Rob Witty

Interviewed by

Tola Sargeant

25th June 2025

Tola Sargeant 0:04

It's the 25th of June, 2025 and we're at the livery hall of the Worshipful Company of Information Technologists in the City of London. My name is Tola Sargeant. I'm the CEO of Archives of IT, and I'm joined today by Dr Robert Witty.

Over the course of more than 45 years, Rob's career has spanned developing real time safety critical systems for industry, to research management in computer science, software engineering, systems engineering and IT, at local, national, European and international levels. Highlights include being responsible for the 1 million pound programme to renew UK's National Air traffic control system, being a director of the Alvey programme and a director of a European Union Research Institute. Welcome Rob. Thank you so much for joining us today.

Before we get onto the story of your career, I wondered if we could start by briefly talking about your early life and how it all began. I believe you were born in 1949 in Yorkshire. What was family life like back then?

Rob Witty 1:12

Moderately idyllic, I think by today's standards. You could play in the street. You could roller skate in the street. Everybody popped into everybody's houses. People knew each other. In that sense. It was, by today's standards, relatively idyllic. I think things were hard if you if you were a parent, there was not a lot of money around. We had bomb sites and all that sort of thing. But as a child, that's great.

Tola Sargeant 1:41

And did you have anything of a sort of scientific or engineering background in the family at all?

Rob Witty 1:49

Yes and no, nobody you would call an engineer. My father had done HNC electrical engineering at night school, so there was a sort of hint of that about that. And he was a plumber and an electrician because of that, so and he had, I'm never quite sure what he did in the war, but he did something electrical engineering in in the war, and I know at some point he worked on radar, not in any R&D sense, but I think he installed radars and those sorts of things. He certainly knew quite a bit about radar, and certainly been to places my mother never knew until after the war that he'd been if you see what I mean.

Tola Sargeant 2:28

So a bit of a technical sort of bent?

Rob Witty 2:30

So there was a there was a bit of that, yeah, but I grew up in in an environment which was the building trade. So my my grandfather was a plumber. My father was a plumber and electrician. His friends and colleagues were carpenters and joiners and bricklayers and blacksmiths and those sorts of people. So I grew up in that very practical kind of milieu, and I think that influenced becoming an engineer as I liked building things.

Tola Sargeant 3:01

Using your hands...so you started at the local primary school, and then passed the 11 plus. Is that right?

Rob Witty 3:08

Yeah, I think I was, I mean I am a classic baby boomer in that sense. I benefited hugely from the state education system that allowed me to pass the 11 plus, went to an excellent grammar school, got an excellent education and, and I think, you know, that's more difficult than it is, you know, it was much easier then than it is today, to do that sort of thing.

Tola Sargeant 3:32

Can you remember back to school which subjects you enjoyed most? Which were you most naturally good at?

Rob Witty 3:39

Oh, I think maths and physics were the things and maths was the thing that I enjoy most.

Tola Sargeant 3:46

Do you have any early memories of computers?

Rob Witty 3:50

Absolutely none. But I remember at the end of our third year, you know, when you get to the end of the summer term, you've done the exams, and you sort of mess about a bit in class, the maths master decided to teach us number basis. So we did binary and octal and those sort of things, not as a computer type thing, but as an abstract mathematical object. That was his idea of fun, right? As he taught us binary. So in later years, when, when it suddenly came up, I thought, I know, I remember this from the third form. So that was my introduction. But I had, before I joined the industry, I had never seen a computer. Didn't know anything about them.

It was a complete accident, in a sense. After school, I went to the careers advisory service. No idea what to do, and they said, "Oh, you're good at maths. We've got a job as a computer operator. Vacancy. Would you like to go along?" So I thought, Okay. So I went to the local library, took out all the books on computers, both of them.

Tola Sargeant 4:59

[Laughs]

Rob Witty 5:02

One on hardware and one on software, read them, understood them, not reading them. Went to the interview to be a computer operator, and I think halfway through the interview, I worked out that I knew more about computers than the bloke who was interviewing me and it was like that in those days, you know, the late '60s, most people had come into the industry from somewhere else. Everybody had been on the four week training course, which is what they knew.

And so I got a job with BP as a computer operator on shifts. I mean, the lowest of the low, mounting magnetic tapes. People don't even know what a magnetic tape is these days. So that was, that was interesting, ruined my cricket because I had to work shifts but other than that... And I quickly worked out that being a computer operator was a dead end job. That was, it wasn't going anywhere. But the interesting bit was programming, and so I got to chat to the programmers. In fact, they'd all been on the six week training course to become a programmer, which was very impressive. And I thought, oh, okay, the obvious thing to do is to go to university and read computer science, and then I'll really know what to do.

So I got placed at Essex University. It was easy, because I was 20, got my A levels and everything so you could just get [in]. And went to Essex, they offered me a place.

And it was all organised. I had met my tutor. I had my room booked in the hall of residence, ready to go, okay, four weeks before the start of term, I go into my boss's office in BP, and I said, terribly sorry to tell you I'm going to resign. Oh, why are you going to resign? I'm going to university. And he said, 'Oh, don't resign. Give me 48 hours.' And I said, Okay. And he said, the next day, he said, a man from London is coming to interview you. And, you know, a man from London was, like, unprecedented. And a man called Dr David Horn came and interviewed me, and he said, if I would go to Brunel in [two] weeks time, the company would continue to employ me.

So I thought, great. So I went to Brunel. So, I wrote a letter to Essex two weeks from the start of term, and said terribly sorry to tell you, but I'm not coming. And I wrote it to Tony Brooker. And that's Tony Brooker of Brooker Morris Compiler, Compiler, and Compiler Compilers play a role in my life later on, just by coincidence. But the world's full of coincidences.

So I went to Brunel, and I got an excellent education. Just once again, I had BP who knew the good places to send people. So I mean that's the advantage of that.

Tola Sargeant 8:05

Was that fairly normal in those days? Or were you unusual?

Rob Witty 7:57

No, it was very unusual. It was very unusual. I mean, I think I was the... I was 21 when I got to Brunel. I think I was the only person who was an employee. There were one or two people who had sort of, small bursaries from people like ICL, but they weren't employees. They had the sort of additional top up grant to their state grant, but I was an employee. And I was three years older than all the other students. They called me

grandpa. It's very kind of them. And I felt utterly different to these kids. I'd been at work for three years. I was a professional. I had a boss in BP who kept a regular eye on how I was doing. And so it's completely different for me. The 18 year-olds had no idea what they were doing. They'd never really seen it, you know, never been to work, never really seen a computer installation properly. I'd worked on them, you know. So it was completely different. I was, I was a professional amongst amateurs, and that was a sort of odd kind of thing. By the time we got into the fourth year, they'd all done three sandwiches, and they'd added work experience, and that difference sort of melted away with with with the age. But at the beginning it was, it was quite something.

Tola Sargeant 9:16

But you still graduated top of your class?

Rob Witty 9:19

Yes, yes, they said I was the professor. I was there to perform, and I had a boss who looked after me very well. And yes, I mean, I enjoyed it. When you enjoy something, you put the effort in. I was, I think my tutor was about three years older than me, and everybody was so young in the business that it was, it was quite, quite interesting. So I had lots of fun. And in my first sandwich period, I worked on the simulation... I went to the research lab, and I worked on the simulation model and the final chloride monomer plant, petrochemical plant, for ICL. And in my second year, this is the benefit of being a BP employee, in my second year, I went to the plant in South Wales, and that was not a coincidence, right? That was planned, sorry in my final year, I went to the plant. And that gave me a great insight into sector critical systems. As soon as I got there, my supervisor on the on the control installation, he took me outside, and he said, you see this big tank - the size of an aircraft hanger - that is full of raw chlorine. He said, if we vent that, there's enough chlorine there to kill the entire population of a local town, which is 300,000 people. Okay, so we're serious. Can you understand we're serious?

We had a Ferranti Argus control computer for that plant, and one of one of those... The second thing that was burned into my memory in that period was the man from Ferranti came to update the operating system. Very nice chap. I went to chat to him. And he was a captain who had been on the six week assembler programming course, and he updated the operating system off a running computer on the hand switches. And I said, this guy, this is not a serious way to upgrade a plant which has got the capability to kill 300,000 people. And that gave me a sort of desire to make sure that we just didn't do it like that anymore, that we stopped hacking around like that. It was just terrible. And I think that stayed with me forever. It has always been in the background.

But when you get the other... the other end of that was, I remember working late one evening, so I'm in the control room in the middle of a plant, imagine a great big petrochemical plant, and these three big Welsh men come up to me. The sort of guys who probably were probably the front row of Pontypridd. You know that, that sort. And they said, 'we want a word with you', they said. 'Erm. Yes'. He said, 'You're a whizz at this computer stuff are you?'. 'Well, Thank you very much.' 'We would like you to programme this to win the football pools for us.' Oh, dear. If there'd been one of them, I had a chance, right? But there's three of them. So we come to an agreement that I will think about this overnight and see what I can do about winning the football pools for them. And they go off on their way. The next morning, I come in and say to my boss, you need to help me. So he goes away, and he has a word with the operatives, to explain to them that that probably wasn't a good idea. But, I mean, they had a very serious job. They were the spanner wielders who maintained the plant and and they walked everywhere in twos, one 50 yards behind the other one. And the instruction was, that if the first one fell down, the other one ran like hell in the opposite direction and raised the alarm because the first guy was dead. Chlorine, right. It just meant the chlorine had got in for some reason. They wore space suits, basically to go on the plant. And again, that's, when you live in that sort of environment -and I've had that because when I've been a computer operator, the

computer centre was in a petrochemical plant - and I thought they were great. They were fascinating, sorts of places. They're just like nothing else in normal life. They're wonderful places. There's jus something about things that run 24/7, that are a different culture in a different world. They're lovely.

So that gave me the err, sort of thing that's always sat in my mind, is that there has to be a better way of doing software than hacking it in on the hand switches. And that motivated me again to be a computer science student. You know, these guys are telling me things about the theory of computer science that you can see is a better way to do things. And then I went back to work for BP.

Tola Sargeant 14:25

So you did a PhD before that?

Rob Witty 14:28

No, so I, so I, so I'm graduating from the first degree. Went back to work for BP, and I had been taught as an undergraduate by Professor Bob Hopgood, who you have already interviewed, so you have him on camera. And he was one day week at Brunel and four days a week for the Atlas computer laboratory, which was part of the research council and literally ran the Atlas computer, the Ferranti Atlas computer. And' he said, 'Come and do a PhD with me in the Atlas lab.' And I said, 'Nah, I'm serious guy, right? I work for a very serious company. I'm not intererested.' And he kept chipping away, chipping away. And I was, I sort of got to that realisation that BP was actually in the petrochemical business, and I was interested in safety critical software systems, and so I said to him eventually, I said to Bob, yeah, okay, I'll take the deal. And he offered me half my BP salary to become a government scientist. I didn't care. I was young. And so during the day, I built an operating system for a special purpose graphics system called the FR80, and in the evenings and weekends, I did my PhD under the Brunel external regulations, and Bob Hopgood was my

supervisor, and that worked very well because my thesis was about how you build serious, real-time systems.

And so I was building one during the day and working out what was the best way to do it in the evenings and weekends, so that I could immediately practically implement the things. And that used... Bob Hopgood had taught me compiling techniques and had taught me compiler-compilers. We had a compiler-compiler at the Atlas lab, and Bob knew Tony Brooker and Derrick Morris, who'd done the Brooker-Morris one. And then the one that we had there at the Atlas lab then was TREE-META, the TREE-META compiler-compiler, and I used that to build a compiler, to build the operating system, and that was clearly a better way of doing things than hacking it in the hand switches in binary. And so that that was a wonderful experience. Not everybody gets the chance to build an operating system from scratch.

Tola Sargeant 16:58

And fantastic to have the research side and the practical application simultaneously.

Rob Witty 17:04

Yes, and that was just the opportunity in the Atlas computer lab in those days. There was still that sort of pioneering sense that you could do those sorts of things. Operating systems were not a commodity in the same way that they are now. Somebody said, We'll build a new operating system, it wouldn't happen, would it? But in those days, you could, you could do that sort of thing, and it was a great opportunity. And that's just part of - I was lucky to enter the business at the beginning and then grow with the business, which was tremendous. And out of that, I got my first ever trip to America.

So the FR 80 was built by a company in Los Angeles, right? And we had, we had problems. I'll tell you very quickly two, right? So I'm building the operating system. It doesn't work. You know what it's like. You build an operating system, it's complicated. It doesn't work. That's no good. It should work. And you narrow it down. Lots of time to narrow it down. And it came down to the arithmetic unit. And when this machine did integer arithmetic, if you took three and divided it by minus two, you get an answer probably minus one, remainder minus one. Okay. That's what it said in the manual. That's what I assumed when I wrote the software. When I actually wrote a test programme, the answer was minus two, remainder plus one. It's ambiguous. Who knew? Right? Yes, three divided by minus two is ambiguous. The manual writer wrote one thing, and the circuit designer implemented something else. Drove me crazy for several weeks, until I found out.

And the other one was they had a fault in the interim hardware, which meant when it was interrupted, you had one instruction which you used to turn off interrupts, and then you entered the interrupt handler, and they had a design fault, which meant you could interrupt the instruction that was turning off the interrupts. So one day, my interrupt handler said, I've been interrupted, which is not allowed, right? Shouldn't happen. So eventually Bob said, 'You better go to Los Angeles to talk to these people'. So I got my first ever trip to America, and it just happened, we timed it nicely. So the second ever software engineering conference was in San Francisco that year. So I went to San Francisco, went to the software engineering conference, and then went to Los Angeles to visit the company. And at the software engineering conference, I met László Bélády, a who was a senior member of IBM Research in the United States, and I was telling him about my research, and he said, so I'll tell you, this is a nice talk. He said, 'That's really interesting.' And Niklaus Wirth was was walking past like that. So he said, 'Oh, Nicholas,' he said, 'Come and have a look what Rob's doing.' So I showed him, it was very graphical, and Niklaus Wirth looked at it, and he said, 'I do not have the reading glasses.' And walked off. That was my entire interaction with one of the greats of computer science.

But László Bélády said, 'Don't worry about him. It's really interesting. Will you come to New York? Will you come to Yorktown Heights and give us a talk?' So I had to telegram Bob Hopgood, 'do you mind if I...', I can imagine his face, right? So I went to New York and I gave the talk there. And it was a wonderful experience in several ways. I mean, it was a lovely experience to go to Yorktown Heights to give a talk. The second thing was, they were waiting for me. I am seven minutes into the talk when this guy asked me a question, and it took me three years to answer the question. And I am eternally grateful to that man, because if my external examiner on my PhD thesis asked me that I would have been stuck, and he asked me, and I thought that's a damn good question. I really don't know the answer to that question. And and it improved my thesis enormously. So I'm deeply grateful to that man, even though he thought he'd absolutely floored me, I was speechless.

So it was, it was a lovely experience, and I and I met Lás Bélády in different walks of life. As I went through my career, he did different things as well. So later on I met him, you could ask me that later.

Tola Sargeant 21:49

Yes, fantastic. We'll come on to that. So how long were you at Atlas computer laboratory?

Rob Witty 22:01

Legally, I was there for 20 years. In practical terms, I was there three. So I took three years building the FRAG operating system, and then Bob Hopgood was tapped on the shoulder to coordinate the first ever national programme called Specially Promoted Programme by the Research Council in computer science, which was called the distributed computing systems programme. And they wanted somebody to help coordinate the academic work together to make a more coherent programme, not just a random set of university projects. And they wanted also to get

somebody in from industry who would help connect the academic work with the industrial work, and that was the vision of Iann Baronn of Modular One and inMOS. So he hadn't started inMOS yet, but he'd done the Modular One. I think inMOS must have been in his mind, because distributed systems was played straight into the inMOS book.

So Bob looked at this, and he said, 'Ah I need somebody who knows about computer science and knows the computer science people to help me'. So I was the bag carrier for Bob. And we rapidly realised that this was not sort of half a day a week for Bob, this was actually a full-time job, because you had to travel the country, meet people, organise events, all that sort of thing. So rapidly I got the job of managing the programme, and Bob was still my boss. But and then David Duce, who you also interviewed, became my, my number two in the DCS programme. And we had a lot of fun coordinating. We didn't manage in the directed sense. We helped people put their grant applications together, and most usefully, we put Professor X in touch with Professor Y, who had common interests but didn't know they had common interests, or maybe had complementary interests and hadn't spotted it. So we would put them together. We spent a lot of time in the bar introducing people at conferences, and so we ran all sorts of special events that were DCS events, that brought people together. And most of the time they would give talks, because it was a workshop sort of environment. And then we would spend dinner at the bar, introducing people and saying, you really should talk to this guy, because he's really interested. That seemed to play very well. So the academics kind of liked that, it wasn't heavyweight management. It was useful. They got value out of it, and it seemed to play very well. And we did lots of things that probably were there because it was the first computer science programme. We did lots of things for the first time, so workshops, visiting fellowships, sponsoring PhD students who were specifically assigned to research projects and that sort of thing. So we did lots of things, and the workshops were very, very popular, not least of which, of course, the Research Council paid you to go to the workshop, so, I mean, it wasn't difficult for the academics.

I think that the most difficult one I remember was a guy called Bill Wage who was a theoretician at Warwick, and I said to I said to Bill, I want you to join the DCS programme, Bill, because we have a lot to contribute. He was into temporal logic and that kind of thing. And he said, 'nah', he said, 'I'm a theoretician. All I need is a pencil and paper. I don't need research assistants. I don't need computing equipment'. I said, 'No, no Bill', and I had to twist his arm to take the money. Can you imagine? I had to twist his arm. And in the end, I got him some travel money so he could come to workshops. And then once he got in it, and he realised that all these people are interested in what he was doing, and he was, he was fine, but... so it wasn't just about the money. It was it was getting people together, and they formed a community. And I think we did the data flow stuff in those days, which I thought was very promising and sort of didn't quite make it into the mainstream for all sorts of reasons, but I thought that was a really interesting piece of work, the data flow stuff, and we sponsored some of the great, the good, like Tony Hall and Robin Milner and the four methods thing. And I thought, yeah, that's how you write something about the Tony Hall, Robin Milner theorem prover, really sought out the theory of the thing. That's how you write something. That's how you've proven it's going to work before it hits the petrochemical plan. That's it. That's how you do it.

And so I had the pleasure to meet all sorts of people like Robin Miller, and he was the nicest man. Bob Hopgood and I once went to see Robin Miller for the first time, and Bob said to him, 'Robin, I have to confess that your papers are very theoretical and very difficult to read'. And Robin said to him, 'Yes', he said, 'and they're even more difficult to write'. He was a lovely man, Robin Miller, brilliant. And then Tony Hall of course, had been one of my heroes from being an undergraduate. And it was lovely to sort of meet him. And he was a real gentleman to work with. And so I met him, and then I met him again in obviously in the Alvey Programme, he was big, a big thing. And I worked with him on the Acorn report, which we might come to.

So the DCS programme was the first, and then I think everybody kind of thought it was a success. It worked, and that enabled me to start the software technology

initiative, which was close to my heart, and we started a robotics programme and other things. And so Bob's division ran the DCS programme with David Duce. I ran the Software Technology Initiative. Peter Davey ran the Robotics Programme, and there were probably a few others eventually. So we had, we migrated from Minneapolis computer lab to being part of the Rutherford laboratory by this time, and so we were sort of centre of expertise for the Research Council in how to manage research programmes with the academics. And that worked kind of well.

And then 1982 came. The Japanese launched the Fifth Generation Programme, everybody, the Americans, the UK, went into panic mode. The Japanese are going to roll us over. And the government of the day decided to have a committee, the Alvey committee, chaired by John Alvey of BT, to decide what to do. And so, like all of these things, the Committee of the Great, the Good, Philip Hughes, the boss of Logica, was given the job to do the software engineering part of the Alvey report, and he was far too busy to sit there and do any of that sort of thing.

And it's one of those kind of 'Yes, Minister' things when you suddenly realise that actually you're very junior and you have immense power and influence, because you actually write the words, right. These people are far too busy to write the words. So you write the words. And the industrial coordinator for the DCS programme was called Jeremy Tucker, who worked for Logica, by coincidence, so Philip said, 'oh, right, you know Jeremy, and Jeremy knows you. So why don't the two of you write the software engineering report for me, Philip Hughes.' Right, so Philip Hughes wrote the Alvey software engineering strategy. But he was a lovely fellow. I mean, we met with him on a regular basis to tell him progress, and Jeremy and I again toured the country, listening to everybody, which was super. And so the strategy when it was put together was not our personal opinion. It was what we had distilled by listening to people. And we listened to industry, we listened to the government people, MOD, and the academics. Of course, I knew the academics quite well, and it seemed to play well.

And the Alvey programme got approved. And I remember being at a dinner between the Research Council and ICL. We had various... we were a customer, obviously, of ICL, there was a dinner. We had the PERQ programme, of which I think Bob Hopgood spoke. So I won't go into the PERQ programme, because Bob did that. And during the course of dinner, Brian Oakley was there, who was then the Secretary and the boss the Research Council, the Chief Executive you would call it now, with the Research Council, and he lent over to me, and he whispered in my ear and this must have been Thursday, and he said, 'Tomorrow it will be announced that I am going to be the Director General of the Alvey Programme'. 'Oh, lovely Brian', I said. And he said, 'and you will report on Monday morning to my office in Millbank Tower'. 'Yes, Brian'.

So I was the second employee of the Alvey Programme. And it was kind of interesting. I mean, Brian got everything going very well. I mean, he was very competent. I liked working for Brian. And so I was the software engineering programme on day one of the Alvey Programme, and rapidly, things improved. One of my earliest memories - and this will make a link for later on - is by about the end of the first week, Brian said to me, I want you to come to a meeting with me. A vice president of IBM is coming to see me.

This chap, and to my shame I've forgotten his name, I'd have to look it up, introduced himself as the vice president of the software engineering for IBM. Serious guy, right? And he said, I have 30,000 software engineers work for me. Okay, you're a serious guy. And he said, I've read your strategy, he said. And Brian said, tell him about the research work. And I started telling about the form, methods, programme, everything. And he said to me, I have 30,000 engineers that work from me. I've probably got about eight who just could understand what you were just talking about, let alone do it. He said, what I need is a 10% improvement in the productivity of 30,000 ordinary software engineers. And I didn't get it. I really didn't get it, because I... the things we were doing, the formal methods programme, the IPS, the Integrated Project Support

environment, all those sorts of things, were the technology you needed to write good software. And his problem was productivity of a big, ordinary, average set of people. And I didn't get it because I'd never seen 30,000 software engineers. I think, you know, we had a few 100 in BP, and most of them were chemical engineers who'd been on a six week training course. They were not engineers in the proper sense and I didn't get it. And the fact that I didn't get it, and the fact that nobody in British industry had said that to me in the six months we spent doing the strategic programme, productivity was never mentioned. And yet today we still say productivity is a big issue for British industry, and British management doesn't walk the talk, doesn't get it, and the Americans got it. And I learned that big time when I went to America, and when we make the link to GEC we will see how that comes up.

So then, we did the Alvey Programme. It was very successful. It was a pleasure to integrate the academics with the industrial guys and the government guys. It worked well. The spirit was good. We did lots of interesting things that showed lots of promise. And I got to the stage where I said to Brian, I've now done nearly a decade of managing the research programmes, so I'm good at it, but one of the reasons I was good at it was because I was a researcher, and I knew the researchers, and I did it myself, and you know, and I'm beginning to lose touch with the coal face of research. I want to go on sabbatical. And, and the devil took me up to a high place and the tower block in London, and the devil said to me, 'All this could be yours. You can be a Permanent Secretary. This could be yours. But if you go on sabbatical, you're a techie, you will never be a Permanent Secretary. Choose'.

So I went to Xerox Park, and that was through the auspices of a lovely chap called William Newman, who came to work for us in the Alvey programme from the Xerox Corporation. And he was very impressive. He was one of the... he had worked at Xerox Park. He was one of the pioneers of the computer graphics stuff at Xerox Park in the pioneer days of the Alto that kind of thing. He, with Bob Sprout, wrote the definitive computer graphics textbook. And he was also interesting because he was the son of Max Newman of Bletchley Park fame, and William I remember telling us a

lovely story, that his father, when he was a maths professor at Cambridge, used to occasionally invite favoured PhD students to Sunday lunch at their home, and the students had to play Monopoly with William and his brother after lunch. I think that must have been the deal already, and so William remembered playing Monopoly with Alan Turing!

But through William, I met - when they came over - the boss of Park, who was John Seely Brown, and Bill Spencer, who was head of research for Xerox. And then I got the invite to go to Xerox Park for my sabbatical. I went and I educated myself and got back to the coal face, I sat in the AI Lab, not the computer science lab, because that was out of my comfort zone. So I sat with a lot of very strange people in the Artificial Intelligence Lab, as opposed to all the computer science guys who were building Altos and Ethernet and all that sort of thing. Where the people I knew would loved would find themselves. So I deliberately went to the AI Lab, and other stuff and I did classes at Stanford. I was taught by John McCarthy, who allegedly founded the term artificial intelligence, Lisp, of course, that sort of thing. So that was interesting to go to Stanford.

And I enjoyed my sabbatical at Park, and when I left the Atlas lab to go to America, everybody sort of said goodbye to me, but with that, not 'Goodbye, see you in 12 months'. 'Goodbye. We don't ever expect you to come back from Silicon Valley. Once you get there, that will be it'. And it was an interesting experience up in the Silicon Valley. Wonderful place, special place, nothing like it that I've ever seen anywhere in the world. Very special place. And the longer I was there... I don't like the culture, love the work, love the people, culturally, I sort of don't get it. And I thought, Well, why have they invited me? So I think there's an agenda here. What's an agenda? And so I thought, Ah, I think I've worked it out, which is that Bill Spencer will retire, John Seely Brown will become a head of research for Xerox, and they'll ask me to run Park. I thought if they asked me to run Park, I can't turn that down. And then towards the end of my sabbatical, somebody sidled up to me and said, 'Would you like to go to New York meet some of the corporate people?' 'Yes,' I said.

And they offered me a job. Park was a few 100 people. They offered me the big lab, 5000 people in upstate New York, minus 30 in the winter, sort of thing. And I had, through visiting all sorts of research labs through the national programmes, you get a feel for the state of a lab. You can kind of walk in and you sort of look around and you sniff, and you kind of go, this place is humming. This place is dying. You, you get a sense of that. And I went to Webster, and I went, now, this, this is fossilised. This, this place is fossilised, right? It's full of, it's full of physicists and chemical engineers who make Xerox machines, copiers, and they're not engaged with what's happening in the real world. And this is the, you know, this whole story about how Xerox blew it, and you could see why Xerox blew it. And so I said, No, I'm not interested. And I came back.

And then, of course, the question was, well, then what did I do. So I'm thinking oh, my God, they're sort of.. what are we going to do with him, right? I mean, he's come back. We hadn't...we'd just assumed that he wasn't coming back. But I was seconded on sabbatical, so I'm still an employee of the Research Council.

And anyway, so I felt the same, right? There wasn't.. Oh, I got off the aeroplane and they told me Margaret Thatcher was cancelling the Alvey Programme. So instead of the second five years of the Alvey programme, it was dead. Thatcher said, everybody has to go to the European research programmes. Just had no understanding of how it worked. Just, just a train crash, everything we built, everything that was working so well, everything that would have taken another five years to come to fruition, was was trashed. And everybody had to go cap in hand as it were to the ESPRIT programme and try desperately to join European collaborations and everything. And we were very successful at it, because we had lots of good researchers, but we, we lost the industry. That was, that was the.. that was the beginning the end for the industry.

Tola Sargeant 41:50

It's such a shame, isn't it, because you were doing such a good job of bringing together academia and industry in the country, government.

Rob Witty 41:56

Yes, it was going well. I mean, when you think we started from nothing, to build it up in five years. So it was going, well, you know, another five years. I mean, most research projects take 20 years from start to end. So, I mean, you can't expect things to deliver in, in short order. So that was, that was very depressing.

So I thought, Well, okay, message received, Mrs. Thatcher, right, and my predecessor, David Talbot, who's no longer with us. Lovely chap. He had gone to join the ESPRIT programme. So I started talking to David, and I was on my way to join the ESPRIT programme, which was the natural place for me to go. And then one day, the director of the Rutherford lab said to me, 'I've got a visitor from the Commission coming. Would you like to meet him? Tell him about what goes on, right?'. So I meet this chap, who's a Director General of the European Commission, and and he's sort of a physicist guy. I didn't think anything about that. And then after a couple of weeks or so, the director of the Rutherford lab says to me, 'I've been invited to Italy to go and return the visit from the Director General, who came, you know, a few weeks ago, would you like to come with me?'

Yes. Trip to Italy. Never been to Italy. So we go to ISPRA, we meet the director general and have a look around. And it was terribly nice. So nice couple of days. And then sort of a week or so later, the director of Cabinet Office would like to know if you would like to be the UK candidate, to be a director of the Joint Research Centre, i.e., the research centre that this director general ran, which was in Italy and wonderfully pleasant. 'Ah, think I've worked it out, okay.' And I rang up the Cabinet

Office to ask, well, do you want me to send you my CV? And he said, 'Oh, no we've got all that'. So I thought 'Okay, this really is... I've been fitted up here'.

And so it was much more senior than the job I would have got into in the ESPRIT programme, because ESPRIT was secret, and nobody knew I was alking to ESPRIT. And so I became the British candidate for this post, and I got it. And as the Director General loved to say to people when he introduced his new director, he said, this is Rob. Rob is the second youngest man ever to become a director of the European Commission, which meant you had to say, gosh, well, who was the youngest? And of course it was him. He was three months younger than I was. It was an interesting experience.

It was the Joint Research Centre. It was a set of labs across Europe that been set up under the Euratom treaty. So it predated what we think of as the European Union by quite a way. It was the '60s and it was nuclear. It was designed to do the R&D to generate the nuclear fission reactors for Europe. [?] decided to go it alone, and that sort of scuppered the JRC's mission in life. But as it had been put together by international treaty, they couldn't really turn it off. So it was a nuclear lab that was kind of looking for a role for itself, and that's not a good place to be. So amongst my my asset register was a nuclear reactor. So having worked on the final chloride polymer plant that could have killed 300,000 people if we'd blown it up. I now had a nuclear reactor. Ah, okay! Fortunately, those sorts of things don't phase me, but, but then you go 'and I've got a bunch of Italians looking after it', and do I sleep at night? Fortunately, they were all very professional, there were lots of really excellent engineers, Italian engineers.

So I had a European lab. In those days, it was the 12 member states, not quite as many as there are now. And I embarked on another phase of my multilingual, multicultural journey. So I've lived and worked in different places in England, spent six months in South Wales, in a Welsh speaking village, gone to America, lots of

interesting cultural nuances in America. Didn't tell you some of stories about that, but it does sensitise you, I think, in a very nice, gradual introduction, particularly going to America, to the subtleties of language, even when you think you speak the same language as the Americans, you don't. Of cultural norms or whatever, like my Yorkshire sense of humour did not... was not immediately understood by the average Californian. Took a little while for me to adjust my sense of humour and then when you got the 12 member nations...

Tola Sargeant 47:36

So your team was from from those 12 nations?

Rob Witty 47:39

Yeah. So then you have to be very careful with your sense of humour again. So it was, it was wonderful to have that multicultural stuff, but it was very frustrating, because I was used to the computer business. The pace in the computing business was fast. In the, in the Commission, in the research agendas, it was very slow. The director general believed that nuclear fission power had to come back. I mean, it was, it was beyond the pale in those days, in the 1990s. It had to come back, because it was the only viable green energy technology that was going to save the planet. And so he absolutely defended the nuclear activities to make sure we never lost it. Because, you know, he reckoned that in 12 months, everybody would get the light, the message. And of course, the greens continued to kill the nuclear industry, and it never happened. Now. What are we? 35 years later, people are beginning to go, oh, nuclear fission power is actually green energy. Solar doesn't hack the base load, ask the Spanish, right? Solar doesn't hack the base load. But he was too late, and it was too frustrating. So, I just got [frustrated]. I mean, I was used to making things happen. [?] once said to me, what do you do? And I said, I make things happen.

So I said, nah I'd better leave. I'll do my five years, but that's it, and and that's how I ended up going to work for GEC. One of my standard jokes is, I started life in industry, I went into research, and then I went back into industry, and I had always felt that myself as too academic to be a professor and too industrial, sorry, too academic to be in industry and too industrial to be an academic. And so I felt it was time to go back, and I remember talking to Roger Needham, the head of the Cambridge computer labs project. I always enjoyed talking to Roger - he was another Yorkshireman of course - and he said to me, smoked a pipe he did, 'Rob,' he said, 'I think it's time that you chip the rust off your screwdriver'. Which was Roger's advice of go back into industry. We'd lost the computer science momentum. There were going to be no more national programmes. And so I joined GEC.

Tola Sargeant 50:32

And this was the mid '90s?

Rob Witty 50:33

That was 1995. January '95 I joined GEC, and I went to work for Peter Gershon in the defence industry to start with. Loved working for Peter Gershon, absolutely the best Chief Executive I ever worked for. Really, really super bloke. He knew about the computer industry. He understood about software. So in that sense, it was very easy to talk to him. Lord Weinstock said to me, when I was hired, he said, 'Do you know why software engineers write code in red ink?' Because he was losing hundreds of billions of pounds a year. And I said yes, and he said, 'And do you know how to fix it?' And I said, Yes. So he said, 'Well, you better come and do that for me and will you do it quickly?'. Which meant, I'll fire you if you don't. And I went initially to work for Peter in the defence business, because half the software engineers were in the in the defence business, and Peter was committed to driving the whole of GEC to world class performance. So my job was to get software engineering to be world class. Peter was driving everybody else to world class. Wonderful driving with somebody

who was... working with somebody who was driven to do that, and you have to deliver, right? I mean, that was the key difference.

And they thought I was crazy when, when I joined, because the first thing I did was I went to HR, and I said, I want you to count how many software engineers we've got. And so there was a meeting with the directors and I said, I said, you'd be interested to know that GEC has got 20,000 engineers. Roughly 100,000 people. 20,000 of them are engineers. We're an engineering company. 10,000 of them are software engineers. No other professional group of engineers gets above 3,000, and they never twigged. And I said, the only difference between us and Microsoft, remember, this is 1995, is that Microsoft deliver their software in shrink wrapped cardboard boxes, and we deliver our software in things that are much more expensive and much less reliable. Oh. They didn't like that, but it drilled home to them that everything they did ran on software, because they embedded real time software within everything that GEC made, and so software was crucial, and they didn't know how to handle it.

And this links all the way back to when the IBM Vice President with 30,000 software engineers came to the Alvey programme, and I didn't understand what he said. And now my job was to do exactly what he wanted in 1983. And the other irony is, he didn't know it, I don't think probably, but he had a chap work for him called Watts Humphrey. He was one of the 30,000. And Watts Humphrey was an excellent software engineer, and he retired after an excellent career with IBM. And he set about working out why software was a problem, and he created the Capability Maturity Model. He looked at everything that IBM did, everything that worked well, everything that didn't work well, and worked out with the capability maturity model what it was like to be at the bottom of the heap, what it was to be level one, where you've got something in place that worked, what it was like to be level two, what it was like to be level three. And this got unleashed on the world in about the early '90s, and there were one or two places in America, were doing it that way. And the American government set up the software engineering, Software Engineering

Institute at Carnegie Mellon in Pittsburgh, and Watts Humphrey joined them to drive the development of the CMM programme.

I saw the CMM. I instantly understood what the CMM was. Instantly knew that that's what the Vice President of IBM needed in 1983 and that's what should have been in the Alvey software engineering strategy. And I didn't get it, and nobody else got it. And I blame myself for not having the wig to realise we should have done that in the Alvey programme. It would have been a massive success, and we didn't.

But then I saw it. And I roll that across the whole of GEC, and we had the world's biggest CMM programme in no time at all. The Software Engineering Institute used to use us as a role model. The Director used to come, Watts Humphrey used to come, and that was a great success. And we never had a software project go off the cliff on my watch in GEC after I rolled out the CMM programme, and his lordship didn't fire me as a consequence.

Tola Sargeant 55:53

[Laughs] Yes, it's unusual for nothing to go off a cliff.

Rob Witty 55:57

Yes, I loved working for Lord Weinstock. He has a sort of very fearsome reputation, but he was, he was a twinkly-eyed grandfather to me right. His eyes sparkled. He was very bright, but he had a wonderful sense of humour. And at my job interview, he looked at my CV, and he said to me, 'It says, here that you're colour blind'. 'Yes, Lord Weinstock'. 'Can you tell red from black?' And the answer is that, the honest answer, to the question, right, is that I'm very colour blind. I can't tell red from black. So I looked at him, and I said, I grew up in the family business. Lord Weinstock, profit and loss are second nature to me, and he beamed at me. We got on famously from there,

and his sense of humour and mine... we were, we were, you know... he was always playing. He pulled my leg a lot. I enjoyed it enormously. Having your leg pulled was a lot nicer than being fired! But he was a lovely chap. And even after he retired, I was occasionally summoned, and he was asking me, what's going on out there?

It was allegedly, I don't know this... I can't say this for true. But after he retired, was the .com boom, and he put a little team of people together, and he was an angel investor in the .com boom. And apparently, Arnold made more money than anything else in the.com boom and certainly didn't lose any. He wasn't one for losing money Arnold. And the destruction of GEC probably broke his heart.

I was in GEC when it collapsed. And it was... it was awful. The City of London was responsible for the destruction, the looting and destruction of GEC. George Simpson and John [?Mayo] personally looted GEC for their own personal gain. George Simpson bought a peerage by giving Tony Blair millions of the company's money to support the Millennium Dome project. Got a peerage out of it with the company's money, and GEC had - when Arnold retired - had billions of cash in the bank, was growing steadily, was a well run business. Peter Gershon had one done great things, and Simpson came and trashed the company. Just trashed the company, and then the city took the billions to line their own pockets. People should have gone to jail. And what's part of the thing that's wrong with this country is that nobody went to jail because of the scandal at GEC. It was never even a big national scandal, and it should have been. It was absolutely disgraceful what went on in GEC, and I sat there and I bailed out about six months before the actual collapse, and went to air traffic control.

But I really enjoyed my time in GEC. I built a really super programme in the CMA, it was called the Spire programme. It was the CMM based programme. Really, was effective. Really improved things enormously. Peter Gershon was a great guy to work for, and we did the CMM, and we did six sigma, and all of that sort of thing. It was a

super time to be in the company. And the company was doing really well thanks to Peter, and to lose it was, was awful. So, you know, it is what it is. And I went to air traffic control...

Tola Sargeant 59:51

So then you went to air traffic control, National Air Traffic Control?

Rob Witty 59:55

So, yes, I mean that that for me was kind of natural. It's the ultimate poster boy for safety critical systems. It played to lots of things that that I liked. I had the privilege when, when I knew I was going to get the job, I said, right, I'll start on the first of April. And they said, 'no, no, we want you to start at the beginning of January'. So I said I actually I fancied having a couple of months off right between GEC and Air Traffic Control. 'No, no, you really must come in January'. I said, why? And they said, because we're going to turn Swanwick on. And so if you remember, Swanwick had been a kind of a problem for a long time. It took a long time to build the Swanwick Air Traffic Control Centre, so it would be the biggest in Europe. Long and troubled government procurement history, endless investigations and commissions and people who knew how to fix it and didn't fix it and that sort of thing. So, I mean, it went on and on and on.

So I had the very happy experience that I joined at the beginning of January 2002, and we turned Swanwick on later that month, and I actually took over on the first of April. So I had three months with my predecessor, [?Phil Escorit][inaudible].

And so he took me round the business and taught me the ropes because I had no air traffic control experience. I knew a lot about software engineering and real time systems and everything. But I didn't know anything about air traffic control. And he

introduced me to the various air traffic control senior engineers in the other European, Canadian and USA places, that sort of thing. And it was very happy experience. We're still friends. So that was really nice to have that, rather than just get chucked into the deep end. [?Phil Escorit] took me very gently around, and so I, so I was in the control room at three o'clock in the morning, where when the handover happened.

And then another lovely little thing was they did the handover, and they all worked, and all the engineers are in the in the viewing gallery, and they did a little stunt, which was like when you have ice skating at the Olympics in those days, right? The judges take out little cards, right, with technical merit and artistic impression. And all the engineers did this, and all the controllers are going, 'Whoa, what happened?' Nine out of 10 for technical merit, seven out of 10 for artistic impression. And there was, it was lovely to have that experience of actually, sort of being there in that moment and I said to [?Phil Escorit] you know, after 20 years of trouble, 'Will it work, Phil?' And Phil said to me, it will work. He said, you don't have to worry, it will work. And he said, the only thing you have to worry about is.. you know all this complication of the software... he said, the only thing you have to worry about is the power supply. Just make sure you never lose the power supply. That was his words and he was absolutely right. And you taught that to the Spanish recently, right, taught that Heathrow recently. Chief Executive turned his phone off. I slept every night with my mobile phone and a pager, diverts, dual channel redundancy, right, under my pillow every night. And occasionally I got phone calls at three o'clock in the morning. And you think, yeah, okay. And I think we had, we had one difficult... we had a couple of difficult incidents on my watch. We lost Swanwick once, and, and that was one of those sort of ironies.

It was... they were funny. We did our media training and we did them in a in a hotel near Swanwick, so you had to be ready for what was going to come. And part of the training was, you will know this, being a professional, it was the ambush. So the Ops director and I had to go walk about in the car park, and at some point we would get

ambushed by a TV crew, and we had to deal with the ambush. Okay? So we're practising this thing, but I mean, even when you practice, those things are kind of scary, right?

I remember doing the doorstep. You open the door and somebody puts a TV camera in your face. Again anyway, so we get ambushed in the car park. And what we didn't realise was that in another part of a hotel there's a set of engineers, senior engineers, on a management training course. And they see the Ops Director and the Engineering Director walk across the car park, and suddenly, out of the back of the van, a TV crew jumps out and starts filming. And they're going, 'My God, what's gone wrong?' So the management training course stops. They're all on their phones. What's gone wrong? And they're going, nothing's gone wrong. What do you mean? Nothing's gone wrog. The Ops Director, the Engineering Director are on TV now, what the... what's going on? The whole of NATS went into panic mode because of our media training!

There were lots of laughs about those sorts of things. But it was, it was interesting experience, because Swanwick worked, which was, which was a great relief to all concerned and Phil Escorit was right. It worked, and we built a collaboration with the Spanish and the Germans. Because what you what you very quickly realise, and again, this is the sort of tragedy of the European attitude in this country, is air traffic control, is air traffic control, and it's the same all across Europe. There were far too many air traffic control centres across Europe. They were built as national things, and the thing could be streamlined, and we could improve air traffic in Europe enormously and reduce the cost of it by streamlining everything if we all work together. And we were sort of going down that route. Everybody had that spirit I think, particularly the French and the Germans. And it was, it was going, it was going well, and eventually that delivered, and that's what runs in air traffic control today, the result of that project.

And then I retired. And one retires sort of earlier from air traffic control, because they still had the civil service type [contract] even though it'd been privatised, they still had the civil service sort of attitude, terms and conditions or whatever. And so I went and was a professor for a bit.

But I mean, that was winding down. I think the way to retire is not to stop dramatically. It's to wind down. So I wound down after that. So it was, it was, was an interesting experience, because I worked with the Americans, I worked with the Canadians, and I worked with all the other basically, the Member States of the European Union, which I had sort of been prepared for, right? So I know America, Canada, I felt very comfortable with, I felt comfortable with the other people, probably other European nations. And so that was, that was a sort of nice place to be. Was a nice place to finish, to do that on safely critical.,

Tola Sargeant 1:08:17

Absolutely. Almost back to where you started, making the most of all those experiences.

Rob Witty 1:08:21

I think there's just something, something magical about being in a control room at three o'clock in the morning and everything humming smoothly and working. It's... it's a kind of privilege and an environment that most people don't see.

Tola Sargeant 1:08:38

Not everyone's cup of tea, though it's obviously suited you.

Tola Sargeant 1:08:42

Now, first of all, I should ask you now, now that you're retired, what activities are you pursuing in your retirement?

Rob Witty 1:08:49

So I have two hobbies, software engineering research and woodworking. So, as an engineer, I love designing and making things. So that's fairly standard, but I'm still active in the software engineering business, so I still work on Compiler-Compiler technology. And had the joy, two years ago, I went to Silicon Valley and I met Jeff Rollason, who was the guy who, in the '60s, built the TREE-META Compiler-Compiler, which I use a lot. And Jeff Rollason is interesting because Jeff was the software engineer who worked for Doug Engelbart, who you may well know. I 'd met Doug Engelbart. I hadn't met Jeff. So I had lunch with Jeff, and he built the software for the world's first mouse, and he built the software for the world's first internet connections and the first wiziwig editors, if you like, still on teletypes, but on on CRT screens rather. And the mother of all demonstrations, if you've seen the YouTube video. The software, for all of that was written by Jeff Rollason. So, but he built the TREE-META Compiler-Compiler, which I think is the best compiler-compiler that I've seen.

So that's one hobby. But at the moment, I'm actually writing a paper with Professor Tom Anderson of Newcastle University. And Tom is one of the founders of the Centre for Software Reliability. Newcastle and Bev Littlewood was at City, [University of London] and quite a long time ago, Tom and I wrote a paper about proof of termination of software with safety critical in mind, and how you could do that by construction. And we did that for iteration, and so that, now that we have the time to think about these things, we thought we better do recursion as well. So we covered all the inductive cases. And so a couple of months ago, I worked out how to do bounded recursion to guarantee by construction, proof of termination. And so Tom and I have to write the words in the paper now. And that's, that's one of those things where we wrote the first paper, and nobody ever took it up, and we never promoted it

enormously. And so maybe we'll have a bit of a bigger goal now that we can do iteration and recursion, because the number of times that programmes go into a loop and you think this is ridiculous. We've been writing software, arguably, for, you know, 70 years, and people still write stuff that goes into a loop, and there's no reason why that should happen. It's just unacceptable that, particularly when the fix for it is trivial, it's a trivial alteration to programming languages that the compiler could generate the code. It's only a few lines of code, so it's not even expensive to do, and we don't do it. So watch this space when Tom and I produce our latest our latest paper on bounded induction.

Tola Sargeant 1:12:18

It doesn't exactly sound like you have retired yet, then?

Rob Witty 1:12:21

Well I mean, the thing is, if you're interested, and I've been interested all my life, then you don't want to give it up. I mean, it is the standard cliche of, you know, I spent my professional life being paid to do things I would have been quite happy to do for nothing. And so now that my research is funded by the pension fund, courtesy of NATS pension fund, they fund my research and I'm really happy about that. And and it, it's, it's just lovely when you can... when you can still do it. And then you have to pick a problem that's small enough that you don't need 500 people in order to build a [?] and there are plenty of problems out there that don't do that. So I mean, what was my profession is now my hobby.

Tola Sargeant 1:13:18

Fantastic, and looking back across, maybe the whole of your career now, is there anything that stands out that you're particularly proud of?

Rob Witty 1:13:26

I think there are... there are a few things. The Spire programme in GEC, the capability which we were to model, stuff that affected an improved 10,000 software engineers. I think that was the best programme in the world. On its day, there was, there was nothing [to compare] - and I don't say that as my view, that was the view of the Software Engineering Institute that knew everybody's programmes. Most of the American companies who were doing it did it on a business unit by business unit basis. They didn't integrate it across the world, but we were shipping software engineers from Italy to work with people in San Diego, and that's something we had. The whole thing integrated across, and everybody trained by the Software Engineering Institute to the right standard to drive the programming. And you could see it on the bottom line. I mean, you know, I didn't get fired by Lord Weinstock, which is the ultimate test for success. There were those that did get fired. So I think that's probably in the sense of it, if I, you know, if it's what did I do.

There were lots of things, the national programme stuff where I was a cog in the wheel. So, I mean, I think the Alvey programme was a very good thing. And I think it's a tragedy of short term thinking that that never saw it's... you know, if that had become our de facto way to run research in the UK, the UK would have been strong in the IT industry, the way it just isn't these days. So we lost all sorts of things I think. So I think how... and that was an accident of history that we build up from small beginnings with the DCS programme, software, technology, robotics, whatever, and then into the Alvey programme. And I was part of the software engineering programme, but other people in the Rutherford lab were parts of the other strands in the Alvey programme. And that's because we had enough people who had been trained and experienced running the other programmes to contribute to the Alvey programme in a big way. So, I mean, the Research Council was a big sponsor, but the Rutherford lab, I think, played, played a good role in that. So I think I got most of the Alvey software engineering strategy right. I got... I said we would not do compilers and operating systems, and that was the right decision. I said we'd do formal methods. And I still believe that, even though it hasn't happened, and it's a great

disappointment to me that it hasn't got big, hasn't gone mainstream, if you like, it will, it's, it has to be, you know,

The hackers - there are millions more hackers than there were when I joined the industry. And at some point the world collapses, when the software just isn't sustainable. I mean, you see it, progress will grind to a halt just because the technical debt, if you like, in the software business, will just become too great to innovate much more, and it ossifies. I mean, you see it now in simple things, like we all run IP version four, not version six. Frankly, I mean, IP version six is on hand these days and we still run version four. So you can feel that, whereas when I joined the industry, programming languages, half life was about five years and then we'd invented another one. So the pace of innovation has gone down.

So, I think that the national programmes were obviously a highlight of my career. I was just a cog, moderately influential, but I was, was a cog. So I think those are probably, I mean, in air traffic control, I just kept the ship steady. There was... after Swanwick we all, we all did get a bit of a breather after Swanwick, after 20 years.

Tola Sargeant 1:17:46

If you if you were giving advice to a young person starting out in their career now, maybe at school still, what would your advice be from the benefit of your experience?

Rob Witty 1:17:58

I think my advice... I would have a few things probably the same. One is educate yourself to the highest level. So if you can do a degree, fine, if you do a masters or a PhD, fine. I mean, we got to the stage now when I was in NATS where I wouldn't hire anybody with a bachelor's degree, because the UK education system had

deteriorated to the point where if you hadn't got a master's degree, I didn't really think you were worth hiring, and that's a great tragedy. But so go to the ultimate level if you do a PhD, and in a way, I'm an example where you don't have to be a standard three year PhD student. You can do it in your spare time. Took me five years, but you still get the benefit of the discipline of learning how to do the research. I think that, you know, go to the highest level you can.

The second thing I would say is join the wider profession. Join the BCS, join the IET, whichever is the right for you. I was a member of both, and I think being a member of both has its advantages. And participate, you know, for all sorts of reasons, a you'll broaden your knowledge and experience just talking to people, networking is very advantageous. Opportunities will appear both, as it were, in terms of jobs, but also other things like running a conference or an event, or something like that, will crop up that wouldn't if you just said, do the day job.

And continuous professional development, which flows, if you like, from places like the BCS. I said, the pace of innovation is is not as it was, but it's still high. It's certainly high compared to many other industries. Things change and you you can never know everything, you know. Probably in the 1960s you could just about know all of computer science, but you can't know all of computer science today. It's just totally impossible. So continuous professional development, I think, is, is, is the key one.

And maybe the final one is, go for it. Do what you enjoy, particularly when you're young. Money comes later. Fine if you're 21 and married with three kids, well, you have responsibilities, but if you're not in that position, then go. I mean, I went all over the world, lived all over the place, and had a fantastic life as a consequence. I had a fantastic career and and that, I think is, is, you know, it's, it's because I enjoyed it. Do what you enjoy, work hard at it, and, and the benefits flow. I mean, I never made any money as a government scientist, but I certainly enjoyed it and the rewards of

contributing to the national interest. I think I loved working for the national interest, those things, you know, money can't buy that kind of thing. And the connections and the people you meet, whatever, are tremendous.

So it's go for it. I think that I see people, I met someone the other day who was young enough, and he's just done the day job. He's a great engineer. He kind of comes to work nine o'clock, goes home at five o'clock. The company thinks he's wonderful, and that's it. He lives in a box. And I'm thinking, you could be so much more. You know, if you join the professional societies and you broaden your horizons and you participated in the wider thing, just it would add to your day job, and you would grow as a person and an engineer. So I think that sense of looking out...

Tola Sargeant 1:21:50

Being open to those opportunities...

Rob Witty 1:21:51

And being open to those opportunities, which, as an engineer, come from the professional societies mainly. I mean, you can volunteer and do all sorts of other things around but professionally speaking, it's the professional institutions that generate those opportunities.

Tola Sargeant 1:22:09

And one last question, if you were starting out in research or in business today, what do you think you would go into? What areas excite you most in terms of what's out there?

Rob Witty 1:22:21

Gosh that's probably the most difficult question to answer, because you can't unlearn what you've learn. I think I would probably still go into safety critical, and I will say this for probably the wrong reasons. The rest of it is pretty awful. I look ... I had to do some some graphics on the web recently to write in like HTML, HTTP, that sort of thing. I had to write some Javascript. God JavaScript, right? Had to write some Python. These are programming languages that have been put together, by, I guess by people who had dropped out of first year computer science, right? They didn't know what they did. They're awful programming languages. If anybody in air traffic control said, could they write JavaScript? I would fire them on the spot. Just appalling programming languages. And you and you look at the way software works in the world, and you go, why is it like that? And that's because the level of software engineering is so awful, and people don't seem to understand it, don't seem to get it, don't seem to have, you know, the invested base in C and Java and that kind of thing, is so great that they just sort of go, we couldn't face updating it. We couldn't face modernising. And so you think, safety critical is the place where the case can be made, you have to do it, right. You can't say, 'well, I think we'll just hack it out..and if we kill a few 100 people every year, well, you know, it's less than road traffic deaths, isn't it?' So it doesn't really, really sort of go that way, doesn't it? So you can still make the case in safety critical for doing it, for doing it right. It's harder to innovate because you have to go slowly in safety critical, naturally. But in terms of the research agenda, it's there. And, and, and if one was very smart and very mathematically able, then formal methods and ultimately theorem proving. Ultimately, I think, from the point of view of practical software engineering, it has to be mechanical theorem provers and the associated improvements in specification languages and programming language and things and operating systems, that need to fit into that, that will only get us out of the horrible mess that we've got now to actually make stuff work properly and reliably and predictably. And how long would that take? Well, gosh, you know, if I was 21 I'd be thinking, well if we see it before I retire, we'll have done well because it's just difficult. It's just difficult. But if it wasn't difficult, it wouldn't be interesting. I think that's, you know, if you gave me another 50% IQ, I could be doing it, I'd go and do theorem proving.

Tola Sargeant 1:25:44

Oh, that's a lovely note on which to end. Thank you so much Rob for sharing your story with us.