listening to all that on the radio, the whole Peninsula was listening to it on the radio.

[Part 1 01:09:26.19] Lee: Gosh. How exciting. Shall we take a break?

[Part 1 01:09:28.26] Gardiner: We shall take a break.

[Part 1 1:09:21] [End of Part One] Note: my times, in the form h:mm:ss, obtained from Windows Media Player, are slightly different from Bachelder's (hh:mm:ss.ss), apparently about 7 seconds different by the end of Part One. AS.

ad6\_24\_1\_135\_1\_2.mp3 (Part 2)

[Part 2 00:00:00.00] Lee: This is Brian Gardiner, interviewed by Chris Eldon Lee on the 28th of September, 2011. Brian Gardiner, Part Two.

[Part 2 00:00:11.08] Lee: The *Shackleton* came back, Brian, in the New Year to relieve the base, and I think you were quite busily engaged in that process, weren't you?

[Part 2 00:00:18.12] Gardiner: I remember we had a pontoon, which was built out of wooden planks lashed to a group of eight empty forty-five gallon oil drums. And then it had one or two outboard motors (we had Seagull outboard motors, which weren't very powerful) and we used that as a pontoon. We had a sort of pointed bow to it, to shift things around from the main jetty near the base hut, round to the sonde store and back. I think we shifted a concrete mixer on it one time. It was much easier to do it by, shift it by sea, so to speak, than dragging it over the land.

[Part 2 00:00:59.07] Lee: With ..., and these Seagull outboard motors, were they up to the job?

[Part 2 00:01:02.19] Gardiner: I think if you waited long enough, they would get you there. But I can tell you, give you an idea of what we thought of Seagull outwards. There was one time where the tide gauge, which was mounted on a couple of reinforced steel joists, but mostly had wooden cladding around it, in a creek. It consisted of a metal tube with a wire going down it to a metal float that went up and down with the sea, and this was counterbalanced by another weight that went over a drum that operated a pen on a chart. This was the good old days before computers and all that. And we had to put a new chart on every couple of days and calibrate it and so

on. But one of the problems was that, since you've put this tube down into the sea, any ice that comes along is liable to damage it, so it had a sort of square wooden well cladding around it. But a good whack with a lump of ice would smash even that. And sometimes a bergy bit would threaten the tide gauge and over a period of a day or two, you'd see that it was getting closer, and you'd hope that the wind would change and the tidal stream would take it away. There was one occasion where a bergy bit that I reckoned weighed at least fifty tons if not more was bearing down on the tide gauge, and in a few hours as the tide came in it would hit the tide gauge and would give us a lot of work repairing it. So I got one of the rowing boats out, with a big long rope and a grapnel on the end; it was one of the anchors for the rowing boat. And I managed to throw the grapnel after a few shots onto the iceberg, onto this bergy bit, and payed out the rope and then I rowed for about three quarters of an hour, at first getting absolutely nowhere, just rowing backwards to pull this bergy bit away. And eventually I shifted it about a hundred yards out into the tidal stream, where the water and the wind took it away and saved the tide gauge. Well, you might say, 'Why didn't I put an outboard motor on?' I reckoned I'd probably shift it faster just rowing than running unnecessary fuel for an hour. So that was how I...

[Part 2 00:03:09.22] Lee: I've not heard of anybody towing an iceberg before. It must be ...

[Part 2 00:03:12.02] Gardiner: Well there you go. Now you have.

[Part 2 00:03:13.10] Lee: A first for the Antarctic.

[Part 2 00:03:14.15] Gardiner: Probably been done many times if we only knew.

[Part 2 00:03:18.08] Lee: You saw the *Biscoe* coming in of course, and it did run aground at one point.

[Part 2 00:03:24.12] Gardiner: I did see the *Biscoe* aground at one point, in Meek Channel. I think it was about to leave, and we were just watching it go down Meek Channel when it seemed to stop, and we thought, 'Why's it stopped? It seems to be hanging around for a while, and that's an unusual thing for a ship to do once they get underway, they usually keep going.' And then we discovered that it had grounded itself on a rock that had got caught on one side of the hull. And what he did was, he went full ahead for a bit, and sort of turned around, pivoting on this rock, and then went full astern and pivoted back a bit, until eventually he worked his way slowly off the rock and got free. Quite an interesting manoeuvre, how to get a sixteen hundred ton ship off a rock without damaging it.

[Part 2 00:04:06.25] Lee: Can you recall who the captain was?

[Part 2 00:04:08.03] Gardiner: Not off the top of my head. Not because I'm trying to protect him, but I can't remember the name. I remember, I remember the captain of the *Shackleton*. I think the ship that ran aground in Meek Channel was the *John Biscoe*. I remember the captain of the *Shackleton*, who I think must have hit a rock at Signy. That was, he was known as Frosty but his name was Turnbull, I think.

[Part 2 00:04:29.15] Lee: Bill Turnbull.



[Part 2 00:04:30.11] Gardiner: Bill Turnbull, was it? Because there was a rock out in the bay near Signy base, which, the Fids had put a sign on it saying, 'Look out, Frosty, this is a rock.' I don't think he was overjoyed about it.

[Part 2 00:04:44.08] Lee: So, yes, okay.

[Part 2 00:04:46.17] Gardiner: Ships do run aground. It's commoner than you think, especially in waters that are not as well charted as some of the home waters are, although there's a lot of hydrographic surveying being done by *HMS Endurance* in our part of the world around the islands.

[Part 2 00:05:04.05] Lee: You had cause to be grateful to the *Biscoe*, and particularly its dentist.

[Part 2 00:05:08.12] Gardiner: Indeed I did. When I ..., in my first year, after about three months I think, one of my fillings in the right-hand side of my mouth came loose. But I caught it and it was one of those fillings that was quite full of shape, and I managed to push it back into the tooth and it stayed there. And for nine months I kept it in that tooth and I ate mostly on the left hand side to avoid it. Every now and again it would fall out and I'd push it back in again. It probably fell out just because it got bit of hot and cold or something like that, and the metal expanded and contracted. But at the end of my first year in the summer, they sent down a dentist, and I looked forward to getting my filling repaired. But I can't remember the dentist's name now, but on the way down the poor man developed some paralysis of his leg, which sounds very alarming, but he soldiered on. Instead of being evacuated out, he kept going and did dentistry all round the Peninsula. And when he came into Argentine Islands, I was given an appointment with him, so I had to get into one of our little rowing boats – it was called *Platypus*. It was what they call a pram, a very shallow boat, and it had what I call a twenty minute leak.

[Part 2 00:06:25.08] Gardiner: That's to say, if you didn't bail it out in twenty minutes it would sink. So I rowed out to the *Biscoe* and tied the *Platypus* up to the side of the ship as tight as I could so it wouldn't take on water any faster than could be helped. I climbed up the ladder, went to the cabin where the dentist was practising, and he said, 'Unfortunately because of my leg,' he said, 'I normally work the drill with a pedal. But I can't do that because one of my legs is frozen.' He said to me he'd got an electrician or someone to rig up one of those flexes that you use for a bedside lamp, with a little switch that you push through. He said, 'Just hold that, and when I say go, push it, and when I say stop, push it back.' So you had to switch your own drill on, and it's one of these old drills that doesn't go as fast as the modern drills do so you had the pleasure of switching on your own torture. Nevertheless, he did repair my filling and it lasted fine for many years. So great credit, not only to the *Biscoe* but to this dentist, whose name I sadly can't remember now.

[Part 2 00:07:27.11] Lee: Did we have the civilisation of anaesthetic in that time?

[Part 2 00:07:30.24] Gardiner: No, I don't think I needed it, to be honest, but he probably did if I had. It didn't arise. It was just a filling.

[Part 2 00:07:40.03] Lee: You, as you've guessed, there are quite a few hints of stories here that have come from Allan Wearden, who was on your base for the second part of your time there, so I have to ask you about 'a mock trial when Brian was the jury'.

[Part 2 00:07:53.19] Gardiner: That's right. I think that might have been in my first year, actually, because John Dudeney was the base commander, and we had a chap on base who was known as [REDACTED]. His name was [REDACTED], and somehow he got the reputation, as people occasionally do, of drinking more than was good for him. He used to go out and, I think what sealed his fate, was that he was caught one time talking to the snow in his underpants, which is normal Fids practice, I'm sure, but was noticed. And there became a state ... Well he was also seen rowing up the corridor in a cardboard box that had previously been used for beer, and somehow, somebody, I think it must have been John Dudeney, decided that they would have a mock trial and try him for drunk and disorderly or something like that. And everyone had to play a role. I think it was easy enough to allocate the roles of prosecuting lawyer and defence lawyer and so on, somebody had to be the jury, and I volunteered to be the jury. It only gradually dawned on me that although the jury sounds like a boring role because you do nothing but sit and listen, it is the most powerful role. So when we got to the end of this trial, I was obsequious to the judge and made sure I didn't put a foot wrong.

[Part 2 00:09:10.08] Gardiner: And I was asked to go out and consider my verdict and I went out for a minute or two and came back in again and solemnly found him not guilty and that was the end of that. So we didn't proceed to any punishment, which I think would have been carrying things a bit far. Hate to think what it would have been, but I was glad not to find out.

[Part 2 00:09:28.20] Lee: Humiliation was punishment enough.

[Part 2 00:09:29.28] Gardiner: Yes, I'm not a great fan of mock trials but that one went off all right in the end.

[Part 2 00:09:35.02] Lee: Dave Salter took over as base commander for the second year and there were lots of new faces, weren't there?

[Part 2 00:09:39.10] Gardiner: Yes, there were a lot of new faces. I think only maybe about three of us stayed on into the second year.

[Part 2 00:09:44.26] Lee: This was '69, the second year?

[Part 2 00:09:46.12] Gardiner: '69 was the second year. Yes, I think there were a lot of new faces.

[Part 2 00:09:53.00] Lee: And because there were three of you ... You were joined by a third, was Vasco Woods the third guy?

[Part 2 00:09:59.05] Gardiner: That's right, Alan Woods, known as Vasco because on the ship sailing down he spent a bit of time on the bridge and I think he was thought to be over-advising the navigating officer on his duties. He took an enthusiastic

interest in navigation. He was a very good bloke, Alan Woods. I still know him today. He lives in Edinburgh.

[Part 2 00:10:20.16] Lee: Did that give you a bit more time off, so to speak?

[Part 2 00:10:23.11] Gardiner: Not much I don't think, no. I think it just made the work load more manageable.

[Part 2 00:10:30.23] Lee: It gave you time to write some articles.

[Part 2 00:10:34.24] Gardiner: Is this for the *Illustrated Galindez News*? We had a Midwinter magazine that came out each year called the *Illustrated Galindez News*. Galindez was the name of the island that we were on. And I wrote a Galindez glossary, a dictionary of Fid slang. That's maybe what you're referring to. We also had the first output of the teleprinter I think in my first year. I think I probably wrote the dictionary in my second year because it was ..., it required more words and it's difficult for me to remember now what those slang terms were, but all the usual Fids jargon. I've seen other similar dictionaries later, and what you notice is that some terms last for many years and then fade away, but some are just local to the base and the year in question.

[Part 2 00:11:32.13] Lee: So you're making up your own language, in places.

[Part 2 00:11:35.23] Gardiner: I think to some extent that's true. There is a kind of script. I spent one year on base with .... My first year was John Dudeney's second year, and I carried on knowing John Dudeney at work for the rest of my career, and he and I used to be a kind of double act at smoko, smoko being tea break. And because we'd just wintered together, we knew our script and there were things that we would say that we would understand from each other and nobody else around the table would know what we were talking about. There used to be a joke that you could number the jokes and you'd just have to say, '37' and people would laugh. They would know which joke. It was almost like that.

[Part 2 00:12:16.04] Lee: I remember talking to some of the guys at Fossil Bluff round about this period and they spoke to each other in Australian accents.

[Part 2 00:12:23.22] Gardiner: Really?

[Part 2 00:12:24.08] Lee: That was their kind of private language, 'Strine' as they used to call it.

[Part 2 00:12:28.01] Gardiner: There is a small connection there in that the word 'smoko' actually can be found in the *Oxford English Dictionary* and it claims that it's a New Zealand sheep farming term, which I presume must have come through the Falklands on its way to base. Smoko is tea break for any Fid.

[Part 2 00:12:46.14] Lee: Well that was universal around the Antarctic as far as I can make out.

[Part 2 00:12:48.18] Gardiner: It was, I think, yes.

[Part 2 00:12:50.18] Lee: Another of Allan's stories: 'Ask about Fred, the skua, and the sausages.' Is this one you know?

[Part 2 00:13:00.08] Gardiner: Yes. Fred was a skua that came to the base verandah, the verandah of the base hut quite often, and I don't know if it was Fred, but one of the skuas stole a large tuna sandwich. Fids make quite big doorstep sandwiches; there were a huge couple of big pieces of bread and a lot of tinned tuna, and this skua came in and just lifted it straight out of his hand in flight, which is quite skilled. But there was another time when they decided to play a trick on Fred. We had some sausages called Hunter sausages that no one particularly liked. Again, they were tinned sausages and there were maybe two, three, four sausages, big fat sausages in a tin. They took these sausages out and they put them in the verandah, and Fred landed in the verandah, took one of these sausages in his beak. A skua's quite big, but these sausages were also quite big.

[Part 2 00:13:57.09] Gardiner: I don't know if he took one or two, gobbled them down and then set off, and you could see that he was having difficulty maintaining altitude because he was so heavy. That was Fred the skua, a frequent visitor.

[Part 2 00:14:11.15] Lee: What's all this about red, white, and blue breakfast bread?

[Part 2 00:14:16.28] Gardiner: Allan Wearden the cook developed a technique of using food colouring to make pleated bread, like pleating a girl's pigtails. He would make three or four...

[Part 2 00:14:32.25] Lee: Oh plaiting, you mean.

[Part 2 00:14:32.23] Gardiner: Plaiting, yes. You'd make three or four strands of bread, colour one of them yellow, one of them purple, and one of them green, and then plait them or pleat them, depending on how you use your terminology, to make a kind of pigtail bread. And then if you sliced it across the way, you would get a slice that had multicolours in it. I think that's what he's referring to. He taught me how to make bread and how to make ..., I think he taught me how to make flaky pastry where you put little chips of butter in and fold it in three, and roll it out. And so on.

[Part 2 00:15:05.24] Lee: So how were your cooking skills?

[Part 2 00:15:08.20] Gardiner: Well I ended up making very good brandy snaps, I seem to remember, filling them with mock cream made from cornflour or arrowroot or something like that. So one's skills developed. Because of the Ken Portwine incident, we did quite a lot of cooking in the second half of my first year, but even in my second year when we had Allan Wearden as a cook, the tradition was that the cook was given Sundays off. Otherwise he'd have never had a break. So everyone had to take a turn, but of course it was only every eleventh Sunday or something like that that you had to do all the meals. So there was always some cooking to be done.

[Part 2 00:15:42.11] Lee: There were some builders who came down in the summer period: Al Smith, Jim Wilson. Do you remember them coming?

[Part 2 00:15:48.19] Gardiner: I do. I remember ... I was telling earlier about the weighing machine which was a steelyard where you slid the weights along the arm, and that weighed up to 308 pound, which is 22 stone. And I remember 'Big Al' Smith being on base for a few weeks in the summer for some maintenance work on the oil tanks, and he was persuaded to stand on these scales, but we couldn't weigh him because he went over the 308 pounds and he couldn't get the steelyard to balance. And the other one you're talking about, was it Jimmy...?

[Part 2 00:16:21.12] Lee: Jim Wilson.

[Part 2 00:16:21.24] Gardiner: Jim Wilson, yes. He was a Scotsman who did crofting in the northern summer and Antarctic building in the southern summer. He built a new non-magnetic hut for an additional instrument, the proton vector magnetometer that I mentioned at the beginning. And I remember when he was putting in the concrete plinths for the foundations, saying to him, 'Are you not going to scratch your initials in the concrete to show that you built it?' And he said, 'No,' he said, 'I never do that. If anything goes wrong with it, I don't want to get the blame.' Years of experience.

[Part 2 00:16:55.20] Lee: I saw him in April.

[Part 2 00:16:57.04] Gardiner: Did you really?

[Part 2 00:16:57.14] Lee: In Scotland, we recorded him by his house in Scotland. Still quite fit and healthy.

[Part 2 00:17:04.24] Gardiner: Good for him.

[Part 2 00:17:06.15] Lee: How did you get on with the builders? Were they a part of the team, or were they a breed apart?

[Part 2 00:17:13.06] Gardiner: Very much part of the team. I can imagine that in a situation like building a new Halley base where a lot of the people that were involved in building a new base were housed separately, it might be separate like that. But Argentine Islands is automatically a very tight community. There's one hut, you're all eating together. I mean, I knew Jimmy Wilson just as well as anybody else even though he wasn't there for more than a few weeks or a couple of months or something like that. So it was, they were definitely not a breed apart. There weren't very many people doing things like that. He was there on his own, I think, for that project. And when somebody like Big Al came in, there were two or three people who came in and they took the Braithwaite apart and cleaned it, put it together again and did some other things. They were all part of the gang; you all just ate together at every meal time in the one dining room.

[Part 2 00:18:07.15] Lee: Were you, through all this period, were you developing this kind of Fid love affair with the Antarctic, or were you fairly impervious to it?

[Part 2 00:18:15.19] Gardiner: I don't know about a Fid love affair with the Antarctic, but I can tell you that at the end of my two years at Argentine Islands, there were tears in my eyes when I left. I didn't want to go, really. It's quite a wrench. I mean I can

imagine that if you've not enjoyed your time, it would be a great relief to be taken out, but I enjoyed my life on base. Even in my first year when I was worked quite hard, I think I enjoyed it well, but in my second year even more. There's a general principle, as you probably know, that if you can get two people occupied in a job, you try to have a first year man and a second year man. That didn't happen to me because Brian Gilbert and I were together for two years and then Vasco joined us later. But generally speaking, in your first year, you're the younger crew and you're learning the ropes. Your second year, you're masters of the universe because you know where everything is and you can tell other people. There wasn't much bossing around, but I think I enjoyed my second year a lot. I definitely did not want to leave in January, 1970.

[Part 2 00:19:15.22] Lee: Tell me about the escapades coming home, because you headed south first of all.

[Part 2 00:19:19.12] Gardiner: Yes, the ship ... I was taken off in January and we went south to various places. I mean, I think we called it some old bases on the way down, but we also went in to Adelaide and Stonington. I was involved in the sea ice relief of Stonington, where the ship could only get into the sea ice and moored by the sea ice, and then we took everything by tractor and sledge up a creek to Stonington itself.

[Part 2 00:19:45.07] Lee: This was working with Dick Kressmann?

[Part 2 00:19:47.09] Gardiner: I did work with Dick Kressmann in the middle of the night – this was 24-hour daylight of course – where he was driving the tractor and I was standing on the last of the several sledges to make sure that nothing had fallen off on the way. And I remember getting the tractor, being wheels of course, got stuck occasionally in the tide cracks and so on. He was very good at getting the tractor back out again by putting boards under it and that sort of thing. A very resourceful man.

[Part 2 00:20:13.29] Lee: When it came to leaving Stonington, was it fairly easy for the ship to get away?

[Part 2 00:20:17.29] Gardiner: The ship got away and I can't remember what the order of visits were, but we ended up I think at Adelaide, and there came a point at which the *Biscoe* started to go north and it got stuck in the ice. The wind blew all the pack in and hemmed it in and it was beset for, I think about a fortnight, and people were getting very bored and anxious. Some of us were given the opportunity to be taken out in the *Endurance*, but we had to fly north to the *Endurance*. So some of us volunteered for that, and all our clatch was taken with us. We got on a BAS plane, probably a Twin Otter, I can't remember now, and we flew north to somewhere like Anvers Island or Danco or somewhere like that, or Damoy or somewhere. I remember on the journey, the pilot, I can't remember who it was now, had to change fuel tanks. He had a reserve tank and one of the Fids was given the task of sitting in the co-pilot seat and flying the plane for the few minutes that it took the pilot to change the fuel tanks because he had to come aft into the cabin to do that. So that was quite an adventure for that Fid and for the rest of us to see.

[Part 2 00:21:27.05] Gardiner: 'Careful now!', you know. And then we landed in some obscure island near Anvers Island or somewhere like that, and waited patiently

with all our clutch in the hope that the *Endurance* would have remembered us. They sent a helicopter across and we were helicoptered back to the *Endurance*. I remember landing on the *Endurance*'s helicopter deck in the stern and being interested to see that there were two guys standing in full white fire-proof kit masking their faces, each with a fire extinguisher in his hand, and thinking, 'Do they know something we don't know?' But we landed safe and sound and I then spent a week on the *Endurance*, where they put us to work doing various things. I ended up doing echo-sounder watch on the bridge, where I had to sit behind a little curtain so that the light of the echo-sounder didn't disturb them while they were doing hydrographic surveying. And I had to make notes on the scale of the echo-sounder and change its depth range and all that sort of stuff. There was one moment where, at one point it was fairly shallow and I said, 'It's shoaling.' And the young lieutenant on the bridge put his head round the curtain and said, 'Oh my God, we're aground.' And I had to explain to him that it was just the outgoing transmission of the echo-sounder that he was looking at, and we weren't aground at all. But it was quite fascinating to see an otherwise very self-contained naval officer going into alarm when he saw his career disappearing down the tubes.

[Part 2 00:22:57.04] Lee: Well it was a sacking offense, wasn't it?

[Part 2 00:22:58.29] Gardiner: It probably would be, I should think. Then there was also an amusing incident where they were doing hydrographic surveying and so you had an officer of the watch on the bridge and you'd a hydrographic guy trying to go up and down lines on his map. And the hydrographic guy was giving a course direction, strictly speaking, to the officer of the watch, who would give it to the helmsman, who they referred to as the quartermaster. But mostly when the hydrographic guy gave the course direction, the helmsman just took it anyway. But there was one point where the one officer said, 'Steer 3-2-4,' and the other officer of the watch said, "Steer 3-2-5," simultaneously and this grizzled old quartermaster said, "Steer 3-2-4-and a half, sir," without batting an eyelid.

[Part 2 00:23:48.18] Lee: [Pause] Sorry, I'll just check in my notes. There is something else I can't understand here. 'The captain on the bridge, if a problem...'

[Part 2 00:24:00.14] Gardiner: I think that that was probably that .... I remember the captain was Captain Peter Buchanan, came on the bridge at one point. He'd been doing something else, and the officer of the watch said, 'It's getting shallow', and he just said, 'Stop engines,' just like that; didn't waste a second again taking any chances. And that was quite an order to give, because as far as I remember, on that *Endurance* – that was the first *Endurance*, that was the *Anita Dan*, another Danish ship converted. I think if you stopped the engines, you needed compressed air to get them started again and in fact, if you wanted to go astern you had stop and start the engines again. I think that was on that ship. So you couldn't do it too often or you'd run out of compressed air.

[Part 2 00:24:49.04] Gardiner: Peter Buchanan was quite a character. He sailed South with me when I first went South and he'd been sent down because they were planning the conversion of the *Anita Dan* to the *Endurance*. He was to be the captain the following year and he was sent down to learn how to work in sea ice from our captains and so on. And he saw that all our ships were painted bright red and quite

fancied this, so he went back to the Admiralty and said he wanted the ship to be painted bright red for safety reasons so it could be seen at a distance by the helicopters. And the old codgers in the Admiralty said, 'Our ships are always painted grey.' But eventually they were persuaded and he got his way. And then the ship, the *HMS Endurance* was commissioned in Harland and Wolff I think, in Belfast. It was sent off and the helicopters were told to set off from England, wherever they were, in Valley or somewhere. And they were to rendezvous with this ship in the North Sea somewhere, I mean in the Irish Sea I should say. And they were given coordinates in the Irish Sea and told to land on the *Endurance* and they said, 'We can't find the *Endurance*,' they radioed back. 'All we can see is this red merchant vessel.' And they were told, 'That's it.' It must have been about the only red ship in the Royal Navy.

[Part 2 00:26:12.01] Lee: You did some of your journey back home overland, didn't you?

[Part 2 00:26:16.02] Gardiner: In South America, you mean?

[Part 2 00:26:16.24] Lee: Yeah.

[Part 2 00:26:18.09] Gardiner: Yes, three of us, Brian Gilbert and I and Mike Elliott, a geologist from Marguerite Bay, we got off the ship in Punta Arenas and we journeyed up through ... Punta Arenas is in Chile, and so we had to cross the border first of all into Argentina, and then we went to Rio Gallegos, where we discovered a British Club still in existence with a snooker table, and some terribly British people still working sheep stations. It was an old Irish guy who had emigrated to Argentina in 1911. I was talking to him in 1970 and he hadn't even seen the First World War in Ireland, and he introduced himself by saying, 'My name is Cooke: C, dos Os, Ka, Ey.'" He was spelling out his name in Spanish even though he was speaking English. A fascinating crew. And then we went up to, we flew to from Comodoro Rivadavia I think, via Trelew to Esquel in the mountains, climbed some fascinating mountain there and then went up to Bariloche and did the traditional tourist route through the lakes to Puerto Montt in Chile.

[Part 2 00:27:36.28] Gardiner: And then a train up to Santiago. I remember crossing from Argentina into Chile, you go through a customs post where the guy at a desk filling in your details and unnecessary forms. And he says, in Spanish, he asks you, 'What's your profession?' And I said, 'Físico,' physicist. And he wrote down, empleado, employee. So I thought when we were coming back, we could do later crossing over at a different border post. The same thing happened again, and this time, he said, 'What's your profession?' I said, 'Científico,' scientific, scientist, to try and make it easier. And he wrote down obrero, which is workman. Unnecessary bureaucracy, you might say. So then we went to Santiago and crossed the Andes in a mountain bus, where we went up a zigzag spaghetti road, which had no tarmac on it, just a dust road so that as the bus went up the first slope of the zigzag, it created a great cloud of dust and we went around the hairpin and up the second slope, catching up with its own cloud of dust and making it bigger. So by the time he got to the top of the slope, he couldn't see a thing. And then eventually we visited, we took a thirty six hour bus journey from Mendoza to Buenos Aires, and then we flew north to Iguazu to see the cataracts, the falls, where we crossed briefly into Brazil to see the Iguazu Falls from the Brazilian side. The amusing thing is, we got a lift back in a Brazilian lorry,



and when we were in Brazil he took us for Argentines because we spoke Spanish rather than Portuguese.

[Part 2 00:29:13.01] Gardiner: When we were on the Argentine side, they took us for Brazilians because our Spanish was so terrible. And then we went down to Posadas, which is the railhead, and we took another thirty-six hour journey, on a train this time. We were so knackered that three of us were sleeping, one on the floor, one on the seat, and one in between the two seats, and at one point I woke up in the middle of the night, looked out of the window, and saw that we were at sea. I couldn't see land in any direction, but I was so tired I went back to sleep again. We were crossing the River Plate and they'd managed to put the train onto a boat train, onto a railway boat, without waking me, and we went from Zárate to Ibicuy or vice versa<sup>9</sup>, I can't remember, on the way back to BA again. And then we took the BA ferry down to Montevideo and back just in time to meet the ship.

[Part 2 00:30:02.21] Lee: On to the *Biscoe*?

[Part 2 00:30:03.16] Gardiner: On to the *Biscoe* again.

[Part 2 00:30:05.16] Lee: What's all this about Ian Sykes singing a song, Spike?

[Part 2 00:30:10.08] Gardiner: Ian Sykes, I think probably wrote the song. It's well known, there's a version of it in Sir Vivian Fuchs' book, *Of Ice and Men*. It goes something like ... I can remember the first verse to be something like [sings]: "Have a good year", said Sir Vivian, as the ship lay at Southampton quay. "And always remember this motto, whether on land or at sea. BAS knows best. There really is nothing to fear. Confusion may reign on the bases; it doesn't affect us back here". Then it goes on to describe his experiences in Deception, which had erupted. I'm not sure I can remember much more of it<sup>10</sup>.

[Part 2 00:30:53.18] Lee: Okay. We get you back to Great Britain. You've done two years with BAS. You're back in Edinburgh, and I guess you have to write up your work.

[Part 00:31:02.06] Gardiner: Yes.

[Part 2 00:31:03.01] Lee: And was that that, then? Were you expecting to have any further contact with British Antarctic Survey at that point?

[Part 2 [00:31:08.08] Gardiner: Well I just kept on doing what I was given to do. There was plenty of work to do. I worked on geomagnetic data and on radiation data and on ozone data and on seismic data, anything that had to be done. And I was put on contracts. I remember that, I think I had something like; I was on my thirteenth contract when they gave me a Civil Service type post. I came back in 1970, and it was for five years I was in these contracts. There was even a time when my contract had expired and I was still working, and on one occasion, they gave me a renewal contract that had already expired by the time I got it. These were three-month and six-month

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<sup>9</sup> It would have been from Ibicuy to Zárate, across the River Paraná, not the Plate.

<sup>10</sup> A YouTube video of this song may be found by searching for 'BAS knows best'.

and nine-month and twelve-month type contracts. The interesting corollary of that of course is that that wasn't pensionable. These were contract Fids posts, and of course at the time you don't realise that when you're in your sixties this will make a difference to your income. So I ended up with more like thirty years pension when I could have had thirty eight or something like that, but that's the rules of the game.

[Part 2 00:32:12.09] Lee: Were you worried at the time? Were you concerned that you...

[Part 2 00:32:15.25] Gardiner: No.

[Part 2 00:32:18.02] Lee: That you could be out the door.

[Part 2 00:32:18.28] Gardiner: Well, that I could be out the door, yes. I mean, I expected to be out of the door on a regular basis. But Joe Farman just kept renewing my contract, so I eventually screwed myself to the floor and he then decided that he wanted to have a radiation and ozone section, and a geomagnetism and seismo section. So he made me the head of the radiation and ozone section, and Munro Sievwright the head of the geomagnetism and seismology section. And then we had Dave Limbert working on Met at that point; he'd come back from the Met Office, also an ex-Fid (or Royal Society Halley Bay Fid).

[Part 2 00:32:55.26] Lee: And this was all in Edinburgh?

[Part 2 00:32:56.16] Gardiner: This was all in Edinburgh, yes.

[Part 2 00:32:58.00] Lee: Tell me about David Limbert, because he sadly passed away recently.

[Part 2 00:33:00.24] Gardiner: He did. He was a lovely guy, really: very friendly, helpful human sort of person, and long experience in the Met Office. He was a genuine Met man, professional. I can't remember what else I can say about him, really; just a very nice guy.

[Part 2 00:33:22.27] Lee: Right. The next big change was when you, when you met Iris and got married.

[Part 2 00:33:26.04] Gardiner: Yes.

[Part 2 00:33:27.10] Lee: In '75.

[Part 2 00:33:27.17] Gardiner: I got married in '75. At that point, we knew that we were probably going to have to shift because plans were already being made. Probably when I got married we knew we were going to Cambridge, but there was a time when Bonny Fuchs and people in Cambridge were planning to build this headquarters, and there had to be a decision as to where it should be. And Joe Farman had an idea that there was a building in Edinburgh that would have been ideal for it, or very suitable, but he didn't manage to persuade the Cambridge coterie, who wanted to stay in Cambridge. So we all had to move, but I think when I got married we

already knew we were going to Cambridge, so we were only in Edinburgh for a year after I married before we moved in '76 to Cambridge.

[Part 2 00:34:17.23] Lee: To this house?

[Part 2 00:34:18.24] Gardiner: To this house, yes. We were given about a week or something like that to find accommodation, so we bought a car, actually. That was the first time I owned a car. Drove down here and spent a few days looking round all the villages and the estate agents, and found this house which wasn't the top of our list, but we're still in it even today.

[Part 2 00:34:44.14] Lee: You were made head of ozone radiation research and I think at this point, you've got your own Dobson spectrophotometer, didn't you?

[Part 2 00:34:53.11] Gardiner: I'm not sure what you're referring to there. Is this...?

[Part 2 00:34:59.02] Lee: In the UK, was it not then a Dobson photo spectrometer, sorry, I can't get this right. Spectro-

[Part 2 00:35:04.05] Gardiner: Spectrophotometer.

[Part 2 00:35:04.29] Lee: Was there not one of those Dobson machines established in the UK as well? If not, don't worry.

[Part 2 00:35:13.11] Gardiner: The situation with the Dobsons was that the Met Office had one in Lerwick and one or two in Bracknell, East Hampstead Research Station, and BAS, to begin with, had three. There was one at Halley, one at Argentine Islands, and a spare that was back in the UK in the early days and we used to rotate them. We'd bring one out and put one back in again, so these three rotated round and round, because that was a good way to get them reconditioned by the manufacturers in Watford. But eventually South Georgia (King Edward Point), an ozone programmer was started there in 1971 I think. And so that used up the third Dobson. So many years after that, they were stuck in position and grew older and more dilapidated. Not seriously, but they didn't get brought out for renovation until we purchased another one in about 1981 and installed it at Halley in the beginning of 1982. So that was the case with the Dobsons.

[Part 2 00:36:22.24] Lee: So what were you doing in the '70s? I know the research or the measurement of the ozone layer was continuous through that decade, I believe.

[Part 2 00:36:32.14] Gardiner: The measurements of ozone were continuous from the International Geophysical Year in 1957 right up to the present day. There's never been a break in them, really.

[Part 2 00:36:41.17] Lee: When these figures were coming in on a regular basis, were you seeing them?

[Part 2 00:36:44.00] Gardiner: They were coming in monthly because the Fids sent in a monthly telegram giving one value for each day, and then any additional information, like one lamp test or that sort of thing. So what we got was every month

in Edinburgh and the [first month] in Cambridge, we got thirty one, if there were thirty one days in the month, values of ozone, and we could make graphs of them. I mean, the only time we really began to do that sort of thing was ... When we were in Edinburgh in the 1970s, these interesting papers were published by the guys who eventually won the Nobel Prize. The first paper was by Paul Crutzen, a Dutch guy working in Germany in Mainz, who pointed out that oxides of nitrogen could catalytically destroy ozone, and that means it could destroy ozone and destroy many molecules of ozone for one molecule of NO or NO<sub>2</sub>. That was in 1970. And then four years later, Molina and Rowland in California published a seminal paper pointing out that chlorofluoro-carbons could catalytically destroy ozone – stimulated in their researches to some extent by Jim Lovelock's measurements in the Atlantic on a NERC ship, where he was measuring CFCs and found that he could measure CFCs even far from sources of pollution, and realised they were quite long lived. So Molina and Rowland published that in 1974 and we all, everyone realised that you might damage the ozone layer. Nobody was talking about the Antarctic, ever, at all. It was just in the mid-latitudes or worldwide, there would be a small percentage loss of ozone.

[Part 2 00:38:31.11] Gardiner: So naturally we looked for that, and Joe and I drew graphs of ozone. But we were mainly looking in the summer period, summer to autumn, January, February, March, because that's when the ozone is most stable and since CFCs are released in civilised (so-called), industrialised countries, you would expect the Antarctic to be the last place to pick up the news. So you wouldn't expect it in the middle of winter when the stratospheric vortex is quite isolated. News comes in when the vortex breaks down and you get some air in from outside the Antarctic in November, December, January. So we looked for changes all the year round, but the place to look for them was where it would otherwise be steady, and that's January, February, March. And there was no significant change because of course there was no significant depletion at that stage.

[Part 2 00:39:22.00] Lee: So let me get this right. Because of the papers that Rowland and Molina published in '74, that spurred you to check through the ozone readings you'd been having over the last few years.

[Part 2 00:39:35.02] Gardiner: Over the whole period, from 1957 up to...

[Part 2 00:39:37.25] Lee: At that point in 1974, you didn't spot anything untoward?

[Part 2 00:39:40.28] Gardiner: That's right, yes. It would've been difficult to spot any trend at all, really. So we were looking, and we kept looking. We were always looking because it was a hot topic of interest.

[Part 2 00:39:53.17] Lee: When did you begin to spot what you later had to write about?

[Part 2 00:39:58.21] Gardiner: Probably late '70s, early '80s, and I think the first thing that ever happened would be: ... I was telling earlier on about cloud observations. Those are done off charts, and so the Fids had these big charts, it was all done by hand. Remember this was in the days when ... Well, hand-held calculators only came in in the early '70s, so it was ..., a lot of it was done by hand. And occasionally they would complain that the readings of the cloud corrections were off the bottom of the

cloud correction chart, and were asking, 'What should we do?' And we were more or less saying, 'Well, just extrapolate. There's nothing else you can do. Do the best you can. We'll make up more charts as we get more observations in that region.' That would happen occasionally, and I mean, over donkeys' years, there've always been occasional observations that were a little bit odd, either because the ozone has gone through a dip with a big vertical movement over the year, or because somebody's made a bad reading. There are always mistakes being made. It's what you have to watch out for all the time. So I think that the earliest sign would be some of these low readings that came in, with the Fids saying 'One or two of the observations were off the bottom of the chart. And then, of course, the problem would go away because, as we now know, the ozone depletion ... there's an annual phenomenon that happens typically in October. It's most severe depth is in October. So these were probably things that came in October and then a month later, the problem had gone away, and then it would come back again a while later and so on. Not every year was the same. In the early days, there was a big inter-annual variability of ozone.

[Part 2 00:41:37.24] Gardiner: Especially at that time of year, when the vortex is breaking down, typically in November, say. So these were sporadic events that only gradually accumulated to become the story that we know today. So it wasn't sudden; it was gradual.

[Part 2 00:41:59.01] Lee: At what point then, did you start to take it seriously?

[Part 2 00:42:03.03] Gardiner: I think we began to take it seriously probably in the early '80s, where we could see that the values were lower than they'd been before. And in the last two or three years, '82, '83, '84, was where it got more serious.

[Part 2 00:42:19.29] Lee: Was it accelerating?

[Part 2 00:42:22.14] Gardiner: It was getting deeper, yes. I think that's what finally tipped the balance. You have to remember that we didn't get the actual observation sheets in until the end of a year. The Fids would write everything down on their observation sheets and calculate it all for the individual observations, and then they'd take several observations a day, just average them for the day, and then send back the daily values for the month. So that's all we were looking at, and we'd no great ... We'd hundreds of other things to do and we weren't sort of falling over each other every day to look at the ozone ...

[Part 2 00:42:56.24] Lee: So the telexes had stopped? This is now an annual report, coming back on the ship?

[Part 2 00:42:59.18] Gardiner: No, no, the telexes came in every month. But then we also, every year, when the ship came back in May ... the ship came back in May '84, you get all the 1983 observations, which you could then pore over and check and correct. And there's an endless panoply of calibrations that you can do on Dobson measurements to check them and improve them and make them more accurate, which is a lot of work. So you wouldn't have those original data back until, in some cases, sixteen months after they'd been made, and the October ones wouldn't come back until the following May.

[Part 2 00:43:37.08] Lee: So who was doing the checking of the readings? Was it you, or Joe, or Jon Shanklin?

[Part 2 00:43:41.03] Gardiner: Well, it was each of us in turn over the years because Joe started making measurements in about, IGY – '57 and I started with BAS in '67 and Jonathan started in '77. So each of us did it in our turn and then gradually delegated it to the others. When Jonathan was taken on in '77, one of his tasks was to catch up on a backlog of these calibrations, which always existed. So at the time that we're talking about, Jonathan was probably looking at the telegrams as they came in and bringing them to me.

[Part 2 00:44:14.10] Lee: I appreciate that it was a slow, inexorable development over a long period of time, but was there a lightbulb moment? Was there a moment when somebody looked at somebody else and suspicions were aroused?

[Part 2 00:44:29.24] Gardiner: Well, I wouldn't say a lightbulb moment but clearly the crucial moment was in '84. The way I've described it in the past is to say that to begin with, the depletion, if you want to call it that, the lowness of the readings, was small, and gradually got bigger. And the error bar, if you like, you know, the uncertainty that you can attach to it, started large because you didn't know what was going on and whether it was completely rubbish or not. And as we studied it more and more carefully each year, it got smaller and smaller until eventually I would say, the two passed each other alarmingly swiftly in that last year. So it got to the stage where you went from thinking it could be a problem with the instrument, or it could be something going on in the atmosphere that would go away after a bit, because these things do happen. Or it could be something real. You went from that position, thinking that it was nothing to write home about, or might turn out to be rubbish, on the one hand, to the opposite feeling of 'Oh my God, it's real. We're sitting on a volcano. We've got to publish it.' And that happened in, with the October '84 data as it came in. But, I mean, the considerations are things like ... The possibility that it was an instrumental problem was quite serious for a long while. I think even at the time we published, there was still a lingering fear because the instrument, although it's very well defended and beautifully designed by Dobson to his credit, it is quite complex, and the calculations are, to some extent, empirical. And one of the things that bothered me, for example, was that, you make measurements typically at Argentine Islands and Halley from when daylight returns in the spring, and at the Argentine Islands, say, in August when the sun gets high enough.

[Part 2 00:46:40.28] Gardiner: Through to April the following year. But you don't make very many measurements in the winter because it's dark, and if the sun is too low it becomes too difficult to make accurate measurements. And moon observations are scarcely worth the paper they're printed on, although if they're done well, they're all right, but getting them done well is a difficult thing. And one of the problems was that for ... The winter is the time when you can take the lid off the instrument and clean it and maintain it. And here we were, getting these problems that always arose at the start of the new measuring season. It was, you might say, it was almost obvious that it was something the Fids were doing to the instrument when they cleaned it. It wasn't unheard of for instruments to take a little while to recover from a cleaning. It's like cleaning your spectacles. If you have got a lot of grease on your spectacles and you clean them, you make them worse than they were.

[Part 2 00:47:30.02] Lee: You went to Halley in 1980 and found a faulty instrument, didn't you?

[Part 2 00:47:34.09] Gardiner: I did find a faulty behaviour anyway, in that the instrument was in two halves; the top half sits as like a lid on the bottom half. Both halves have operational parts in them. It's not just a lid; it contains all the wavelength selecting quartz prisms and so on, and so you have to get these two parts fitted together properly. And they're held together with: there's an O-ring that goes right around the base of the instrument, and the top sits on top of it. And they're then screwed down with, I think it's twelve nuts that screw onto bolts, and there are washers, as you might expect. And so there were twelve nuts and twelve washers. For some reason, when I arrived on base I found that there were three washers at each corner and no washers in all the others. I don't know how this arose; somebody just misunderstood where they were meant to go or didn't think it mattered. This meant that the middle of the instrument was being pressed down just a millimetre or two more than the end, and that's enough to make a small difference. It turned out that the instrument is so well built that all the tests had managed to overcome this and eliminate it. You could even bend a Dobson and it still works. But it was a sign of what sort of thing could be going on that you wouldn't know about, because the Fids were just doing their best on base and if you're not looking over their shoulder every minute, you can't see what they're doing.

[Part 2 00:49:01.23] Lee: So the fear of Fid failure, of Fid fault?

[Part 2 00:49:04.26] Gardiner: Or instrumental failure or instrumental fault. I mean, there were things like: there was a copper commutator that rotates and sends copper swarf onto all the optics and so on. There are lots of reasons why you might expect an instrument to misbehave, and other instruments in other stations misbehave regularly. And ours are some of the best in the world; they're well trained, well run, continuous programmes. Other places you might have a university where an enthusiast runs it for twelve months and then it falls into disuse and so on. So it was a serious worry. And the other big problem of course was that NASA had a satellite that had been launched in October 1978, and the satellite is polar orbiting. So if you're at the equator, it only passes over you once a day, but in the poles, it's passing over several times a day. Surely to goodness, if something were going to turn up in the Antarctic, NASA would see it before us because they've got the daily values coming back. And so there's all this slight feeling that we're going to go out and say that the sky is falling in, only to be told not to be so silly.

[Part 2 00:50:06.08] Lee: Were you actually talking to the Americans at that point? Were you getting their results as well?

[Part 2 00:50:09.24] Gardiner: No we weren't, no. It wasn't like that. It seems now that that's the obvious thing to do but we weren't really. We had good connections with NASA in that we'd been flying ozone sondes for what they call ground truth, which is calibration of the satellites, so we knew people in NASA. But there are many different branches of NASA, and they're not the same people, and it turned out later actually that Jonathan at one point wrote a letter to the people that we did know at NASA. I could probably have told him that these were not the people who would know the

answers to this particular question, but I didn't know that he'd written that letter, or these letters, until later.

[Part 2 00:50:48.14] Lee: What was the letter saying?

[Part 2 00:50:50.05] Gardiner: 'Have you had any low ozone values?' or words to that effect. My feeling in my head at the time was that we were independent. One of the joys of our calibration system was that we did it by ourselves. It's a technical point, but we do our fundamental calibrations by watching the sun go up and down, making maybe twenty observations in a day to do this, whereas other people get their calibrations done by cross-calibrating with an instrument in their local Met office.

[Part 2 00:51:19.21] Lee: So just to clarify that then: as the idea about publishing started to grow in your minds, you actually didn't know what the American results were going to be, or were.

[Part 2 00:51:29.07] Gardiner: That's right.

[Part 2 00:51:30.24] Lee: Or what results the Americans were getting?

[Part 2 00:51:30.24] Gardiner: Not only that, it turned out later that even they didn't know what they were getting.

[Part 2 00:51:33.21] Lee: Because they were ignoring the extremes?

[Part 2 00:51:35.01] Gardiner: To some extent, yes. We can come back to that but my feeling was that as we were independent, and had independent calibrations, we should be confident of our own results whatever else anyone was doing. And that to some extent, my feeling was that if I'd asked NASA, it would have been like cheating in a way. It would be like saying, 'Are you seeing what I'm seeing?' Whereas I think a good scientist should look at his own data and say, 'I've decided that, on the basis of my calibrations, I can't find any other reason for this. I'm going to say it's real and let the chips fall where they may.' And that's what we actually did in the end. We went out to publish on our own, knowing in our hearts that it could turn out to be baloney. We had nothing else to stand on but our own conviction and our own professional skill.

[Part 2 00:52:23.07] Lee: I want to go back a bit for a moment but...

[Part 2 00:52:25.14] Gardiner: And I'm glad of that.

[Part 2 00:52:25.06] Lee: Let me ask you a question about the three of you deciding to publish at that point, because you could have done another couple of years, couldn't you, to get more statistics?

[Part 2 00:52:35.29] Gardiner: We could have done. And you might even argue that we could have done it a year earlier. That would be more...

[Part 2 00:52:40.01] Lee: Except you were concerned about the veracity of the results coming back from these spectrophotometers.



[Part 2 00:52:45.06] Gardiner: Yes, I think if you were going to say, make one of these charges, if I were a lawyer it would be easier to say we should have done it earlier than later. I don't think we could have waited another minute after the time.

[Part 2 00:52:55.20] Lee: Why, why's that?

[Part 2 00:52:57.01] Gardiner: Well, because it had got so severe at that point that we would have been criticised if we'd sat on it any longer.

[Part 2 00:53:01.00] Lee: You'd be negligent in not spreading the news.

[Part 2 00:53:02.08] Gardiner: Correct, yes. I think we were lucky to get away with it in some ways, that NASA hadn't spotted it. Although the fact that we published at that moment and that NASA were coming to something like a similar conclusion, they claim, shows that the timing was right, that both groups were taking care to try and get it right. If you talk to NASA now, the people that were involved in it at the time, they will tell you that it wasn't a case of merely marking their data down as suspect because it was too low. There is some truth in that but they were looking at their data and they can point to an abstract that they'd prepared for a meeting in Prague, independently, where they were pointing out the low values. After ..., I think they prepared the abstract in, was it in February of '85 or something like that?, they claim, before our publication actually came out, although they might have had wind of it through the review process. But they were coming, they would have come to the same conclusion about a year after us, maybe. It was inevitable that somebody would spot it after a bit. I mean, you couldn't miss it. It was staring you in the face. The only question was, is it real? And if it's real, what the hell does it mean?

[Part 2 00:54:09.21] Lee: And the Antarctic Treaty didn't apply to processing of scientific results?

[Part 2 00:54:14.12] Gardiner: In what way?

[Part 2 00:54:15.06] Lee: In the sharing of information.

[Part 2 00:54:17.01] Gardiner: Well, it would have done in the sense that we would gladly have shared data if people had asked us. But they didn't.

[Part 2 00:54:25.05] Lee: Let me go back then to October, 1984, and you're drawing your conclusions which you hope are accurate, based on correct readings rather than faulty ones. Who at BAS did you tell? Liz Morris?

[Part 2 00:54:41.18] Gardiner: No, it wasn't Liz Morris; it was Michael Rycroft was the Head of Division at that time. I don't know who Joe told. I mean, there is a story that Joe puts about that he's, he found, he got wind of some letter that Michael Rycroft wrote to the Met Office trying to discourage publication of the paper, but I only heard about that donkeys' years later. As far as I was concerned, Joe and Jonathan and I knew that we were writing this paper. One or two of our pals eventually found out about it as we spoke to them in smoko, probably at the point where we were just about to submit it, I think. I remember John Dudeney joking to me and saying ... Because

Joe was notoriously fastidious at getting everything right, it would take a long while to complete something. Dudeney said, 'You ought to get the Nobel Prize for psychology to get Joe to finish a paper.' And when we were preparing the paper, I sat in Joe's room and you probably know that Joe Farman was an inveterate pipe smoker. The stratosphere was stratified layers of smoke in his room. I sat for several weeks from some time in November to completing the paper on about December the twenty-somethingth. And we doggedly hammered out every word and phrase and I went back to my room every night again and typed out the next paragraph and came back and discussed the next one and so on. That was once Joe had decided that we should publish the thing. I should say, before that, there was a point in which, to show you that even at that late stage, there was still uncertainty in our minds.

[Part 2 00:56:27.15] Gardiner: Joe had to face, quite incidentally, quite coincidentally, an inspection by NERC. I think it was an inspection of the stratospheric work, and that was ... He was due to make a presentation to these, the great and the good, on Monday, it must have been Monday the 12th of November, 1984. And to show you what position he was in, he was naturally going to present to them this ozone depletion. We didn't call it that back then, but these ozone values. And he was obviously getting quite nervous in case it should turn out to be rubbish because on the Sunday, which was the 11th, Remembrance Day, it was one of those years in which Remembrance Day actually falls on the 11th, I was at home on the Sunday, and I got a phone call from Joe saying, 'Come in to work' – something he'd never done before. So I drove into work and he said, 'Persuade me that these readings are real.' And I went and got, we didn't obviously have the 1984 originals at that point, but I went and got the '80, '81, '82, '83, and went through the direct sun observations, which are the most reliable ones, and pointed out ... We were playing Devil's Advocate; we went through and said, 'Could that be a wrong reading?' If that one, surely not that one as well. It's a different set of initials against them, a different person, different time of year, and all that kind of stuff. We looked at the ones in the summer, the ones in the autumn and the spring, and I persuaded him, if you like, in a dialogue, like a Greek dialogue, that there was no escape; that you couldn't falsify this. And he was persuaded at that point.

[Part 2 00:58:05.17] Gardiner: And he presented it to this inspecting committee the next day. Interestingly, he subsequently said that he was very disappointed by the reception he got. They said, 'Oh yes, I think you should publish that, that's very good.' But they didn't go berserk, which you would have thought they would have done given the subsequent importance of it.

[Part 2 00:58:22.10] Lee: Is this the scientific advisory committee?

[Part 2 00:58:24.11] Gardiner: Something like that.

[Part 2 00:58:25.06] Lee: He was talking to. Who didn't get it?

[Part 2 00:58:28.12] Gardiner: Sort of. That's what he says.

[Part 2 00:58:30.23] Lee: I think we should ... If I may just take you back then to referring up. The three of you had this revelation, and it seems to me that (if I've got this wrong please say so), that there was a certain amount of autonomy surrounding

Joe, which meant that he didn't worry too much about whether he talked to the hierarchy at BAS. He was more concerned about talking to the world.

[Part 2 00:58:54.01] Gardiner: There was a certain independence. What was the word you used for it? Autonomy?

[Part 2 00:58:57.13] Lee: Autonomy.

[Part 2 00:58:58.23] Gardiner: Yes. There was a certain autonomy about all three of us. I'm not sure whether this is being fair or being conceited, but all three of us are independent thinkers. We're more likely to be a thorn in the flesh of the establishment than yes men. We probably were selected by each other, that is to say Joe selected me and I selected Jonathan for that reason: people who could think for themselves and didn't automatically toe the line. And certainly I mean, in subsequent occasions I can remember there was some long rigmarole you had to go through to submit a paper. I have been known to submit the odd paper now and again without quite going through that rigmarole at entirely the orthodox time. And in the *Nature* paper, I think Joe did exactly that. I think it should have been submitted up through the hierarchy, but that would have delayed it. I have to explain that when I was typing up this paper and discussing it with Joe and arguing over the wording and getting the figures right and so on, Jonathan prepared some of the figures and I prepared some of the others. And Joe and I, as I say, Joe writing the paper and me criticising it as we went along, and me going back to my room and typing it up and so on. It got to the stage where the Christmas break was approaching and I was determined to get it finished in time for Christmas and not have it drag into January.

[Part 2 01:00:26.28] Gardiner: And at that time, there was a little minibus that was driven by a guy called Frank who was a sort of local handyman, that always left at exactly 5:30 to go into the town where I could get my bus home. So I had to get, I had to leave my room at 5:27 and a half. And I got the final prints and had to do a lot of photocopying, of course because you had to send so many copies in, and the covering letter that they'd already prepared and everything, and got the last thing off Joe just in time about an hour before that time, or time to do the photocopying, to bundle it all together into envelopes, you know; take with me enough paperclips so to speak. Take it all home, collate it, staple it all together, and put it in an envelope. And then the next morning I went to Joe, to Joe's house with a bottle of wine to congratulate him on it and he actually said something like, 'Have you posted it?' And I said, 'Yes.' And I said, 'Why?' He said something like, 'Well, I was just thinking about... ' And I said ... [laughs]. So I went and posted it and that was it. So I think I posted it on, that would be Saturday December the 22nd or something like that.

[Part 2 01:01:38.25] Lee: Which post box?

[Part 2 01:01:40.27] Gardiner: I think it was a post box in ..., on the Backs in Cambridge, not so very far from Joe's house.

[Part 2 01:01:49.26] Lee: Did *Nature* know what was coming?

[Part 2 01:01:51.13] Gardiner: No.

[Part 2 01:01:52.16] Lee: They had no idea?

[Part 2 01:01:53.04] Gardiner: They had no idea.

[Part 2 01:01:54.17] Lee: Well I...

[Part 2 01:01:55.11] Gardiner: As far as I know, I don't see how they could have done. They just get a paper, arrives through the post. It's a good question; you wonder when these things come in, how do they know that it's not a load of cobblers? And the answer is: they send it for peer review.

[Part 2 01:02:08.18] Lee: Okay, I'll come back to that in a minute then. I think it was Dick Laws who was Director at that time. Is that correct?

[Part 2 01:02:14.23] Gardiner: I think that's right, yes.

[Part 2 01:02:15.03] Lee: Because he has no knowledge, he has no memory of this process. He doesn't seem to remember being consulted or referred to or...

[Part 2 01:02:21.24] Gardiner: That doesn't surprise me.

[Part 2 01:02:22.11] Lee: Taken into the confidence at all.

[Part 2 01:02:24.14] Gardiner: I think that's correct. I think Joe's attitude probably was: 'It's a paper. We've got something interesting. We should publish it. Here we go, let's publish it. What does anyone else know about it? They don't know any more about it than we do. What contribution could they possibly make?' would be my guess.

[Part 2 01:02:40.21] Lee: When *Nature* sent it to the peers, to read it, they would be in the same position as Dick would've been in, that they would know nothing about it.

[Part 2 01:02:47.11] Gardiner: Correct. They had to take it face value.

[Part 2 1:02:42] [End of Part Two]

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[Part 3 00:00:00.00] Lee: This is Brian Gardiner, interviewed by Chris Eldon Lee on the 28th of September, 2011. Brian Gardiner, Part Three.

[Part 3 00:00:11.04] Lee: How was Christmas 1984 for you? Because you were like somebody who had a devastating piece of gossip, weren't you?

[Part 3 00:00:17.22] Gardiner: I think it was a relief to have the thing finished, from the point of view of getting all the i's dotted and the t's crossed, but I was well aware that there was a long road to go because peer review is a process that takes quite a while. And when you get the results back, you have a lot of corrections to make usually to answer the criticisms of the peer reviewers. So it was just the beginning of a road, and I was well aware in my own mind that it would cause a sensation if it was,

if and when it was published, as I was sure it would be. How could it not? And the newspapers would be agog with interest, so I imagined.

[Part 3 00:01:01.20] Lee: Did you get some bounce-back from the peer review? Were you asked for corrections, or illuminations?

[Part 3 00:01:07.18] Gardiner: You always are, yes.

[Part 3 00:01:09.13] Lee: So that happened?

[Part 3 00:01:10.04] Gardiner: That did happen, yes.

[Part 3 00:01:11.10] Lee: You did some rewrites?

[Part 3 00:01:12.20] Gardiner: I forget the details now, but nothing serious, just the usual. You have to answer their criticisms. I mean you don't have to change something if you think their criticism is misconceived. But I've forgotten the details now, really. I know that Susan Solomon was one of the peer reviewers because although peer review is very often anonymous, she signed her review, and as far as I remember, it was a very favourable review, and I've spoken to her about it since.

[Part 3 00:01:44.05] Lee: What was to stop people like her spilling the beans? Because, my understanding of the *Nature* magazine is if you did publish somewhere else first, they wouldn't then publish themselves.

[Part 3 00:01:56.01] Gardiner: Yes, and also they wouldn't publish anything that the bean-spiller was submitting either. I mean...

[Part 3 00:02:02.04] Lee: They call them spoilers in the journalism world.

[Part 3 00:02:03.04] Gardiner: Do they, yes. Well, there's two questions there. One is, what is to stop a peer reviewer talking to a colleague? And the second question is, what's to stop a colleague publishing it? I don't think that second question arises. They didn't have the data to publish; it would have been absurd. *Nature*, or no other journal, would have entertained somebody else submitting our data.

[Part 3 00:02:27.09] Lee: They could have gone to the press.

[Part 3 00:02:30.01] Gardiner: Yes. Well, they didn't and it didn't happen. I think professionalism was good enough to avoid that. But it's a good question in general, isn't it? And it's certainly worth considering. I think, to some extent, I think probably they did consult, and you are allowed to consult, to an extent. Most journals, if you read their instructions to reviewers, will say, 'If you don't feel you're competent to do the review, send it back and we'll find another reviewer, and you can even recommend one.' If it's just some minor detailed point and you have a colleague who could resolve the point, they sometimes let you consult, provided you impose on the colleague the same duty of secrecy that you have yourself. So there's a certain amount of latitude there. From what I've heard over the years in the rumour mill, I think that possibly the other reviewer might have consulted a colleague, but I can't be sure really, and I don't strictly know who the other reviewer was sorry. I think there were

two but might have been three, now I've forgotten. But it's a good question. I mean, we're recording this in September 2011 and only a few days ago there was an article plastered over the newspapers that some scientists had measured neutrinos travelling faster than the speed of light, and if this was true, the newspaper said, Einstein would be wrong and the whole of physics would be overturned and all that kind of stuff.

[Part 3 00:04:02.08] Gardiner: Patrick Moore came on to a popular programme and said it was bunkum and he didn't believe it, although he reserved his judgment and said he could be wrong. And Professor Jim Al-Khalili, a popular science presenter, said he would eat his underpants if it turned out to be true. Now, you and I don't know at this point whether that will turn out to be a load of bunkum, or the discovery of the century. And your question almost is similar to the question, should they have published it when they did? Or should they have done as we did, studied their data carefully and worked out all their errors before they published? And I can see merit in both answers, because if I was sitting on something like that, and I felt that it was good to overturn Einstein, would I have the courage not to publish it, for fear, as you say, that somebody else might or somebody else might repeat the experiment? These are not easy questions to answer, no more for the neutrino guys than they were for us.

[Part 3 00:05:05.17] Lee: But the three of you were convinced about publication?

[Part 3 00:05:09.05] Gardiner: We were all convinced it should be published, yes. I think Jonathan was already champing at the bit and thought ....

[Part 3 00:05:14.18] Lee: Well he'd already written a draft, hadn't he? Earlier on?

[Part 3 00:05:16.14] Gardiner: Well what he did was, he, just at that particular moment in 1984, he drew a graph and wrote a little memo, more or less to ..., I think with the aim of chivvying Joe and me into action. He was the youngest of the three of us and probably saw us, with some justification, as being old codgers who took a bit of persuading or something like that. Joe's position, of course, was more terrifying because although I was the Head of the Radiation and Ozone Section, he was clearly the boss of the group, and would have carried the can if it had gone wrong. You were asking earlier on whether Dick Laws was in on the chain of command for the submission. If he wasn't, can you imagine what would have happened to Joe in Dick Laws's eyes if this had turned out to be a load of rubbish? If there had turned out to be an instrumental error and NASA had turned round and said, 'We've been measuring ozone every day for all this period, why didn't you ask? We have received nothing of the sort.' That was a possibility when I posted that manuscript, and it was still a possibility for *Nature* when they received it. I may say that ..., you were asking earlier on about Dave Limbert. One of the nice things that Dave Limbert did was he was going to a conference in 1985 in Hawaii. I think it would have probably been about in August 1985, and he encouraged me to go to it. It had nothing to do with the ozone, but to present my radiation research. I was researching the effect of clouds in reflecting radiation between bright surface snow fields and the underside of clouds and so on.

[Part 3 00:06:53.11] Gardiner: While all of this was going on. And he said to me, 'You should go to Hawaii.' We weren't conference-goers. People now look back on us as though we were a sort of hot research team the way you would find in a

university today. We were more like dogged measurers. Joe's favourite quote was: 'The only thing better than ten years of continuous records is twenty years of continuous records.' And we only became researchers *per se* as a result of the ozone thing, really. So I was doing research on radiation, which was probably the first sort of research that had been done in that group for ages, and Dave Limbert encouraged me to go to Hawaii. When I went to the conference in Hawaii, I was walking down the corridor at one point when Rowland, the guy who was subsequently to get a Nobel Prize with two others ... He was a larger than life American and probably in Bermuda shorts and a Texan hat at this point. And this was a conference in the Hilton Hotel in Waikiki with about two or three thousand participants and lectures going on simultaneously in twelve different rooms. We were all scurrying from lecture four to lecture ten. And we had name badges, of course, as you do at conferences and as he passed me in the corridor, he said, 'Ah!' he said, 'I know who you are. You're one of these guys from England who produced this paper.' And he pinned me to the wall and interrogated me, and he opened his briefcase and he pulled out an A4 transparency with one of the graphs from our paper on it. Now *Nature*, they're very short of space; they only allow you a thousand words; I think we were given twelve hundred. The figures were only about an inch square, and he'd blown this thing up to be A4 size. The first thing that impressed me was that he had a copy of a figure from our paper, the great Sherry Rowland.

[Part 3 00:08:41.22] Gardiner: The thing that really impressed me was: he had a photocopy of it enlarged. We didn't have anything like that in our department. So anyway, he talked to me in detail and quizzed me endlessly. And I remember some time later, reading one of these documentary books, I think it was by Sharon Roan, called *The Ozone Story*<sup>11</sup> or something like that, and in, far into the book it mentioned this encounter and said, 'Rowland was impressed with Gardiner.' And I thought, well, that's nice. What it actually meant was: the poor man was in the position that you were asking me about a minute ago. How did anyone know that this was true? Or did they have any warning about it? He just saw it when it was published in May '85 and he'd been running around, wondering who the hell these guys were and whether this was all true or not. And so he was ..., I think he was relieved to question me and find that I had plausible technical answers to plausible technical questions, that we'd tried hard to do our calibrations and eliminate all the possible errors in the instrument and we'd convinced ourselves that it must be real. And at that same conference, I bumped into another person who is part of this story, and that's Shigeru Chubachi, the Japanese guy who had been to a conference in Greece in October '84, I think it was, or something like that, and he'd presented a little paper on his ozone data from his wintering in 1982 I think it was, together with a previous year, 1966, and he showed the comparison of the two.

[Part 3 00:10:19.09] Gardiner: What he was pointing out, as he thought, was a difference in the stratospheric warming episode which turned out to result in a large ozone rise. What he didn't realise because he didn't have the perspective of all the years that we had – he could have had but he didn't – was that it wasn't a dramatic ozone rise; it was a rise from a dramatic ozone low. And we happened to sit next to each other in a lecture and introduced each other to ourselves. And he told me that he'd been ..., he'd got some measurements of CFCs in the troposphere and I said

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<sup>11</sup> *Ozone Crisis*.

'How interesting.' Then he showed me his ozone thing and I realised that he'd got low ozone values in 1982 just as we had. And we discussed it and we said, 'We are the only two people who know for sure that this is true.' because we'd got two independent readings, although he hadn't realised at the time what he was sitting on. I think he then got a medal from the emperor of Japan for discovering the ozone hole, and who can take it away from him. He sat in the seat that you are sitting in. I invited him home one time. He came home and played with our children after a conference in the late '80s. Lovely guy. That was Shigeru Chubachi.

[Part 3 00:11:30.25] Lee: Let's go back, then. That's great, thank you very much. Let's go back, though, to this period before. The article was in the post. *Nature* was published on the 16th of May.

[Part 3 00:11:41.20] Gardiner: Correct.

[Part 3 00:11:41.20] Lee: Five, four, four and a half months later.

[Part 3 00:11:44.21] Gardiner: That's quite fast for some journals, you know. I mean, some journals can take twelve months or eighteen months to publish. Not so much nowadays; the Web and all that kind of stuff has speeded things up a bit but in those days, it could take forever to get responses out of reviewers.

[Part 3 00:11:57.07] Lee: What was your state of mind during those four months, because...

[Part 3 00:12:01.18] Gardiner: I think I was busy doing other things. You just wait for the...

[Part 3 00:12:05.08] Lee: Really? You'd relaxed, you weren't relaxed were you?

[Part 3 00:12:05.21] Gardiner: Yeah, you don't get up every morning agonising over it. You know you've done it. You wait for the results. I think by that time we were pretty sure it was real. But we'd no reason to know for certain until we'd got the confirmation from, you might say from Chubachi on the one hand, or more importantly, from NASA on the other hand.

[Part 3 00:12:29.16] Lee: In some respects, publishing it was one way of finding out whether it was real, wasn't it?

[Part 3 00:12:31.23] Gardiner: That's, that's exactly the purpose.

[Part 3 00:12:32.27] Lee: Because there'd be somebody who'd come out of the woodwork, who said, yes, I've been doing the same sort of thing.

[Part 3 00:12:36.02] Gardiner: That's right. Or somebody, or NASA would turn around and say, 'No, we didn't.'

[Part 3 00:12:42.09] Lee: So you were fairly calm and collected during those four months?



[Part 3 00:12:45.09] Gardiner: As far as I remember.

[Part 3 00:12:46.08] Lee: First part of '85. Were you preparing for fame?

[Part 3 00:12:51.21] Gardiner: Not really, no. I think, as I say, I knew and Joe knew and Jonathan knew that if it survived peer review and it turned out to be real, it would be something quite dramatic. There was also the question of the explanation. Joe had been doing some work on the chemistry of the stratosphere with a PhD student from Cambridge University. And he courageously, you might say, decided that he could have a stab at a mechanism that would explain it. It turns out that the mechanism that he dreamt up at that point isn't the right one. It may exist, but it wasn't by any means enough to explain the ozone depletion. That turned out to be quite a different mechanism for reasons we can go into if you want but are rather technical based on polar stratospheric clouds that weren't in our explanation. So you could say that we published correct measurements with a stab at the explanation that was half right and half wrong, and that the details weren't the right mechanism. But we attributed it to CFCs, which turned out to be correct, but not for the reason that Joe put in there. So there was this interesting question about the paper being open to peer review on two aspects: one, the measurements, which nobody really criticised, and secondly, the mechanism which they did. But nobody's unduly critical about that. The paper was still widely cited of course and one of *Nature's* most celebrated and well-cited papers.

[Part 3 00:14:31.27] Lee: Do you think *Nature* magazine knew what it had in its hands?

[Part 3 00:14:35.24] Gardiner: Probably as soon as it got to the level at which you could regard it as an organisational opinion. I mean, I think so, yes. But once they got the reviews back ... I mean obviously if they got reviews back that said, 'What? Who are these morons? Don't you realize they've got their instrument upside down?' That wouldn't have helped.

[Part 3 00:14:56.00] Lee: Presumably somebody at *Nature*, in their press office, issued press releases about what was in that month's magazine.

[Part 3 00:15:02.06] Gardiner: They do, yes.

[Part 3 00:15:03.22] Lee: And majored on your story?

[Part 3 00:15:05.19] Gardiner: Right, probably, I've forgotten now to be honest.

[Part 3 00:15:07.08] Lee: Which is why the press were beating a pathway to Cambridge?

[Part 3 00:15:10.20] Gardiner: Yes. I don't remember the press being very fast. I've got a feeling that it was over the following two years that the interest developed. I remember my, one of my colleagues in the computing section in BAS coming to me one time, probably a couple of years later and saying ... He was an Irishman and very talkative and talked to anyone. He stopped on the way home from a trip in a pub and fell into conversation with a lorry driver, and the lorry driver started talking to him about ozone depletion. And my computer manager said to me, 'You really have found

something after all, because a gash lorry driver in a diner had heard of it.' That was fame at last.

[Part 3 00:15:51.04] Lee: When the magazine was published, what was happening in the corridors of power at BAS? Were they all reading it?

[Part 3 00:15:58.05] Gardiner: I dunno. I expect they got a bit of a shock when it came out. I honestly don't know when they first found out about it.

[Part 3 00:16:08.09] Lee: Were people not stopping you in the corridor?

[Part 3 00:16:12.10] Gardiner: When it was published? Well probably, but to be honest, I've forgotten the exact timing of all these things. I know that it took the chemical industry off guard, if you like, just to some extent I think.

[Part 3 00:16:26.01] Lee: Let me come to that in just a moment. So BAS didn't capitalise, the BAS press office didn't particularly capitalise on your discovery at that point?

[Part 3 00:16:34.26] Gardiner: The BAS press office now is wonderful and marvellous and does everything that you'd expect of it and more. I honestly don't remember now much about the BAS press office in 1985. They probably did what it was meant to do, but I can't remember now. I wouldn't criticise it at this long distance.

[Part 3 00:16:53.10] Lee: So it was a low-key period?

[Part 3 00:16:57.17] Gardiner: I can't even be sure of that, to be honest.

[Part 3 00:17:01.13] Lee: OK, fair enough. It is a long time ago.

[Part 3 00:17:02.01] Gardiner: It was a long time ago, yes.

[Part 3 00:17:02.16] Lee: Quarter of a century ago.

[Part 3 00:17:03.18] Gardiner: Yes, yes. Some things I remember clearly, and others are a bit of a fuzz because so much happened in the subsequent years, it's difficult to remember what happened in the first months and what happened in the second year. My vague feeling is that it was slow to develop its full potential, I would say, in certain ..., in wider circles. In narrow professional circles, it was recognized much more quickly of course. And then the Montreal Protocol, which was signed in 1987, the people who participated in that had already known about it since it was published, just as Rowland did.

[Part 3 00:17:37.00] Lee: So how were you feeling after publication? Were you frustrated that it hadn't shaken the tree? Or...

[Part 3 00:17:44.03] Gardiner: No, I think what I thought mostly about, after publication, was the explanation. What happened was that, looking at it from the professional, scientific point of view .... The way I've described it in the past is that each scientist in each scientific group attempted to explain it in terms of their own

specialisation. So the chemists came up with chemical explanations, one of which turned out to be right. The dynamicists explained it as due to air coming down with poor ozone from above, which it wasn't. Or air coming up with poor ozone from below, which it wasn't. Or air coming in with poor ozone from the side, which it wasn't. The people who studied the mesosphere, which is the layer above the stratosphere, argued that it was due to nitric oxide particles coming down from above. Or cosmic rays, if they were studying cosmic rays. Whatever it was you studied, you tried to explain the Antarctic ozone hole in terms of your specialisation, a bit like looking under the lamppost for your keys when there's no reason to suppose they're there.

[Part 3 00:18:50.17] Gardiner: Not quite the same as that but that's what happened. And so we spent quite a bit of our time trying to distinguish between these different theories. I mean, I remember going to a conference in Vancouver in 1987 and showing by graphs of 100 millibar upper air radiosonde measurements that we had plenty of, and other graphs, that it couldn't be due to dynamic effect, or something like that. And I remember one particular scientist interrupting me in the middle of my lecture and, as you do, and saying something like, 'But it's going down in September,' or something. And I had to point out that the two things were in the wrong order. For his argument to work, effect had to be before cause. You know, something as simple as that: looking in the graph, this happens first, that happens second. That cannot be the cause of the thing that has happened before. We had to sort of argue cogently and clearly against each particular theory. There was a group, I remember, Callis and Natarajan, published a paper that was all to do with stuff going on in the mesosphere. Perfectly well-written, peer reviewed papers but it just turned out later that they were incorrect. Speculative theory is perfectly appropriate but all from their own specialisation; an interesting phenomenon.

[Part 3 00:20:18.06] Lee: So when the publication took place then, there was no sense of BAS calling you in and saying, 'Well done, chaps. Here's ..., come have a martini in the head office.'

[Part 3 00:20:25.22] Gardiner: I'm not saying they didn't do that. I can't remember, to be honest. I don't remember a martini but I'm sure that they were happy that it had happened. At least, I hope they were.

[Part 3 00:20:33.11] Lee: I mean, as it transpired, that paper in some respects, that plus the aftermath of the Falklands War and Thatcher's funding about BAS ...

[Part 3 00:20:44.10] Gardiner: Made BAS famous.

[Part 3 00:20:45.01] Lee: Saved BAS's bacon, didn't it? Those two things together.

[Part 3 00:20:48.12] Gardiner: Indeed.

[Part 3 00:20:49.01] Lee: Thatcher deciding to invest more money in the British Antarctic Survey but coincidentally and very conveniently, your ground-breaking paper, which kind of ...

[Part 3 00:20:58.00] Gardiner: Did no harm.

[Part 3 00:20:58.24] Lee: Elevated BAS in scientific circles.

[Part 3 00:21:00.29] Gardiner: Yes, I think you might say that if you were in a committee where you were trying to make financial cuts and chop things, it would have been quite difficult to chop BAS when the ozone hole was in the air, wouldn't it? So to that extent, I think it was...

[Part 3 00:21:16.16] Lee: Fortuitous.

[Part 3 00:21:14.26] Gardiner: Fortuitous, yes.

[Part 3 00:21:16.22] Lee: Yeah, timing. Tell me a bit then about your feelings about the political reaction, because there was the Montreal Protocol in 1987, but it wasn't an instant change of heart, was it, amongst the politicians?

[Part 3 00:21:30.27] Gardiner: Among the politicians?

[Part 3 00:21:34.13] Lee: Well, my reading of that is that they decided to do things but not for a few years.

[Part 3 00:21:39.01] Gardiner: Yes. Of course, the first political reaction was long before the ozone hole. And even after Molina and Rowland published in 1974, I think it was in about 1978 that the Americans and I think probably some Scandinavian countries banned CFCs from aerosol sprays, although they still allowed them in refrigerators and so on. So there was political action. That was probably mediated by the EPA, the Environmental Protection Agency in America, among others. So there was action before the ozone hole ever appeared, to be fair, to some professionals and activists did persuade politicians to take some action. And then politicians, yes, are not always easily persuaded now to take some steady arguments for a while but the same is true of the chemicals industry. The chemicals industry, I think, had a little while of hoping that it would go away and thinking that it might not be them, because it wasn't immediately obvious that it was them. That took extra measurements by Susan Solomon's group and by the ER-2 plane that flew down to the Peninsula measuring ClO<sup>12</sup> to make that incontrovertible. At that point, I think the chemicals industry saw that the writing was on the wall and saw more interest in making, manufacturing alternatives than in holding out for the existing ones.

[Part 3 00:23:12.02] Gardiner: But even the chemicals industry was a much easier game to play than climate change is today, for example, because you could sit all the world's chemical manufacturers around a table. You'd have a couple of dozen major representatives, and as long as they all acted together so that one didn't get an advantage over the other, there was a chance of getting them to do something and to, for governments to support them. So the Montreal Protocol was, in that sense, a possibility. It was an industry in which ... was comparatively small compared to the energy industry that climate change involves. It was a nice early warning.

[Part 3 00:23:53.12] Lee: So were you sat at that table with those chemicals ...?

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<sup>12</sup> Chlorine monoxide.

[Part 3 00:23:55.16] Gardiner: No, but we did work with them, the chemical manufacturers association and subsequent groups like AFEAS<sup>13</sup> and so on. We did know people that sat on those groups and we liaised with them. In particular, Archie McCulloch at ICI was a very good spokesman. He was ICI's man who was meant to keep an eye on what these chemicals were doing in the atmosphere because the chemicals industry wanted to know what was happening to their chemicals because they didn't want to be told later they'd invested in twenty years, forty years of production only to be regulated out. So they spent a modicum of money out of their vast budgets on getting people like Archie McCulloch to be aware of what was happening. So he was our channel to the chemical industry. He....

[Part 3 00:24:48.21] Lee: They were connecting directly with you, Joe, and Jon?

[Part 3 00:24:52.04] Gardiner: Yeah, Archie McCulloch talked to us and we talked to him at conferences and so on, and by letter and meeting. He was very good, actually.

[Part 3 00:25:00.18] Lee: That seemed to have happened quite quickly, the chemical industry, well in the Western world anyway, them changing their tune.

[Part 3 00:25:07.24] Gardiner: Yes. Yes. A couple of years or something. I think by 1987 they were well on their way to...

[Part 3 00:25:14.04] Lee: And what about India and China?

[Part 3 00:25:16.14] Gardiner: Well, that's a long and difficult story of the history of the Montreal Protocol and so on. That's very complicated. The great benefit of the Montreal Protocol was that it had within it provision for review. It was compulsory that every few years there would be technical meetings and political meetings to tighten the regulations by adding on new chemicals that had been ignored to begin with, and by tightening the percentages. When the Montreal Protocol was first signed, it was to reduce CFCs to 50% by the year 2000 I think, or 1999 or something like that, which everybody knew was totally inadequate because we were pumping the stuff in faster than that, but the idea was to get signatures on paper. Once you got this thing signed, a couple of years later you could tighten it up. You could bring the dates forward; you could increase the 50% to 80% to 90% and so on. So every couple of years, there was another Addendum to the Protocol, the London amendments, and the Copenhagen amendments, and so on. They gradually took it from being a useless piece of paper to being something with some bite. And the answer to your question, of course, is that there are lots of provisions in there for Third World countries to go on manufacturing small amounts at the time of the Montreal Protocol for reasons of economy. Difficult to kill them stone dead, as it were. But the implication of your question is also correct, that there are countries, I'm not up to date on which ones, who have not always done everything that they were meant to do. And one hopes that as time has passed, that's being gradually overcome and that the ozone hole will eventually go away when the Montreal Protocol has its fullest effect.

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<sup>13</sup> Alternative Fluorocarbons Environmental Acceptability Study.

[Part 3 00:26:59.12] Gardiner: But complacency is definitely not advisable. I've seen someone predict that the ozone hole would go away by 2050, but I think 2070, 2080 is probably more realistic. And there could be things that we haven't quite spotted and chemicals that are being manufactured on the side and so on that might drag it out even longer. I used to say in lectures, 'There's nobody in this lecture theatre who will see the Antarctic ozone hole removed.' I did find myself once in, I think it was about 2001, talking to an audience with some young children that the parents had brought along, saying that if they behaved themselves and ate a healthy diet, do plenty of exercise, they might see it go eventually.

[Part 3 00:27:40.06] Lee: How did that publication change your life?

[Part 3 00:27:43.02] Gardiner: Well, it dominated my work, certainly. It meant that there wasn't a lot of time for doing anything else.

[Part 3 00:27:51.20] Lee: Because you were being an ambassador?

[Part 3 00:27:53.02] Gardiner: To some extent, yes. I mean, there was a period where it came into everything you were doing. You were not only giving interviews to radio and television and that sort of thing, which is sporadic, but just writing reports and generally doing more work on the ozone values than you would have done before. I mean, before all this happened, as I say, we weren't so much doing research on ozone as measuring it like a geophysical station, and logging the data. But we turned into a team of researchers despite ourselves. I had been doing research in radiation, as I say, but I had also dabbled a little bit in ozone. One of the things that influenced me to some extent, on the treatment of the ozone depletion, was that there had been other papers where people had published things that turned out to be not correct. For example, there was a guy called Kulkarni, very good scientist, who published a paper or more than one paper perhaps, claiming that, I forget what it was now, I think it was that you could measure nitrogen dioxide with the Dobson spectrophotometer, which, with suitable modifications, structural modifications, you could do. But he was trying to do it with the instrument as it stood, I think, if I remember correctly. At any rate, after a while, another scientist, a New Zealand guy called Reid Basher debunked this and explained that you couldn't, or somebody did, anyway. And then Reid Basher himself then published a paper describing how you could extract information about particles in the atmosphere: aerosols, not aerosol sprays but aerosols in the sense of suspended particulates in the atmosphere, from the Dobson measurements. That didn't sound quite right to me because Dobson had very carefully made it measure ozone and eliminate everything else. And so after a while, I analysed this and I published a paper demonstrating that Basher's technique was wrong. I used a technique, mathematical technique involving orthogonal polynomials.

[Part 3 00:30:03.02] Gardiner: Which was a little bit mathematical, but this was in the days when I had one diagram to draw. I had to draw it with Indian ink with a steel pen. This was in 1977 or '78 or so. That was the first paper that FIDS or BAS had published in the Quarterly Journal of the Royal Meteorological Society, which was the main meteorological journal in Britain, which shows you that there hadn't been a lot of Met research going on up until that point in BAS. And because Kulkarni had been debunked by Basher, and Basher had been debunked by me, I used to joke that I lived in fear that someone would come along and tear my thing to pieces. So I wasn't

in any mood, when the ozone hole came along, for publishing rubbish. That probably influenced me to some extent, and making, essentially making very sure that were confident about our publication before we went out to press.

[Part 3 00:30:54.23] Lee: Let me ask you a bit more about how it changed your life, though. I remember talking to Dick Laws, who is basically ..., he was a marine biologist.

[Part 3 00:31:03.09] Gardiner: Yes, and elephants.

[Part 3 00:31:04.19] Lee: Yeah, elephant seals. And elephants, played a part. Who ended up sitting in a room full of generals, advising them about how to conduct the Falklands War.

[Part 3 00:31:13.28] Gardiner: Really?

[Part 3 00:31:14.13] Lee: So, your story is a kind of parallel one. You were a scientific technician, studying and doing readings, collating readings, who, through no fault of your own, suddenly became the harbinger of startling news.

[Part 3 00:31:29.05] Gardiner: Yes.

[Part 3 00:31:29.23] Lee: And became quite a well-known figure, certainly in scientific circles, and I wonder if there was any difficulty you experienced in adjusting to that new role.

[Part 3 00:31:38.28] Gardiner: I don't remember any difficulty in adjusting to that new role, really. I don't think any of the three of us did. We were all, as I say, independent thinkers with ..., able to work things out for ourselves and express ourselves. Joe was a polymath. You can talk to him about anything and he seems to know about it. Jonathan is a very good public speaker who's spent a long time ...; well I think he trained as a school teacher before he came to us. So he talks to schools as well as to every other type of organisation, from the bottom to the top, and I did the same. My university time also included debating. Glasgow University had a very good debating chamber. And so I ended up debating with people who subsequently turned out to be moderately famous, I mean, with people like Ming Campbell and the Liberals and Teddy Taylor. I don't know if you remember him and the Tories. Donald Dewar, who became First Minister of Scotland, and many other who became MPs, famous lawyers and so on. So we were trained in the art of debating and public speaking and I don't think any of the three of us, Joe and Jonathan and I, had any difficulty in presenting something that we understood. Obviously you can't present very well something you don't understand, but if you think you know what you're talking about, we could put it across.

[Part 3 00:32:58.18] Lee: So there's no sense of stage fright at any time?

[Part 3 00:33:01.03] Gardiner: I don't remember much ..., Stage fright is something you should have, to some extent, but I probably got more stage fright talking to you tonight than...

[Part 3 00:33:09.28] Lee: I'm sorry.

[Part 3 00:33:10.06] Gardiner: No, no, I'm only kidding. I have to say, by the way, something that, when you're talking about the three of us. An interesting point is that we don't have a PhD between us. Joe is now Doctor Farman because he was given various honorary doctorates from several universities after the ozone hole. But none of us were, none of us did a research degree in the first place – an interesting and amusing point.

[Part 3 00:33:34.01] Lee: And none of you have ever had an emperor, a medal from the Emperor of Japan.

[Part 3 00:33:38.06] Gardiner: Not from the Emperor of Japan, although we have had medals from other people. We've all had Polar Medals, but then you get these for things other than ozone holes, for wintering often enough, for example. And we've also ..., we were jointly given the Institute of Physics Charles Cree Medals, and the Society for Chemical Industries Environment Medal. So we're not without minor gongs, here and there.

[Part 3 00:34:03.02] Lee: Was the rest of your scientific life a bit dull in comparison?

[Part 3 00:34:06.22] Gardiner: By no means, no. You mean subsequently? Well, apart from all the hoo-hah over the ozone hole, which kept us busy right up to the present day, I then departed into another related subject, because Jim Lovelock, who I've mentioned once or twice, used to say, 'This is all very well but when you measure ozone with a Dobson spectrophotometer, you don't actually measure the amount of UV that's coming down.' This is true because Dobson designed it to measure the comparison between two wavelengths. So you don't measure the amount of UV at this wavelength and the amount of UV at that wavelength. You measure ...; you don't even measure the ratio of those amounts. You just compare them in a very cunning, subtle way as the sun goes up and down. It would take me longer to explain this than we have time for tonight, but it's quite a fandango to get it right, and that's why I was proud of the fact, and still am, that our instruments are independently calibrated by the fundamental method and not just by comparing with the instrument in Mauna Loa, which is what most people do, in Hawaii. But that's to say, where did that come from now?

[Part 3 00:35:14.29] Lee: I was asking about whether life afterwards, scientifically, was rather dull?

[Part 3 00:35:17.27] Gardiner: That's right. So Jim Lovelock said, 'You don't measure the absolute amount of UV. And so you don't know for sure that with ozone depletion people are getting more UV on their skin and causing skin cancer and all that.' Stuff that was being put about. And I said, 'Well, you're absolutely right.' And so I got myself involved in a project that did measure absolute intensities of solar ultraviolet radiation, strictly speaking the spectral irradiance with spectroradiometers as opposed to spectrophotometers, so they measured the actual intensity. And that was a European Commission project, or series of projects, in which I worked with, in Britain with Ann Webb, who was then at Reading University and subsequently at UMIST, University of Manchester Institute of Science and Technology. And we got



into an international group of people with spectroradiometers from practically every country of Western Europe. And from about 1990 until about, well until nearly my retirement, I worked with that group and I became the referee for their inter comparisons of instruments where they were trying to improve the quality of the measurements and the standards of the instruments and the technical specifications. And I designed a sort of system, an algorithm for comparing these instruments in as blind a way as possible so that nobody could cheat, and their instruments were exposed with warts and all. And we did a series of these projects over the years. So the answer to your question is: my life became far from dull.

[Part 3 00:36:57.05] Lee: Good. You didn't peak too soon?

[Part 3 00:36:59.03] Gardiner: I didn't peak too soon, no. I may have peaked now, I dunno.

[Part 3 00:37:02.27] Lee: How did ...? Final question I think for the time being, for tonight, although there could be a supplementary. Are you optimistic or pessimistic about how mankind is reacting to the news you broke?

[Part 3 00:37:16.22] Gardiner: To the news that we broke, I'm optimistic. But the broader question really is, never mind the news that we broke, what about the other news?

[Part 3 00:37:24.01] Lee: The greenhouse gases?

[Part 3 00:37:25.19] Gardiner: The greenhouse gases and everything else, and the things that are happening to bees for pollination and I could name another twenty disasters that are looming, some of them environmental; some of them not. Space debris. There must be a list as long as your arm of things that other people have announced and are equally terrifying, plus the things that we haven't thought of. I mean, we can't tell you what these are because we haven't thought of them yet, but we have to be on the lookout all the time. So I'm optimistic and pessimistic. I don't think there's a straight answer to that question because the short answer is nobody can foretell the future. People that have tried to have fallen flat on their faces. The ozone hole in the Antarctic is a perfect example because the CFCs were released mostly in the Northern Hemisphere where the big industrial populations are, at the ground and all the year round, and the effect was in the Antarctic, in October, and in the stratosphere.

[Part 3 00:38:25.19] Lee: Where you'd least expect it?

[Part 3 00:38:26.26] Gardiner: Where you'd least expect it, and nobody, but nobody, predicted that because you know very well that if anybody could even find half a sentence hinting at it vaguely in one of these earlier publications, they'd have jumped up and waved a flag. Nobody did. It was completely unforeseen. And that shows just how appallingly ignorant we all were about something that only took ten, twenty years to develop. The CFCs manufacturing quantity increased dramatically in the '70s and '80s. When we published the *Nature* paper, we cunningly flipped the CFC graph upside down so as CFCs went up, the ozone went down. We put the two on the graph together to show the contradistinction which the chemical industry wasn't overjoyed

about and said, 'That's just speculation.' But of course, in the end, we were proved right even if we didn't exactly know why, to start with. But optimism and pessimism, you have to have both as you go along. You must be optimistic so that you can plan for the future and take action to improve things, but you must also be pessimistic, otherwise you let your guard down and you'll get caught.

[Part 3 00:39:34.13] Lee: You become complacent.

[Part 3 [00:39:35.21] Gardiner: You become complacent and you'll get caught.

[Part 3 00:39:38.03] Lee: And were the three of you, was it just a case of you three happening to be in the right place at the right time?

[Part 3 00:39:43.21] Gardiner: Well, if we hadn't been there, or if we'd made a pig's ear of it, NASA would have picked it up eventually. Maybe even the Japanese would have done it eventually, or somebody else. Certainly NASA, you would think, couldn't miss it in the end, could they? Then we couldn't miss it in the end either, and we did about roughly about the same time. I have no criticism of the NASA group. I feel that they were doing more or less what we were doing, carefully examining their data the best way they could. They had so much data, they couldn't handle it all at once.

[Part 3 00:40:15.04] Lee: So mankind would have got there at some point?

[Part 3 00:40:18.00] Gardiner: We'd have got to the ozone hole.

[Part 3 00:40:19.29] Lee: We'd have realised.

[Part 3 00:40:21.22] Gardiner: Yes, although I can imagine a world in which, if the International Geophysical Year hadn't existed, and people hadn't taken much interest in the Antarctic, there might have been nobody measuring in the Antarctic. And if the satellites hadn't been launched, I mean that's a big project. Supposing there hadn't been funding in America for those satellites, or in Russia, you could have lived in a world in which the ozone hole developed before people started measuring these things and the ozone could have been depleted much more. I mean, if we hadn't had the Montreal Protocol, the amount of free chlorine in the atmosphere would now be much, much greater, and you would start to get depletion that would seriously affect mankind and other biological entities. So it could have been missed. You've got to encourage these measurements and ...

[Part 3 00:41:08.16] Lee: ... international working?

[Part 3 00:41:09.07] Gardiner: And international working, certainly.

[Part 3 00:41:10.22] Lee: Yes, so the guys who devised the IGY, little did they realise they were paving the way for the discovery.

[Part 3 00:41:18.00] Gardiner: You could say that, although I think they were wise enough that they did realise that they were paving the way for future improvements and understanding, even if they didn't know which discoveries would transpire. But

they were wise and far-sighted people, and very good committee men. It's quite difficult to get a big thing like that organised.

[Part 3 00:41:37.29] Lee: It's been a fascinating evening, Brian. I'm very grateful. Thank you very much.

[Part 3 00:41:41.23] Gardiner: Thank you.

[Part 3 0:41:37] [End of Part Three]

ENDS