



Dr Bob Nowill

Interviewed by

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Welcome to the Archives of Information Technology, where we capture the past and inspire the future. It is January the 28th 2019, and we're in the headquarters of the British Computer Society in London. I am Richard Sharpe, and I have been researching and covering the IT sector since the Seventies.

Twenty or eighteen or so years ago people seemed to be empowered by the new technology of PCs and workstations, and particularly the rise of course of the Internet. It looked as if information would flow, and people would be freer as a result and get more services. But something else rose at the same time, and in tandem to it, and it wasn't just a coincidence. Concerns about cybercrime as we now call it, concerns about hacking, and, to those who were critical of the State, concerns that maybe the individual was empowered, but the State was empowered even more by these new technologies, because now, the State could see what we were doing, and indeed what we were interested in day by day. And at the centre of many of these issues is Dr Bob Nowill. And he has been in the Ministry of Defence, in the famous GCHQ, and as a director in BT. So he really is at the centre of many of these issues.

[01:32]

Dr Bob, you were born around Leeds was it?

Yes. Morning. So yes, I was born in Leeds in 1955, in Headingley, overlooking the cricket ground.

Very nice. Your father was a chartered mechanical engineer.

He was, in power stations and subsequently the CEGB.

Right. And your mother had worked in Bletchley Park.

She had, during the latter stages of the war, been a Bombe operator at Bletchley. And, I'm sure as everybody knows, that wasn't a subject that was much talked about until the stories started to break in the mid-Seventies, with a book called *The Ultra Secret*, and then subsequent revelations continued ever since.

The Bombe was the first machine that Turing and others put together.

Yes. The Bombe was one of several machines which you can see now obviously at the National Museum of Computing, or the Heritage part of Bletchley Park. And, I think it's fair to say that the women, largely women, who were there, who were in the Wrens, the Women's Royal Naval Service, if you think of ages, my mother was born in 1924, and she went there in about 1944, so she was 20-ish, and the worker bees were all of that age. Obviously the famous people you hear about, like Turing and Denniston and so on, were the boffins in charge, and the military in charge, who are now all dead, but the women who were there at the time were much younger and they just did things, so they're not famous names. My mother's still alive, she's 94. But, they weren't famous names, but they were the, the workforce that have since sort of, talked about as far as they could what they got up to, and, or sort of, verified the stories.

[03:28]

And, it was hard work, and there were long hours, shift work, and you had to really concentrate on what you were doing.

I'm sure that's right, but, my mother does talk about it from time to time, although they're still now reticent, because obviously, they were sworn never to talk about it, even though they're allowed to talk about it now. But, the stories she tells aren't so much of the war, breaking ciphers and all of that; they're much more about, the fun, or the sad times you would have in a group of, twenty-odd thousand people doing common cause and living in barracks and away from home for the first time, and, just generally, almost a, a boarding school atmosphere if you like. And it's that sort of thing that makes her light up as much as pride in the mission.

Do you know how she was selected?

Yes, to a degree. I think, like many of them, it was, it was cloaked in mystery. So, women would either be asked to join up or just joined up because they volunteered, one way or the other, the right age, for the Wrens in her case. And if they seemed to be impressive enough, or just, I don't know what criteria particularly, but, let's say

impressive enough, selection, they would then get a, a tap on the shoulder and be sort of directed to a specific part of the service which had cover stories of all sorts of things, down in Portsmouth or wherever it happened to be. But eventually, through, through a process, a mysterious process, they got diverted to Bletchley, or one of the buildings around Bletchley, it wasn't just Bletchley at the time, to do something towards Ultra and the work that went on at Bletchley.

So she was really a, a computer operator, almost?

[hesitates] Well yes. I mean the word computer probably wasn't around in those days, but the machine operator.

Yes, it was attached to a human being though wasn't it.

That's right. That's right.

Yes.

And, whether they really knew which little bit of the huge machine they were a little cog within, I doubt. But, that's not to demean it, it's just that it was very segmented, and difficult I suppose unless you were a, a Turing or a Churchill, to look over the entire operation and, and understand what was going on.

[05:51]

You went to Leeds Grammar.

Yes.

Which means that you passed your Eleven Plus.

It does.

And, how were you in primary school?

Was at primary school in Sheffield, at a, what was called Ecclesall County Primary School, which these days would just be what you might think of as a normal state primary school. And...

Were you good at school?

[hesitates] Yes. Certainly good enough. We moved to Leeds, because of Father's job, which doesn't sound much these days, you'd probably go by train, but even then it was a bit of a trip. And went to, did the entrance exam for Leeds Grammar School, and, and got in.

And enjoyed it there?

Yes. Yes, no end of fun. I wasn't sporty particularly. Everyone played sports in those days, but I was more, academic if you like, and went up through all the various classroom groupings that you do at a grammar school, and my sort of extramural activities were more around chess and things like that, than around, rugby.

[07:04]

Grammar schools were then, well still, streamed, were they not?

Very much so.

Into arts and sciences?

Yes.

And you are in sciences and mathematics were you?

Absolutely.

Right.

I think, it was only reasonably recently, it depends how you define recent of course, that the ability to do a choice of either O Level/GCSE or A Level that mixed up arts and science became acceptable. Certainly anyone of my era and a bit younger would have struggled to mix up arty and science-y subjects. So it was very normal if you like to have done something like, chemistry, physics and maths, but extremely unusual, in fact I can't think of anybody who did something like, psychology, history and chemistry, or something like that.

Yes. Yes.

That would be a much more modern way of doing things, and in my opinion better, but that's a different story.

Right.

Certainly of the polymaths, who had to pick too early.

[08:01]

Had your father been to university?

No, he had not. And I think both my father and my mother would have said, the war got in the way, because it was just at the wrong age for them.

Right.

But, he went, after his effort in the war, which was as a captain in the Army is where he finished, and, and time in Egypt and places like that, he went on to become an engineer by hard work on his own at Wakefield Technical College. I don't actually know if Wakefield Technical College exists any more, or whether it's a UTC or a university now, but that's what it was at the time.

Right.

And, and subsequently go on to be professionally qualified.

[08:44]

And, you applied to Trinity.

Yes, that's absolutely right. So...

The first person to go to university from your family?

No.

No?

No. Absolutely not. Certainly in the generation before me, my mother's sister had gone to Leeds University to do pharmacy, pharmacology. And, my grandfather on my mother's side certainly had connections with Sheffield University in metallurgy and maths. I'm not quite sure what the connections were to be honest. But, no, so it wasn't the first. Probably was unusual then for, for that generation, just because the war got in the way.

Yes.

And, grammar schools, looking back, well in fact, I suppose it's a truism of that era, sort of, Leeds Grammar School, Bradford Grammar School, Manchester Grammar School, et cetera, all seemed to have particular affiliations with one or two Oxbridge colleges, as well as obviously other universities, but just talking about Oxbridge for now, and Leeds Grammar seemed to have some sort of affiliation with Trinity College. So the, the push was, because when you're in Leeds you don't actually know which college you want to go to, the push was definitely, why not look at Trinity, and, and you always look at more than one, but why not look at Trinity, and I did.

And this was the late Seventies, early, early Eighties by now?

I went to Trinity College in 1974.

Right. And you were there reading what?

Natural Sciences. So, that was, a mixture of things that easily followed on from combinations that, like I spoke about before, like chemistry, physics, maths sort of combinations, ends up at a place, the first year in natural sciences, doing things like, chemistry, physic and maths, with a few odds and ends dotted in, like, crystallography or geology or, optional extras, but essentially it's chemistry, physics and maths, before you then decide for either, like, your second year, Part IB, or Part II, to do something much deeper and specialised a bit more. So it was an excellent system, obviously I believe it to be so, and it's similar now, that gives you a, a year if not two years to decide where you want to focus.

[11:08]

And the late Sixties, early Seventies, [laughs] revolution so to speak had blown out by now in the, in the...

Yes, if you like.

...in the mid to late Seventies, and things were a lot more serious, and a lot more studious than before?

Yes I think so. That's not to say an enormous amount of time wasn't spent having fun, because it was, but there were a lot of, a lot of time for doing some, some decent studying, and hard work, as well as rolling sleeves up and having fun and so on. So yes, it didn't, I mean it just felt at the time, as I'm sure everyone would say, whatever age they are, it just felt normal.

[11:46]

Mhm. Mhm. And you stayed on to do a PhD.

No. I left in 1977, after getting a BA in Natural – in Electrical Sciences, and the Cambridge system, well the Oxbridge system, then allows you just a couple of years later if you wish to take an MA, which I did. That doesn't mean you do any more; it

just means you turn up and, appear. But then after a couple of years of, of working, for the Ministry of Defence, I thought, I'm sort of missing it. So I went back in 1979 to take a PhD.

Oh right, so '82. '74, you started work at the MoD?

Well yes. So that, that's why it slightly sounds confused, because, the way I was funded at university, it was paid for by the Ministry of Defence.

Aha.

Because at school, I, through my father's encouragement, was lucky enough to gain a Ministry of Defence scholarship, which means a place on the, what was called at the time, their Student Engineer Scheme. So, I, the fees and, and me personally, received a salary. The fees were paid from Ministry of Defence for the five-year period of three years at university and the two years afterwards working, and one year before. So it was, a sandwich course essentially. And I think although sandwich courses have sort of fallen out of favour, apprenticeships are in, and apprenticeships leading to degrees are in, and to be encouraged, and have sort of supplanted that way of doing things. But certainly for me, the sandwich course scheme of going to an organisation, in my case Ministry of Defence, for a period, it wasn't a whole year, it was almost a year, and then on to university for three years, and then back to the organisation for a year or two, so adding up to about five years altogether, paid...

And you had to sign a contract saying you would do that?

Well yes, although, at the end there was no particular obligation to stay on. There was perhaps a moral obligation, but no, nothing else. And you could argue, and I think we did at the time, and I would now, retrospectively, say, it was one of those national interest things almost, it sounds rather grand, but it was, that, almost, if you were that sort of person who wanted to do engineering for, in the UK, if you ended up in the Ministry of Defence, that was lovely of course, but actually, if you ended up at, anywhere else in the UK doing engineering, that was good for the country. And there was a sort of, circular, some people started at the home organisation and went

somewhere else, and other people start somewhere else and ended up at a different organisation. You would circle round and find somewhere comfortable to be, career-wise. And of course in those days, there was quite a lot of feeling as though if you then got your head down and stayed put for forty years, got promoted and so on, then you would retire from the same organisation, as many people have done, and all would be well. These days, I wouldn't counsel anyone to do that; life isn't like that any more. You need to zigzag around a career to get on, not stay put. But in those days, perhaps it was the end of 'those days', put it that way, then staying put was thought to be a good thing. Perhaps we'll come on later, I'm not sure it is a good, or even was then a good thing, but it was supposed to be a good thing.

[15:08]

When did you see your first computer?

So, yeah, that's an interesting question. So, certainly, analogue computers were a thing that we looked at, even at school, in the sixth form, from memory. And of course in, now we know better, places like Bletchley Park and so on, had a version of computers even then. And of course, you know, rockets to the Moon in the Sixties, the Space Shuttle – not Shuttle, the Space Programme, from the Americans, and the Russians, used analogue computers. So the concept of a computer, be it analogue, was around in those days. Perhaps not very many people understood them completely, including me. But in terms of what you would now call computers or, digital computers, that was just sort of, starting to happen at the, my sort of, probably middle and last year in the sixth form at school. I remember we had a computer club. Computing wasn't particularly taught, but it was an after-school activity, and we went down to Leeds University, who had an Elliott 903, from memory, running, heaven knows what, some proprietary thing. And we all learnt very very basic ALGOL as the programming language, and did things like, printed out a list of cube roots or, you know, just on a bit of maths. It was like, arithmetic really. And... Which prompts me to remember of course, calculators started to be around at the same time, basic ones. But, in terms of what you would now think of as a desktop computer, the, I suppose we more had terminals in those days rather than desktop computers, attached to mainframes, and that was end of sixth form and through university such things were

around. The first desktop, self-contained computer, was probably that very early era of BBC Commodore PETs, early Apple, Sinclair, and so on.

Did you have one?

Indeed, we had, a Commodore PET was probably the one I did most work on, and that was through my research work at university.

Mhm.

But things like, programming in assembler for microprocessors, obviously, high level languages were taught, like FORTRAN, but lower level languages were taught at university as well. Not everyone did it, not everyone found it very interesting. I didn't find it particularly interesting at the time. But you soon get into it once, once life takes off.

Did you buy a BBC Micro?

No. Never did. No. I remember ordering an Acorn, which was the predecessor to BBC Micro, in Cambridge, but for some reason it never turned up. And I went down the Commodore line instead.

[18:10]

Ah. OK. Yup. You worked on the shop floor at Farnborough.

Yup. So that was part of the sandwich course I was talking about.

Yes.

So the very first year. Which was, January to September 1974, for me. It was all about being on the shop floor, it's all about learning how to get on in an engineering environment. By engineering, I don't mean electrical engineering, I mean, mills, grinding machines, welding, bending metal, noise, oil, you know, the general hubbub of a workshop. And for, for people who had never done that before, it was probably

quite gruelling. I hadn't done particularly much with it before, but obviously Father's influence meant I had done some of it before. And that was, that was great. So we had good fun there.

What type of things were you building there?

So, we all did various bits and bobs, meaning, you could, a good example is, everyone had to make a tool box to a particular design, and, right from bending the metal to getting it sprayed and making sure it worked, and then, if you were brave enough, having it sort of, stress-tested. Doesn't sound very hard but it probably is when you're only seventeen and never done it before. But everyone also had a project, the student engineers all had things to do, and I remember people had to make, for example, a polythene bag sealer with, with heated things, the sort of thing you see now in, in the supermarket, you put your fish in and they put it in a machine and it comes out in a nicely sealed bag. So, that was a sort of typical project. And I remember they, obviously there was only, three of us out of the cadre of about 30 who were Oxbridge, and we were all given what they said were, they didn't use these words, they used a ruder version, but the excessively hard projects, and I was told to find a vidicon tube and make a TV camera, I remember was my project. Which, after a lot of effort, I did, and it worked. The only problem was, it had a focal length of about six inches, so, you could only sort of, do it up to your nose or up to something very small, because I got the measurements wrong on the lenses. But I was quite pleased with that.

[20:22]

And you went, as well at Malvern?

Yes, after that....

This is an MoD centre dedicated to what, Malvern?

OK. Well all the places we've spoken about, like Farnborough is the Royal Aircraft Establishment, which was MoD, Malvern was, at the time, called the Royal Radar Establishment, RRE, and then re-badged as the Royal Signals and Radar

Establishment, RSRE, part of MoD. In later life, after privatisation of many things, it turned into DERA, Defence Evaluation Research Agency. And eventually, after that it was split into DSTL and QinetiQ, but that's, that's more, a few years later. But yes, so at the time, that was a Civil Service establishment, part of the Ministry of Defence, the Royal Radar Establishment, in Great Malvern. And it was established, again, back to sort of wartime and, and around that period, to investigate, as it says on the tin, radar.

And you were pulling crystals then.

Yes. Nothing to do with radar. Again, we went round lots of places as students within the Establishment, but the one that sort of, caught my interest, was, in the more physics-oriented part of the Establishment, rather than the radar part of the Establishment, where they did some pioneering work on lasers. And in those days to create a laser, one of the things you would need would be a ruby, and a piece of ruby like a cylinder with highly polished ends, if you can think of it like that, about the size of a small pencil. And to create a ruby, or anything like that, a sapphire or something, but it was ruby, there was the technique called Czochralski, which starts with a c-z, which was essentially to make some exceptionally hot, in a kiln, mix of precursor chemicals. And then, turn it round quite slowly with a little seed core in the middle. Pull that out, at a very slow rate, and out would come miraculously a single crystal of ruby, which you could then shape and polish and use as a basis for your laser.

[22:36]

And, those were... The thought was, perhaps, that they could be used in telecommunications, transmission, for example.

Well, for example, so, lasers at the time, obviously, just sort of starting to be realised as a, as a fantastic thing and a source of coherent light, and, you know, shoot a beam of laser at the Moon and it wouldn't spread. Well it would a bit, as we all know now, but at the time you could imagine that. And there were all sorts of lovely things on James Bond, *Goldfinger*, of, lasers chopping up bits of metal and bits of James Bond himself. So, the public imagination for lasers was, was interesting. And they were always thought of as...

And the immortal line, 'No Mr Bond, I expect you to die.'

Exactly. Precisely. And everyone thought of it as a red beam with steam or smoke coming off the end as it sizzled through things. The reality of course is a bit different. High-powered lasers tended to use infrared, so you couldn't see the beam, destructive type lasers. But that...

What was the MoD going to use them for?

Well they probably hadn't quite thought about it yet. So, there's telecoms, there could have been weapons, there could have been, sources of, well, as you say, communications, telecoms at very very high wavelengths, to carry a lot of information. The thought of shooting that then down a fibre optic, to make a comms channel, was in its nascency, but, but nonetheless, as we know, that all happened.

STC were working on that, weren't they?

STC, Standard Telephones and Cables, were, and others, BT obviously, as we now call it, GPO/British Telecom at Martlesham in Ipswich ditto, and others. Cable and Wireless no doubt.

[24:17]

Right. And then you moved into the London HQ, did you? MoD.

Well, London rather than the HQ.

Right.

So yeah, the... I was in the Procurement Executive part of MoD, which is the one that ran all the outstations and, and bought things. And the, still part of the sandwich course, but then as a graduate engineer rather than a student engineer, I took a, a first proper posting into the Procurement Executive in a part of the organisation that was responsible for buying secure equipment. It was called DCOMMS/S at the time,

Directorate of Strategic, slash, probably really secure, Communications, which was in New Oxford Street. So that was, that was good fun.

What type of equipment were you buying?

So that was, secure communications equipment. At the time they were called, they may still be but I don't think, now, BIDs, b-i-d, followed by a number. And people remember fondly some of the very early ones which were very Heath Robinson, valves, and then later ones which got much more condensed. But essentially, cryptography machines for speech or for data. And, clever people at CSG, which was the information assurance arm of GCHQ at the time, would do designs and assurance and get these things then manufactured in quantity, for the military or for others, for the Diplomatic Service, in British industry, and this part of the Ministry of Defence was responsible for placing such contracts and making sure that the deliveries happened. So we'd be buying, you know, hundreds of a particular VID device from a Marconi, for from a Plessey, or from, other companies like that, who were the big names in British industry at the time.

No longer with us.

No. Well, they were sort of, somewhere hidden inside BA Systems, but, no longer with us as they were.

[26:22]

Then you moved, did you... You went on to do your PhD.

Indeed. So, 1977. I then resigned from the Ministry of Defence, and went back as a, as a PhD postgraduate student to Trinity College, which was lovely. And... It sounds so each now of course. And got the student grant, which was also lovely. Because I had been a sandwich student and hadn't had one before, I was allowed to have one. So now, thinking of my own children, and the student debt they had, one of, two of them still have, from their time at university, in my time at university, at least that was paid for. Must seem like heaven, but, that's how it was.

You are in your mid-twenties now.

So 1977, I'd be 22. Yes.

Yes. A more mature student...

Well a little.

...rather than the undergraduates.

A little.

A little. And you do your PhD in?

Yes, so, I, I only hesitate because, one of the reasons, or one of the constraints of being a student engineer for the Ministry of Defence was, I had to do engineering. So although I did, for my first degree, Natural Sciences, Part I, for Part II I had to move to Electrical Sciences, and there's somewhere inside me a tiny piece of regret that I had to drop chemistry and do electronics. But having done electronics for Part II, that then enabled me to do my PhD in an electronics-related subject, which was to do with communications, sponsored by what is now BT.

And, you met computers then again.

Again, yes, there was a lot of computers then. Obviously had taken off in, in a big way, certainly in terms of mainframe computing at the Computer Labs in Cambridge, which has always been at the forefront. People from my era will remember expressions like the Cambridge Ring, which was the sort of, predecessor of Ethernet and local area networks and that sort of thing. The work I was involved with was, as I say, sponsored by British Telecom of the day, BT now, out of their research organisation in Martlesham where it still is, the BT Research Labs, although it's much smaller than it used to be. But it was to do with the use of twisted pair cable, which is the standard cable that goes into everyone's home in the country, to carry the old-fashioned telephone lines, analogue telephone lines, the use of those cables to carry

what we would now call broadband. Broadband wasn't a term that was used at the time. But to say, is it possible to get two megabits down a twisted pair line so that we don't have to dig up all the roads and replace them with coaxial cable, or even fibre optic, and that hadn't really been dreamt of, for consumers, at that time. And of course, as we still know, in the UK, the answer is, yes, it can be done, and the vast majority of broadband connections to homes in the UK are still carried for the very last part of their journey on twisted pairs that have been around for a considerable period of time.

And the protocol used is ADSL?

Well it was, certainly ADSL, or DSL in the early days, is still very much used. Very few people have any options in terms of other forms of cables or other forms of protocol. So yes, yeah, the modem to your home, which is built into your router. Again, old people will remember routers going bdoing bdoing when you connected them, and, and being pleased to get a sort of eight kilobit connection. And of course, now it goes up to something like, if you're lucky, somewhere between 40 and 80 megabits downloads, very same lines, but based on the research, I'm not claiming any credit for it whatsoever, but based on research that largely BT were doing at the time.

That must have been a great relief to BT, to be able to do that.

Oh I'm sure. And...

Because the capital investment of putting down coaxial cable or fibre would have been huge.

And it still is of course.

Yes.

Even today as we speak, in the papers it's reported that Open Reach, which is the part of BT that looks after the, the last mile on behalf of all the tech cos in the UK really, are recruiting heavily to start to roll out finally fibre to the home in a big way. It's

still not there. Some companies did it, so Telewest that turned in Virgin Media started with fibre, but that's not to every home in the country of course. It's too big a...

No, it's very selective.

Yes.

[30:58]

Yup. Then you moved into GCHQ.

Yes. So...

After your PhD.

Having done a PhD, you then think, right, what am I going to do next? And, you know, the whole process of, the thinking about jobs and, and careers at that stage as a, as a PhD, postgraduate. There were various options, but the option I took after a, a reasonable, reasonably quick thinking period, was to go to GCHQ, in Cheltenham. Which wasn't well-known. It hadn't at that time... Well it was well-known by some, but it hadn't at that time formally been avowed by the Prime Minister, who did that as I recall in 1984. I went there in 1982.

Did you go to them, or did they come to you?

[hesitates] So, I went to them, essentially. Having... The reason I hesitated then was because, it probably still exists, but certainly when I was around, the careers organisations at university, it wasn't at all difficult to get a tap on a shoulder to say, 'Why don't you apply for Civil Service exams?' And if you were of a certain, I don't know, displayed certain interest, then organisations like the security service and others, or Diplomatic Service, would ask you to either give an interview or sit their component of the exams or whatever. So I had been round that circuit, but it hadn't particularly landed for me. But in going round that circuit and talking to people, the GCHQ alternative popped up. So I thought, mm, that looks interesting. And I went down there for an interview.

And that really, is back to the place where your mother was working in effect.

Well yes, although, the connection hadn't sort of, that wasn't the reason I did it.

No.

Because the connection between the Government Code and Cypher School, GCCS, which was what Bletchley really was, and turned into, and GCHQ of the Eighties, although obviously it is a direct connection, it wasn't the reason I, I went for it. Although subsequently I can put that jigsaw together. So no, it was interesting, because it was a place that was taking on graduates and postgraduates to look into complex subjects. I think previously they had largely focused on, on maths and sort of, basic engineering, but it was beginning to come together in the era of telecommunications and satellites and other difficult things where they needed different sorts of engineers than they had had before.

[33:39]

Well there's another connection with the old GCHQ at Bletchley Park, which is, if you are putting your telecommunications on a coaxial cable or a fibre, it can be difficult to get at it from anybody else. If you're putting it up in the air, in terms of, radio, or particularly up and down to a satellite, anybody can look at it.

Well anybody can find it.

Find it.

Let's put it that way. And I think, the early days of HF radio, which is, where it was up to that point, absolutely, that was sort of bread and butter.

Right.

But, as you say, moving into either satellite technology where it would be visible but hard, or, coaxial or fibre optic or something that's, not so much invisible but hard to access, was, was things that organisations like GCHQ had to think about at that time.

Yes. And they had to crack those codes.

Well, GCHQ does, does lots of things. Some of it is to do with both creating and the opposite of cryptography, so if you like, breaking codes or creating codes that other people can't. But there's lots of other things that are done at GCHQ as well, and I'm not going to go into any particular details, but it doesn't take a genius to work out that, in any organisation like that there'd be two halves. One of those halves would be defending the UK against perceived threat actors from doing things to the UK; and on the other hand, the opposite of that, the poachers if you like, seeing what we can do to find out what other potentially disruptive threat actors overseas might be doing.

[35:18]

And what was your first job at GCHQ?

So, I went into the Engineering Organisation as a project manager, and, having explained that I had done all sorts of things with cables with BT and all of that, I just sort of naturally assumed that I would find myself in a busy organisation that was interested in that sort of subject. But I was actually placed into a bit of the organisation that was developing satellite communications, which I thought at the time was an odd way of deploying me. Although I probably didn't think of it in those terms; I can say that now. But of course it wasn't, it was method in their madness somewhere of, of broadening people to be able to do a range of things. So, into satellite systems, which was remarkably interesting.

[36:09]

And you did that job for, three years?

So I did things to do with satellites for, yeah, about that amount of time. About three years. And then I thought to myself, having been around and, and got a promotion, and sort of, for no particular reason, probably financial as much as any other reasons,

I responded to an advert in the professional press for a role at SHAPE in Holland. SHAPE stands for Supreme Headquarters Allied Powers Europe. They have a technical centre which at the time was at The Hague in Holland. The organisation has changed since then. And so, we went there for a three-year posting, which was good fun.

And that is basically the NATO command and control centre for Western Europe.

Is part of that now.

Right.

I can't actually remember what the acronym is. It's something like, NACISMEUR or something like that. It doesn't matter, there's lots of NATO type...

What were you doing there?

But NATO and SHAPE were different, because France was in one but not the other.

Oh OK.

But they weren't that different. And no, so I, the post I took was in what was called the Radio Branch, which was all about looking at the sort of systems that should be deployed by SHAPE, by NATO, across the theatre. So the, essentially Europe, but broader than Europe really. So resilient systems which were defensible for HF comms, for frequency op in radios, for, things in aeroplanes, and so on and so on and so on. So the avionics end of it. But, the Radio Branch, yeah, it was a senior scientist, as they used to call it in those days. But actually, there was, as I said, there was a sort of, mm, this is interesting, because, this is Holland, that's great. We had just got married. We would have health insurance, we'd have a higher salary. We would have, not so much diplomatic but no-tax status. And, could build up a bit of a, a nest egg over three years. And we also had all our children in that three years. So it was, generally, you know, a, a good thing that worked out. And when it was all over, we, I came back to Cheltenham, to GCHQ again.

[38:36]

So there are two sides of GCHQ, one is securing the Government's communications, another one is looking at what other people are trying to do to the Government and the State and...

Yes.

...threats and so on. Are there two, were there two sides to SHAPE, as in, yes, we want our tanks to be able to talk to their commanders and so on and so forth, that type of radio, but was it penetration as well into the Warsaw Pact area, to think about, how, how do we get to know what they're doing?

It's not particularly my, my subject, but, certainly the work I was involved in was much more about making sure that communications were interoperable across the SHAPE and NATO nations, and obviously not exploitable by, the other side if you can put it that way. But, not in terms of any sort of, function of, of trying to do anything to the other side, no.

[39:29]

How did SHAPE see its radio technology compared with Warsaw Pact radio technology?

Well I think, there was a sort of change happening at that time, the sort of mid-ish Eighties, as we all know, in the, in the run-up to the end of the Soviet Union, before that was happening, the end that is. Then the technology being deployed by the Soviets was reasonably well understood, not in terms of exploitability but in terms of what they were using. And, and it didn't change much. And so, there was a sort of status quo. All right, it's a cold war, but it was a status quo. The big change that followed, obviously, was, as that all started to fall to pieces, and different things happened in the world, organisations like SHAPE, NATO, Ministry of Defence, GCHQ and the equivalents around all the other countries, suddenly had to say, oops, the old enemy isn't quite the old enemy any more. There are new players around, as, as has happened ever since, including much more recently, non-state actors, rather

than state actors. And the change needed to have some sort of capability for defence and offence in that new scenario was, a huge agenda item, and still is.

[40:55]

By now you're getting quite a high level of security clearance.

Well right from the beginning, if you have anything to do with an organisation like GCHQ you have that level of security clearance. It doesn't build. You, whether it's a new student or whether it's the chap who serves the sandwiches, or the person who empties the bin, or the director, everybody has that. So, the GCHQ, the *modus operandi* if you like, is, is system high, so, there's, there's no differentiation in that sense. It's all high, or higher, but it's all high.

[41:39]

When in Holland at SHAPE, did anybody come up to you with a strange accent saying, 'Here's some money. Tell us what's going on'?

No. Not ever.

No?

Lots of strange accents, because of all the different nations, but no.

No, never been trapped into a honey trap, or...

No.

...any of those things?

Not that I'm aware of.

Oh. [both laugh] Not that you're aware of.

No.

[41:55]

'88, you moved back to GCHQ.

That's right.

Yes. What was your role there?

So, having done all those things, and also done lots of things around the sort of, radio and computing, I was given a role in the branch that was responsible for computer project management, meaning, the procurement and installation of the sort of computer systems that a place like GCHQ needs. Again, no, no detail possible really, other than, it's obvious that a place like GCHQ needs very very powerful computers, supercomputers as they're called, and, as they emerged on the scene, which was about that time, desktop computers. So, so the whole spectrum of computing, and of course embedded computers and other systems.

Right. So you needed supercomputers, of which the UK was not then a producer.

That's absolutely right. So...

You had to buy American.

The...

Or Japanese.

Well not Japanese, but American.

And why not Japanese?

Japanese were bought by people... I'm just thinking back. So Fujitsu and others were making things that perhaps the weather forecasters might use, or other people who needed supercomputers. It tended to be, either atomic or places like GCHQ, places

that did hard maths, or, weather, obviously, if you sort of think about, who needs that sort of massive power at the time. And because of a, the Five Nations Alliance, that everyone's aware of these days...

Sorry, what's the Five Nations Alliance?

Five Nations would have been the UK, the US, New Zealand, Canada, Australia, would, would share a lot of things. That was the sort of, first amongst equals group. Then, things like supercomputers and what they were used for could be shared amongst that set of countries, but not beyond. So...

You were buying Crays presumably.

Well exactly. So, the UK had no significant capability to create its own, then, America was the obvious choice. So, certainly, the interesting part of the job, or part, that element of the job, computing end of it, was, the transition between, do we want to make something that's unique for the Brits, albeit made in America, or do we want to buy something that's, not quite off-the-shelf but is, is more in production than, than not? And, the early days of Cray was certainly in that latter space, and still are. Seymour Cray was still around in those days. So, Cray was a big name. You can now see one of the original Cray ones at Bletchley Park in the National Museum of Computing by the way, which, which had for a while been at GCHQ but it's now, was obviously decommissioned a long time ago. Immensely powerful at the time.

Immensely powerful, and strange physically elegant.

They are. One of the beautiful things about supercomputers was, was Cray designs. I mean you know, just boxes of wires and copper obviously, and chips, but, they were made to look beautiful. And just because they, because they could.

[45:12]

But yeah, so we, the custom-built ones sort of faded away. I remember, I mean with all these things, you can say, gosh, at the time they were so powerful, and now you can say, but probably not as powerful as the, as the PC on my desk any more. But that's by the by, that's sort of the growth of, the power of computing, and the

shrinkage of semiconductors, which probably is, is, everyone thinks of as Moore's law, which is sort of, every, eighteen months or so, things either get twice as small or twice as cheap or twice as powerful. And so... And probably all of those at once. And if you sort of put it all together, you're still keeping up with the Joneses, but just in a, in a, everything's better.

[45:57]

About this period, I remember going to an exhibition run by the British Embassy here in London to promote new American companies, and went to one stand, and this man had a new type of computer called a Tandem, which was a fault-tolerant computer, which was, really was the bee's knees at the time. And I said, 'What interest have you had?' And he pulled out a card. He said, [with accent] 'I've got a card from this man at Cheltenham. I've got to go and see him.'

Yes.

So we ran the story, GCHQ to buy Tandem, which I'm sure you did.

Tandem NonStop did good work for a long time at GCHQ.

You no longer need those I imagine, because the nonstop capabilities of major systems are so high now.

Yes. Well, the redundancy is built in.

Yes.

So yes, you're right.

Yes.

But, they need a lot of compute power, but, that's obvious. But, but the specific brands if you like, they moved on. But, but there are still companies making fantastic machines, as we all know.

[46:55]

And presumably, well, I've got to test this now, but presumably you weren't plonking PCs on people's desks; you were plonking what were then called workstations.

Workstations was, to start with, so people accessing mainframe computers. Whether they're supercomputers or not, is irrelevant.

Who was your preferred supplier?

[pause] That is a question that I haven't been asked for such a long time, I can't remember the answer any more as to the original workstations. It might come back to me.

Three Rivers, Sun?

I don't know. It's before, before Sun. It probably isn't a name that's well-known any more, but it will come back. But the reason I paused was that, certainly in that time of the sort of, late Eighties-ish, was the first time I came across the, what we'd now call a PC. So, the desktop workstation, and we had certainly IBM, their original workstation. The first PC, we had a number sprinkled around, and... But they weren't joined up. You'd sort of, share things by swapping rather large floppy disks. But it was, essentially the architecture was not dissimilar to what a desktop PC would be for the next 20-odd years.

[48:11]

And if you are handling floppy disks around, you're handling issues of major security.

Well there's, obviously security issues, although, as I said earlier, in organisations that are system high, as long as the wire fence is strong enough, and the clearances are good enough, then, the internal need to do lots of extra things was less than it is now. But we were also starting to experiment with use of local area network, so joining up PCs and workstations, not just single wires or single lines back to

mainframe computers, but to do local area networks. So, networks as we know them today.

Right.

Which obviously was done in lots of places, not just in the defence and intel sector, but, it was beginning to take off. And I suppose the challenges, the technical challenges were, a lot to do with standards, which is, we can do anything, any organisation could do anything, but which is the one the world is going to adopt? And so, very difficult and quite intellectual discussions between the merits of one protocol or another were important. And obviously, people, different organisations, would go one way, others the other, and eventually it all standardises, but making those choices was hard. Still is.

[49:30]

A protocol which had emerged with some degree of force, like a typhoon really, was TCP/IP.

Yes.

The Internet. And the very year that you moved back to GCHQ, 1988, somebody developed a worm which attacked the Internet.

Yes.

Did this raise bells in GCHQ?

Not particularly. I'm sure it must have done in some people, and no doubt in the information assurance end of GCHQ, or the computer security end, people would have been very aware, because they're exceptionally clever people who just would be. But, that sort of thing of, of viruses, worms and those sort of words, hadn't quite got into the mainstream yet.

Mhm.

And, one of the, the issues, I mean, the protocol that you mentioned, TCP/IP, which was just sort of, beginning to come on the market, and then the subsequent protocols for, say, exchanging emails and all of that, there were lots of arguments between, should we use what's now become commonplace, Simple Mail Transfer Protocol, or should we use a more professionally standardised, military, one, which was X.400? And, and those arguments went on for years and years and years. Eventually the world went SMTP, and for the Internet, but, you wouldn't have known that back in, 30 years ago.

[50:53]

No. And the problem with the Internet, and the problem with, as well, UNIX, and that becoming a ubiquitous operating system, is that neither were developed with security in mind.

Oh well that's absolutely true.

It had to be bolted on later, if at all.

Exactly. So the, the original versions of CP/M and MS-DOS and IBM DOS, discover operating system and all those things, and pre-Windows but what eventually then became Windows in its very early versions, Windows 2.0, Windows 3.0, they had none of that, obviously. They were Internet protocols that do things, they'd be, work jolly well if you had enough bandwidth, but, things like password control and, so on and so forth, just weren't uppermost in, in the minds of the designers.

[51:40]

And in the same year as well, '88, as you were going back to GCHQ, I'm not sure whether that year is so pivotal, but, it's quite, not a coincidence perhaps, that several things happen. And one of the things that happened was the first transatlantic optical cable, TAT-8, was laid in 1988, and so...

The clue's there with TAT-8. There was probably a TAT-1. [laughs]

Yes.

So it probably wasn't the first. But yes.

Yeah, but, but it wasn't optical.

Correct.

This is optical.

Correct.

This is...

Yes.

...a massive expansion of, of bandwidth, which means that, we have broadband...

Yes. No, all that's true. And, I remember the early days, so going back to BT at Martlesham, where they were experimenting with 565 megabits over fibre optic, which seemed an impossible dream, but of course wasn't. It was fine, and it all developed from there. So the... You are absolutely correct, that eventually optics went under the sea, and all round the world in due course, and, sort of, put an end to satcoms as the principal mechanism for international communications. It's not complete end, because it's always there as backup, it's always there for specialist things, even now, with Inmarsat and so on, and for, for mobile, maritime use. But yeah, I mean largely, that then became a new challenge.

Were you scratching your head at GCHQ? Because, until now, you've been able to pluck this stuff out of the ether as it went up and down from satellites. Now it's on fibre.

Well I'm sure not just there, but, but the world over, people would have said, ooh we've got some new challenges to, to think about. So...

How did you solve that?

So yeah. Well, the solutions aren't... I don't, I'm not going into that. But the, the fact that it was a difficult challenge is nonetheless true.

[53:28]

You say that there were the big five working together, Canada, the USA, UK, Australia and...

New Zealand.

And New Zealand. OK. So we'll call them the axis of Anglo-Saxons, shall we?

If you like.

OK. Was there a formal or an informal arrangement, who did what? Presumably each looked after attacks on its own state and on its own domain, and on its own financial interests and economic interests, but was there also a division between those, particularly between GCHQ and NSA, the National Security Agency, Fort Meade, USA?

Well, there's certainly, the ability to share with friends in the Five Eyes, was massively important, because, not all, I mean, there was obviously difference in scale, if you think, scale between New Zealand and USA, so there would be quid pro quos, which might even be geography, so you could think that, some places where the Americans wouldn't have the reach they might have wanted, which would be helpful for them to, to have allies with reach, geographical reach. And, and other things, some countries would, would perhaps, just through, crumbs, I don't even know what, DNA if you like, perhaps more skill at some branches of mathematics than others.

Or naval for example.

It doesn't really matter. And, you might have an advantage in, in brilliant maths to do cryptography over here that you could do something over here with. Something completely different, like, I don't know, chemical weapons or something. So, there would be a quid pro quo that overall, even though you would never be completely equal, it was just a helpful, and still is, a helpful cooperation that allowed the whole to be greater than the sum of the parts, is the way I would put it

Did GCHQ, for instance did they specialise in, in naval, compared with NSA?

I don't think we would think of it like that.

OK.

Just be an overall capability that was enhanced by having a Five Eyes community rather than not.

[55:36]

Right. And, in this period, this is '88 to 2005, you were at GCHQ?

Uh-huh, that's right.

And the last five years at GCHQ, from 2000 to 2005, you are Director of Technology.

Yes, that was a great role.

No less than. A great role.

So that was reporting to *the* Director. Structures changed, it's slightly different these days, but at that time, that's how it was working.

[56:01]

What were your technological issues that you were then facing?

Well it's, it's everything and anything. So, all the things we've been talking about are brought up-to-date, or date at that time. But of course, you know, moving from being a practising engineer or scientist or technologist to managing people doing that, the, the real challenges were more about workforce, rewarding people proper. It's always an issue in the Civil Service, because, pay is never ever going to be as high as it would be in small niche companies. On the other hand, there are lots of non-cash benefits, lots of later-life benefits, in those days, like pensions, but they sound a bit boring if you're, if you're young. And, there are lots of other non-cash, non-remunerative benefits, like the interest of the work. So, cutting-edge things, and clearances, and, some people find all that interesting. The James Bond factor if you like. So you put all those together, and recruitment was always a slight challenge but, but, and is still, but getting that right, so getting the right sort of clever people in, with good enough pay, and very very good non-pay if you see what I mean, was always tricky. I think, you can look back wisely at some of these things. The workforce size is always difficult, you know, what is the right size? Nobody really knows. The expressions like rightsizing were developed only because nobody really knows what the right size is. But just that whole thing around technical workforce of very specialised people in a Civil Service department is, is always a big challenge, not just there, but in any, in any large organisation, I'm sure whoever's running the technology departments would say the same thing.

[57:50]

So you were at or near the top while Y2K was kicking round.

Yes.

Was there a great concern in GCHQ that the roof would fall in?

Yes there was. Yes there was, very much so.

Was it justified?

[hesitates] Ye- It was certainly justified to be prepared. On the night I was on duty, on the bridge as it was called, with one or two colleagues from, head of engineering

and others who were there, sort of, just in case, to give the top level cover, with hotlines going all over the place. One or two minor things cropped up, nothing of any substance, as is true across the world. But, for people to look back and say, you know, cynically, yeah, it was all hyped up by the IT community, is completely wrong. The enormous amount of work that went in in preparation for it, around the world, paid dividends, is how I look at it. And I think, you can be wise after the event, and, and say, well yeah, but what would have ever happened, what could have happened would never have been catastrophic, we, we don't know that. And I think better to be prepared than not. So, an awful lot of great work was done specifically for the, for the potential for an event. But in any case, it was a fabulous reason to upgrade and modernise what you would now call apps, applications and operating systems, and software generally, to be much more, current than they would have been otherwise.

Italy apparently spent hardly anything on it, and the place didn't fall apart.

Well, I'm sure that's true. Yeah.

But you thought that it was warranted?

Well, I mean, we... I'm absolutely convinced it was warranted at the time, and, and had great benefits since, some of it second order benefits, as I say, through modernisation, that's still a good thing.

[59:41]

The enemy so to speak is changing while you are at GCHQ in this period to 2005. The Soviet Union is no longer the great threat it was, and we have now the introduction of asymmetric warfare.

We do.

And asymmetric processes. And, why didn't you catch the guys at 9/11 beforehand?

Interesting, 9/11 was about the first significant incident after I took over as the Director of Technology. This will be, in 2000 obviously. And I recall we were

hosting an international IT conference at the time. Obviously the air space between the UK and the US, and other places, was closed down for a period, so, various people stranded in the UK. And, you know, the major, major shock to the system understates it, but, but the sheer scale of what had happened, the enormity as we all know, was, overwhelming at the time. I can't possibly comment on who knew what in advance and subsequently, any of those things, but...

Well people who were learning only to take off planes and not to land them, should be a warning somehow, should there?

I'm sure you're right. But, that, that wasn't my world. My world was then dealing with the aftermath of the crisis through technical eyes obviously. And as you rightly say, with the, the end of the Soviet Union and the rise of other actors, non-state or difficult state, but certainly non-Russian or non-Soviet, that was a, a great deal of activity. So the five years that, and I was therefore moving on, on top of the technology...

What did you change as a result of 9/11?

Well, we built a new building, and that's not meant to sound like a silly answer, but responding to the change in the world order needed a different sort of workforce dynamic, and the buildings that we had operated in hitherto, were fine for the largely unmoving and static sort of opposition we were up against, as I spoke about before. But they were essentially old-fashioned, brick-built, small buildings dotted around a campus, as you can see in many ex-World War II sites, a bit like parts of Bletchley Park now, the Heritage part of Bletchley Park now. And, realising that in order to be more effective, with, with the limitations on workforce size and budget and a changing operational scenario, the best way to be more effective was to have everyone under one roof...

A doughnut one.

Exactly. In one place, and without the sort of constraints of, of doors everywhere. That was recognised to be a great thing. There were some huge challenges in, in

creating a new building. It's just bricks and mortar, but it's, you know, really rather substantial. The design is eye-catching, but that's neither here nor there really. It's the fact that it's, it's one big open-plan organisation. The challenges of moving technology from where it was to where it needed to be were, were huge. The modernisation challenge, obviously there's the technical one, but there's a, as I've hinted, a workforce one as well, a different mindset for, for a different mission. And all of that was sort of happening around that early part of 2000, and it was extremely interesting to be involved in. No doubt about that.

[1:03:21]

In 2001 the National Security Agency publicly issued, this isn't from WikiLeaks, actually publicly issued a document called 'Issues for Congress', which was very interesting indeed to read. And one of them was that, already, in 2001, there was a growing concern and criticism of organisations like the NSA, and like GCHQ, by people who were concerned that, here were the States snooping on what individuals were doing, in their lives, quite appropriately, and that many of the things that GCHQ and NSA were doing were probably illegal, certainly unethical, and probably unnecessary. How do you respond to that criticism?

Well it sort of brings us into much more recent times as well as obviously the early 2000s. I think for people who are looking from the outside in, saying, oh, it's all illegal, that's just demonstrating ignorance. There was always a proper, legal cover for the activities, and I don't need to develop that. But, we, we, through the sort of things you were talking about, got to a point where the old Interception of Communications Act got replaced by the Regulation of Investigative Powers Act, RIPA, and that much more recently turned into the, the most recent Act, which was the IP, Investigatory Powers Bill, IP Act, all about, you know, where the position of the so-called surveillance state should be, the snooper's charter to use the, the jargon, which isn't a very attractive term, but it caught the public imagination. And, coming sort of, leapfrogging over lots of bits of history here to only three or so years ago, I got involved in a very small way with David Anderson QC, who at the time was the, the judge responsible as the Independent Reviewer of Terrorism Legislation, and he had been asked by the Prime Minister to have a look at some of the things going on

with what was then the IP Bill, and the balance of where the surveillance state ought to be. And, I was brought in as technical adviser.

You were. And you were individually criticised for that, because it was called, that you were marking your own homework, weren't you?

Yes. Indeed. No, there was, I think one or two newspapers said, how can you do this, how can you have someone in who sort of, is from the other side as it were?

[1:05:56]

And it's one of the few areas where, you know, I could google lots of people who I've interviewed, there's virtually nothing about Bob Nowill in, when I google. But there, that, there is that reference.

Yeah, that's interesting isn't it. Yes, you'll find me doing things for charities and so forth.

Yes.

But yes.

But this one, yes.

But that one, it was sort of, I suppose it's fair comment from the outside looking in, but the, the justification, and obviously it went to the top to decide how these things ought to be done, was that in order to be trusted to have access to all those pieces of evidence within, not just GCHQ but the, the other security intelligence services, which is very very sensitive, you needed somebody who knew the words, knew the vocabulary, trusted obviously with clearance in all that sort of stuff, to sit alongside the judge and the other legal people on the team. We also had somebody who was extremely high ranking police with us.

Another marking their own homework.

Well, you can, you can put it that way. But all I... So, so that was the justification: in order to understand really what the hell was going on in a reasonable period of time, you had to have somebody who, who could do that. But, I hadn't actually at the time worked there for really quite a long time, so, you could say I was well away from it. But that, by the by. The criticism still is there.

[1:07:21]

But, the other, the other part of that story is then the spectrum of who was spoken to about the balance, and, and where we found the answer, or at least where David Anderson plotted the answer on his map. We spoke to an awful lot of NGOs, non-governmental organisations, and the FOI world, freedom of information world, people like Liberty, but, not just Liberty, lots of them, I don't need to list them all, who are very very well-informed and intelligent on these subjects. So that's if you like one end of the clock, or one end of the dial. And then round to the other side, you could argue the, the organisations that would find life much easier if they could just have access to everything, and sort of keep a big database, sort of, Stasi approach to life if you like. There's not really any of those, but let's wind the clock right round to that way. So where should we set that needle for the surveillance state in the United Kingdom? And I think most people would say, 'Well it's not one end or the other; it's somewhere in the middle. Is it about right at the moment? Well, politically, some would say, it's a little bit to the right, or, ooh it's a little bit to the left. And the position of that needle, whenever there's an incident, a bomb or a murder or something happens on the streets, or something much more significant, a huge outrage somewhere in the world, the needle swings, public opinion says, 'No no no, you should have caught these people. You should have known exactly what they were all doing, and had all their, all their telephones monitored,' whatever it is. But that soon fades, as memory of the ghastly incident fades, back to a, a more reasonable place.

[1:08:59]

So, I would say this, wouldn't I, you could say, but I would say that in the UK we probably do have that position of the needle about right. There's a little bit of wriggle room on it to move it one way or the other according to public opinion, but it ain't hard over to the worst excesses of surveillance state, and it isn't hard over either to the complete freedom of information, no surveillance whatsoever, world.

But you do have bulk powers.

There are still bulk powers, and one of the things Anderson and his team looked into was whether those bulk powers were pitched in the right place.

And these are powers to just Hoover up stuff?

Er... There are... There are a number of bulk powers. You can call it Hoovering up, but, yeah, that's one way of thinking about it.

Well Dysoning up if you like. [laughs]

If you like.

Right.

But, but... And some of those things were tested in the court, in the European Court of Human Rights, and there's been one or two judgements made as to whether the UK's position is, is OK or not. And some MPs and some of the NGOs take specific points to the courts to, to challenge them. And so having come out the other end of those, some changes were, and are still being made. And as I say, I think it's probably about right. It's been hugely well tested. Other people will argue differently. But, but that's fine in a democracy, we can have the argument, but we're certainly not a surveillance state in the way that an Orwellian view of life would look at it.

[1:10:27]

You left GCHQ in 2005, and it has realigned itself to this world of, a fragmented, strange world in which we have terrorism on the streets of London, et cetera et cetera.

Indeed.

And, CGHQ seemed to be able to transition itself to be able to look at those issues, and of course in the, in this world of, of this murky world of cyber, you are probably

unable to say how many plots were unravelled as a result of GCHQ, because it would expose your methods.

Well it... I had left, so I can't talk about it anyway.

Yes.

So I don't know.

Right.

But I think there's one thing we just need to be clear on, is, the missions of the different organisations. So, terror on the streets on the London is police and the security services world, rather than GCHQ's world. I know, if you look at television programmes, they'll say, sort of have pictures of satellite dishes pointing at things in London, and go, oh yeah, you know, we're all over it. It isn't. That's so far from the truth. GCHQ's mission obviously is focused on overseas activities, rather than homeland activities.

There has in Continental Europe been a criticism of GCHQ and the NSA, both of which they claim are Anglo-Saxon organisations, and looking out for Anglo-Saxon economic interests.

Well, again, they would say that, wouldn't they.

OK.

But it's not, not my world any more.

[1:11:55]

Not your world any more. And your world became, British Telecom in 2005.

So I moved, moved to BT, which was great.

Yup.

And, BT Security, which is an organisation within BT, obviously.

Right.

And, so at the beginning when you said, a director of BT, I wasn't a director of BT, I was, I was the Cyber Director of BT Security. Director for BT would be a completely different thing.

What were you facing, what was BT facing then, in 2005?

So the, the sort of challenges BT was having, obviously it was protecting its own networks, as well as the networks and communications of its customers. And, so, through... That, that manifests itself in a number of ways. Some of it's the sort of things you can think about, hacking and, and risks to consumer broadband and stuff like that. And ditto to commercial. But other things would be much more supply chain risks. So if we can just sort of take a, a completely different look at some of this. And it's all over the papers at the moment. Huawei, the Chinese company. One of the roles I had was, doing a piece of the work that was assessing whether or not it would be a good idea for BT to have a relationship with Huawei. As we know now, that moved on quite considerably, and at the consumer end of BT, Huawei is in the system, quite rightly, because the risks are assessed as, as low. There might be an individual risk to individual bits and bobs, but sort of, the risk that is, that matters, which would be the denial of service risk to the entire network, was managed. And so, trying to place where that red line is, where a Huawei, but not just Huawei, but let's sort of pick on them for now, but it could have been someone else, can be in a domestic network, and where they really shouldn't be, that red line was what the work was all about. Other countries take different views. Some of those views are quite properly security and technology led, to come up with an answer, other than will be, certainly competitor and competition led. So, clearly, if you're not buying Huawei, you're buying something else, and therefore, there's an advantage if you are the manufacturer of that something else. So there's commercial aspects in here as well

as, as quite proper care being taken with what could be a, a potentially hostile outcome.

[1:14:40]

So... But what did I sort of, get out of that, apart from the, the challenge of the, to Huawei or not, sort of question? Exploring the world is part of the answer to that. I had never been to China before, so, having been, now having been to China a number of times to, to bat for BT in those sort of activities, along with colleagues from other UK telcos, was, was remarkable, and, and interesting. And more broadly in BT Security, because BT operates in pretty much every country in the world, or has a relationship, where it isn't within, it certainly has to interconnect with every country in the world, the sheer scale of a job which touches every country in the world, but also has a, a huge base in the United Kingdom of many thousands of buildings, plus a non-trivially sized team of security people, means that anyone involved in, in the management of BT Security has to be in ten places at the same time, and is immensely busy. So, I had, I had great fun. It was very tiring, and I know the person I handed over to, who's a friend, who, who is, you know, after, when did I leave? 2013. After five or six years, is in exactly the same place of, of loving it, but being immensely busy all at once. So, yeah, BT do a, a splendid job in securing as best they can for a huge organisation, the network for its customers.

[1:16:12]

So you weren't in a telco.

Yup.

And, interestingly enough, that's where the work hacking originally came from.

Because people were hacking AT&T were they not?

Well they were, yeah. I remember the very first book I bought with the word hacking in it, it was called *The Hacker's Handbook*, which is nothing to do with hacking as we know it now; it was all to do with what was called phone phreaking, phreaking with a p-h, whereby you play tones, da-da-da, down a phone line, in order to fool it into thinking there was something clever going on and giving you a free telephone call.

Yes.

That's how it all started. Obviously it soon developed into, hacking as in unethical penetration testing.

[1:16:49]

Right. Can we just move now to the present? Unless you've got more to say about your role with BT, move to the present. There have been a number of reports out at the end of 2018 and the beginning of 2019 which are prioritising or suggesting what the cyber issues are around. The number one, according to KPMG, the CTO of KPMG, is cyber warfare. Shooting people is one thing, and shooting buildings and dropping grenades and bombs on people and so on is one thing, but a total component now of any warfare is cyber warfare. How well do you think the United Kingdom is defensible with this cyber warfare going on?

I would say, if you are placing a league table of competence in cyber, whether it's offensive or defensive, the UK would be in the premier league. That doesn't mean we're the best, nor the worst, but we're premier league rather than championship or division one, two, three, four. And so we're, we're as well placed as we can be to both respond to and keep up with those threats and opportunities. But, in terms of, let's not be complacent, goes right back to where we started in terms of, of people. Having the right calibre of workforce engaged with Ministry of Defence and others in dealing with the threat and the opportunity is massively important. And I think as we know from, just generally, reading the papers, and hearing what people have to say on the subject, there is a shortage of people with the right level of skills in cyber, and trying to deal with that is one of the challenges of the day, and it's why I personally am involved with the organisation called the Cyber Security Challenge, which is all about trying to find and interest people to come into the profession who wouldn't have otherwise thought about it. So it's not so much aimed at people who are already involved; it's aimed at people who have never thought of it as a career path in the first place.

[1:19:04]

The Institute of Information Security Professionals, you are a member of that.

ISP, yeah, I'm a Fellow of that.

You're a Fellow? I'm sorry, not just a member.

And, a Founder Fellow indeed.

Your Chief Executive has gone on record as saying there really is a massive skills gap, which has to be filled if...

Yes, if you mean Alastair MacWillson.

Yes.

Yes. So... And it, it... Well the whole team would say that.

Right.

So the, ISP has been around for, only a modest number of years, but does represent people who really are information security professionals rather than people who do that as well as other things, and recently has been recognised with the award of a Royal Charter, which I'm delighted about. But, in order to try and champion the profession as something that people would want to go into, obviously there's the ISP. There are all the other institutions who recognise it as well. There are, not-for-profit and charitable organisations like the one I spoke about, the Cyber Security Challenge. We're all trying to bat for this. As well as government departments themselves of course, who, who do an awful lot of work in this space. And yet, there is still an awful lot to be done. We have to look at what the reasons are in terms of inclusion and diversity as to why there are gaps in the workforce. And I think, you can almost take a step back and say, well it's not just cyber. I think if we were talking about the nuclear industry or heavy power engineering, or, making propellers for, for boats or something, any silly examples, you'd probably find there were, there were issues with non-traditional workforce; in other words, an awful lot of boys seem to go into this

and rather fewer women. And, it's not just gender diversity, there's all the other bits of diversity too, but that's the one that's big at the moment.

[1:21:05]

Number three on the KPMG list by CTO was fake news. Do you think that the social media platforms are doing enough?

Well that's hugely topical at the moment. I'm sure... [pause] I think, in order to be able to make money, the social media companies obviously have to advertise, but the algorithmic way in which, in which adverts are pushed to their customers, their users, seems to me, I think it seems to all of us, that there must be a huge amount of room for improvement there. They are very clever, we all know that if we've been on the Internet and, and had a, a look at, oh I don't know, a pink shirt, then for the next month down your Twitter and Facebook feeds you'll get pink shirts pushed at you. Now... And you say, well that's fair enough. Or it's gardening or something. But it isn't fair enough if you've been, for some reason, looking at mental health sites and suddenly get a whole load of nonsense pushed at you that is not at all relevant, indeed it's very very unhelpful, but nonetheless is in your feed. And if you're feeling vulnerable, it's going to impact you as we know, and has caused deaths. So, there should be things that can be done on that front that aren't being done. And I would hope that the penny drops. Do we need more regulation? Do we need more legislation in that space? Well it... Maybe. But we ought to, I would have thought, technical people and organisations that run social media platforms ought to be able to find solutions without having to go right down the heavy rule of legislation, but it'll happen if it doesn't self-regulate properly.

[1:22:57]

Now Bob, in your opinion, are these neutral platforms, or are they publishers?

Well that's always a difficult question that we'd ask ourselves in BT. Are we responsible for the content of the pipes, or are we neutral? And, I think both arguments are able to be made. And I think if you just look at the outcomes though, where you're causing harm, as the recent cases around mental health and suicide and depression have shown, where you're got it wrong and you're causing harm, then,

how do you get a grip of the content and the delivery of the content, even if you are the service provider? And, I'm not going to answer the question, but, there are solutions, and where there aren't, they need to be found, and very quickly. Regulation might be part of the answer, but I'm sure it's not going to solve the problem completely.

[1:23:50]

KPMG CTO is number four. His number two by the way was lack of awareness among the individual consumers.

Yes, I could've guessed that, by the way. Yes.

Yes. But number four is, he is pretty sure there's going to be some massive problem with a break into somebody's cloud, that somebody's cloud is going to be heavily hacked, and there is such a dependence on them nowadays, it would seem to me, there might be an argument that this is rather foolish, to put your vital data on a cloud which people can attack.

Well, that's, that's an argument you could start with. I'm sure he's right in so far as, a, a cloud as we know it could have, could be exploited. So, if you have data that you really really really care about, what are you going to do about it? Well you could protect it better in a cloud if you really care that much. So, governments have their own clouds, G-Cloud in the UK, and, if you really really care, you'd have a private cloud. So, it's not really a cloud at all is it, it's a load of servers and racks and, joined together in bits of wire in a datacentre somewhere, and you protect that properly. But if you're going to the cloud concept, which is, it's all up there somewhere, and you don't really know where and you don't care very much, and it's only your photographs anyway, then you might not care that they all get lost. Sorry, you might not care they all get pinched, though you would care if they get lost. So you, you're more looking for redundancy, and, backup of the backup, than you are the theft per se. The theft would annoy the hell out of you, but it's not the end of the world. So I think it's, it's a, it's a question of degree isn't it. If it's stuff that really really really matters, your financial information, or a government's information, then, you have a responsibility to protect it yourself, as well as the service provider. There's no such thing as a free

lunch, so if you're relying on free Dropbox, free iCloud, free OneDrive, and all the others, then, you're getting what you pay for.

And you're paying nothing.

Quite.

So, you're not going to get very much security.

Yes.

[1:25:59]

You've been tremendously successful in your career since the 1970s right through to working with BT. Let me ask you, what's the biggest mistakes you've made?

That's always a splendid question. So I think... [electronic tone] There's always something around people. So, either underestimating or overestimating the workforce, is always tricky. I would never claim to, to have got that right. I think, I'm pleased with the fact that certainly in, over the years, putting in place schemes to train and educate and do good things for technical people has been great. On the other hand, I could equally argue, has it been enough? Were they robust and resilient enough such that, say, they would sustain through the ups and downs of, of finance cycles and all that sort of thing? So, yeah, there's, there's something in that space which is, you know, I'm sure we all ask ourselves, did we ever do enough to make sure that the, that people got the best possible deal? We like to think yes, but, it's always a question. [pause] I suppose, yeah, the other thing... Some are a bit more trivial really. But, I see people now, and obviously when you get to my stage people say, you know, 'Give us some careers advice,' or whatever, and, and we touched a bit on this earlier, which is, careers have moved from, you know, 40-year vertical, to, zigzagging every few years from here to there to, to build careers. I'm sure that there must be a better way of giving people helpful advice and steerage. Obviously there's a personal responsibility for everyone to do what they think themselves is right. But the fact that we have a skills gap in technology generally, STEM generally, as well as right down into cyber, means that we haven't entirely got that right, and I'm a little

piece of that jigsaw too. So, so it's, it's all somewhere over that bit. I think, the penny dropping earlier on inclusion and diversity would have been a good thing, and I think we all have a responsibility on that, or the people like me who have come through as it were as the, the role models that people don't need any more. So, there's something in that space where we could have worked differently in the early days. Yes, so there's a few bits and bobs, they're mainly around people.

[1:28:58]

OK. Well thank you very much for a fascinating contribution to the archives, Dr Bob Nowill.

Thank you very much indeed.

[End of Interview]