Capturing the Past, Inspiring the Future

Brian Collins CB

Interviewed by

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Welcome to the Archives of Information Technology where we capture the past and inspire the future. It is Tuesday, 28th January 2020 and we are in the Livery Hall of the Worshipful Company of Information Technologists in the City of London. I'm Richard Sharpe and I've been covering and analysing the IT industry since the early 1970s. Making his contribution today to the archives is Professor Brian Collins, CB. CB means Companion of the Order of Bath and is normally awarded to senior civil servants. You may think, oh, he's just a senior civil servant, but no. Out of the ordinary, Professor Collins has been in the public sector, in academia, in the private sector and been a consultant, so he has a very wide ranging experience with which to inspire the future.

Professor Collins, you were born in, just at the, after the end of Second World War in '45.

Correct, yes. I was born in Orpington, which is now in the London borough of Bromley, it was in Kent at the time, and went to a local primary school. My father was the quantity surveyor for Middlesex County Council, which as you can imagine, during the first part of- sorry, the last half of the 1940s and the fifties was largely dealing with bomb damage, and he retired in the mid-sixties after the generation of the Greater London Authority, which is no longer with us, of course. Sorry, the Greater London Council which is no longer with us, it's now the GLA. My mother retired from work when in fact my brother was born in 1940, and as was the time of the day, mothers didn't work, so she was a housewife. So, as I said, I went to a local primary school in Orpington, passed the eleven-plus, I'm told I passed one of the top four or five in the neighbourhood, and went to Chislehurst and Sidcup Grammar School, based in Sidcup, which was one of the best grammar schools in the neighbourhood. In fact, by the time I left it, it was one of the best in the country, vying with Manchester Grammar School which was, most people would know of that era in the 1960s, was one of the best in the country.

Did you enjoy school?

I enjoyed bits of it, yes. Like most people, I think, I enjoyed not everything about it but I am of an academic orientation, probably why I went to a grammar school in the

first place, so a number of good memories, which actually in retrospect stood me in good stead. I enjoyed playing cricket a lot and we had really good facilities, and I still enjoy watching cricket – indeed, I've watched it this week with great pleasure. So that was good. I also did, I was involved in a lot of amateur dramatics which, although I wasn't on stage, I was helping people who were on stage and it sort of rubbed off on me after a bit that I actually understood the concept of performance, and that has stood me in really good stead in a number of places latterly in my life, when I actually understood that delivery of a message concisely was really important.

The time that you were at grammar school, was there a definite split between arts and sciences?

Yes, there was. I had to make a choice between that two years before I took what was then O levels. And again, in retrospect, there were a number of subjects which I'd love to have done more of, particularly geography and history, but because I really wanted to do maths and physics, that was my real area of interest, I had to not do those. So in retrospect, the sort of choices that now kids seem to have of doing twelve GCSEs is something I wasn't allowed to do, and I don't know whether that rubbed off. My O levels weren't that brilliant. Maths and physics were fine, but everything else was sort of fairly mediocre and I don't know whether that was sort of feeling that actually I wasn't doing the things I really enjoyed, those other things, but nevertheless, by the time I started doing A levels, somehow I got my act together and did extremely good A levels and then was, somewhat against the, I won't say against the wishes of the headmaster, but to the surprise of the headmaster at the time I said no, I want to go to Oxford and Cambridge, or Oxford or Cambridge. My brother by then, by the way, had got a double first in maths at Cambridge so, as one of my teachers said to me at the time, 'You've got a rather difficult act to follow, haven't you?' So I said, yes and then did it.

You probably did physics.

I did physics. I went to Oxford because actually Oxford uniquely allowed you to do physics as opposed to compete with the mathematicians and chemists doing natural

sciences, which is what you did if you went into Cambridge, at least at that time, you did the natural sciences Tripos and specialised later.

[0:04:55]
Sixty-four you went up to Oxford.

Yeah, I got an open scholarship at St Peter's College.

What was Oxford like in '64 for a bright young man from Kent?

It was very interesting because there was a stark difference between the rapidly growing population from grammar schools from all over the country and then reserved places in, particularly the older colleges, for people from the older public schools, as we call them of course: Eton, Winchester, Harrow. Actually St Peter's was not in that mould because it was a relatively new college, but obviously one rubbed shoulders with people from Christ Church and Balliol, Magdalene, where those sorts of situations did arise and I rapidly realised that grammar school kids weren't necessarily seen as part of the normal Oxford population. I guess I was a bit of a geek and I just got on with doing what I wanted to do, which was physics, and play table tennis, play cricket, generally socialise with the crew around me in college. So my life didn't spread out particularly into the university as much as a lot of other people did and indeed, some of my colleagues at St Peter's did. So, but nevertheless I enjoyed it immensely, it left me with loads of advice and mentoring. I had a particularly good tutor, so…

Who was that?

A man called Kemble Woodgate who was a research physicist in the Clarendon Lab, and he was a really good teacher. He understood the tension at that age in having lots of other things going on in your life, not least of which was testosterone of course, but also dealing with the complications of teenagers and young people suddenly becoming part of the landscape in the 1960s, which hadn't been the case even in the fifties. So that was something he seemed to understand. He was a very cultured man, he played violin in the string quartets at Dartington every summer, he'd served in the

Royal Navy during the war, had lost an eye, and yeah, it was just an inspiration to have one-on-one tutorials once a week with someone who had that sort of view of life, I enjoyed it immensely. In fact, just as a little anecdote if I can insert it, I went to his memorial service, because he died not that long ago, sadly from Alzheimer's, and his son gave an excellent speech about Kem's life – Kem was what he was known as - and he said, when the doctor had done all the diagnosis and got the family together with Kem and said, 'Kem, we've got something to tell you which is that you've got a problem with your memory'. And he grinned and apparently said, 'No, you've got a problem with my memory'. Which I thought was typical of the man, he had this gorgeous stiletto-like view of what was right and what was wrong and I can see him saying that, grinning. With one eye, of course. [laughs]

[0:07:58]
Had you met a computer yet?

Actually I'd met a computer before I went to Oxford. Growing up where I had, there was one of the Ministry of Defence research establishments, which I latterly of course got to know very well, called the Royal Armament Research and Development Establishment, RARDE, which was just down the road from where I grew up, just north of Sevenoaks. And I still to this day can't remember how I managed to get the possibility of doing a six-week vacation course just before I went to Oxford, so I knew what I was doing, they knew my qualifications, and I spent six weeks there not only with a digital computer which had a cathode ray tube memory, but also with an analogue computer, which in those days was beginning to be faded out, and did some mathematical calculations and then some programming, which to begin with they wouldn't tell me what it was about, but I knew enough physics to know that it was to do with radiation and it was to with heat transfer. And as I was leaving I said, look, come on, tell me what all this lot's about. And he said, well, this scale here is temperature and the numbers were like ten, 100,000, and this is seconds, actually it was milliseconds or hundreds of milliseconds, and the curve that I drew out, they said well, that's the rate of expansion of a hydrogen bomb fireball. Which at the age of eighteen, given everything else that was going on, that was the Bay of Pigs time, the escalation of the Cold War was reaching its height, rather brought it home to me that actually, these times and distances were measured in tens of miles and I lived ten

miles out of the centre of London and you'd got about, you know, a hundred milliseconds before you didn't know anything. So that was rather sobering.

What type of computer was it? It was a digital computer.

Yes. D'you know, I can't really remember. It was one of those cobbled together computers that came, I think out of Manchester, and I learnt a programming language which I can't remember much about because latterly, of course, I started to do proper computer programming. But I did actually lay hands on a computer in 1964 which was pretty early, actually.

[0:10:02]
You got your degree.

Yes.

And you carried on doing a DPhil.

Yes, I did.

Sixty-seven to '70. And then you carried on more studies after that, also at Oxford.

Yes. In fact in that time I then laid hands on another computer, a PDP-8, which was the second one in the country. And Digital Equipment Corporation, no longer exists of course, had really risen to stardom on the back of the American space programmes. So we had the second PDP-8 in the country, so it was a real privilege to have what was a ridiculously primitive machine by modern standards, 8k of memory and a 12-bit instruction set. So I learnt how to program very, very efficiently with that.

Yes. 12-bit, yes. We never knew… I don't understand why Digital Equipment chose that, and were never able to explain to anybody why they chose it, but they did.

They did, absolutely, yes.

The Olsen brothers thought it was good, so that's what it was.

Yeah, yeah. But they did do computer systems engineering, which faded away once the PC much later on came in. So the engineering of that computer was fabulous of its time, it was all discrete components of course.

What was your subject for your DPhil?

My DPhil? It was, the title of my thesis was 'Studies in Laboratory Astrophysics'. What had happened was that during the first fifty years of the decade- sorry, of the century, people had started to understand why the relative abundance of elements in the universe was as it is and it comes from understanding the nuclear collision processes that go on in the middle of stars, where of course it's incredibly hot. And in late 1940s four very eminent astrophysicists had done calculations to work out what the relative abundance of all the elements should be on the basis of nuclear cross-sections which had started being measured at that time. There was a very seminal paper called 'Burbidge, Burbidge, Hoyle and Narlikar' – and that's Hoyle of Fred Hoyle fame – wrote this paper which showed what the relative abundance should be based on the nuclear physics and the calculations. There had been a lot of observations of similar quantities based on the atomic physics, because basically you only see the atomic properties in the outer layers of stars because that's where it's cold enough to see anything, you don't see the nuclear processes, you only see the atomic processes. So similarly, people had inferred from measurements what the relative abundance of the elements should be and most of them fitted, but one that didn't was manganese, one of the iron group elements. And so, my thesis was to say so why is it wrong, what is it that people have not done. So I did a whole set of very accurate measurements, from the sun, of spectral lines in the sun and infer from that and the atomic constants what the abundance should be. But, I discovered what had happened was that people had ignored the fact that of all the elements in that group manganese has a much bigger ratio of stable isotopes, which cause the spectral lines to be at slightly different wavelengths and if you don't take that into account in analysing the data, you end up with the wrong answer. If you do it properly, which is what I did, you do end up with an answer which fitted the Burbidge, Burbidge, Hoyle and Narlikar equation. So my little piece of, nugget of knowledge in terms of science

is, I resolved the apparent paradox that the nuclear calculations and the atomic observations were inconsistent, they are consistent. And what is really nice is a lot of other people have done work after that with lots more sophisticated techniques than I had available in the mid-sixties and confirmed what I did was right.

So Brian Collins cracked it!

Yeah. I mean it's a very minor thing, but it's one of those things where you want consistency.

But it's very good for your career, surely?

I think so, because what it told me was that accurate measurement, accurate calculations, standards, good data processing – because I did a lot of data processing, a lot of computer modelling, I built a computer model of the sun, the outer layers of the sun, so that I could infer…

How big was that?

Big in terms…

In terms of bytes, or words?

Oh, we didn't even work about it, I mean it was a roll of punched tape, six inches in diameter – let's get the technology straight here. I wrote it in ALGOL, I shun Fortran, I would not program in Fortran.

Why not?

Oh, it's so clunky. It was a very unsophisticated language. Being a brother, having a brother who's a very eminent mathematician…

You're a snob! [laughs] When it comes to program languages.

I like the prettiness of ALGOL.

Okay.

And you could do things in ALGOL you couldn't do in Fortran.

True.

Specially recursion, which was absolutely crucial to some of the calculations I needed to be able to do. In fact, Oxford University, I had to write all these programs on what was then the Oxford computer KDF9, an ICL I suppose it was still, KDF9, and they then decided to change the computer two years into my three years and bring in this 1906 computer which didn't have an ALGOL compiler, or at least it didn't have one working when it arrived. And they said, well, you'll have to rewrite all your programs in Fortran. I said, I can't actually do that because I can't write what I need to do. So I debugged not only the ALGOL compiler and made it work, I debugged GEORGE 3, which was the operating system, to get that to work the ALGOL compiler. So I actually got deep into the entrails of this machine, not because I was particularly interested, although it was fun, to work out how these damn things worked, but to get my programs to run so I could finish my thesis, which I did. So yeah, I laid hands on the Oxford computing systems at that time. So yeah, I didn't actually worry about size, to be honest, you know, I just had to make it work.

[0:15:51]
You then were recruited or did you go to Malvern?

I was recruited.

The RSR…

I'd done three years postdoc and what happened, what had happened…

We need to clarify. It's the RSRE, which is the…

It was at the time the Royal Radar Establishment, RRE.

Right, okay.

But we're saying that I actually found myself married and with one child and another one on the way, in need of getting a proper job after I'd done my three years' postdoc. And what had happened in the previous decade is someone from Oxford had gone to Boulder, Colorado on a joint fellowship for three years, that had been funded either by NASA or by the Department for Defence, or both. In 1973, the year I'm talking about, both the Apollo programme stopped and the Vietnam War ended and both the DoD and the NASA budgets folded and there were no fellowships. So suddenly my thought that, well that's what I'm going to do, I knew I was the only person in Oxford applying for it, there weren't any. So I had to go and find myself a proper job, so I applied to five public sector establishments, public sector research establishments: RARDE, the one I've already mentioned, the Royal Aircraft Establishment, GCHQ, the National Physical Laboratory and RRE. They all, all but one offered me jobs, the R…

Who didn't?

National Physical Laboratory. Real irony is, twenty-five years later when the government was going to privatise the National Physical Laboratory, they asked me to be a member of the team to consider whether or not it ought to be privatised or not. Which I managed to…

What was your decision?

Managed to win the case that it should not be. In fact I was at a dinner with the current Director last week and he said, thank god for that, because no way could we have delivered the mission of the National Physical Laboratory if we were a private organisation. So, these things come home to bite you. Another lesson I learnt, by the way.

It wasn't revenge then, in your case?

Not at all, no, no. And in fact, looking back, it was the right thing to do. So I chose to go to Royal Radar Establishment because they offered me (a), they didn't actually offer me more money, but they offered me a much more exciting opportunity with regard to what I was going to be working on, which was basically laser systems.

And what does HSO mean, because that's what you started…

Higher Scientific Officer.

A Higher Scientific Officer? Not just an SO.

No, I went in as an HSO because I'd done three years' postdoc. They apologised profusely that they couldn't hire me as a Senior Scientific Officer, because the civil service rules forbade that, except for GCHQ, who did offer me an SSO, but I didn't take it because the work was very narrow and very specific and wasn't actually what I wanted to do.

[0:18:33]
What was this work then in Malvern?

One of the issues that were facing us at the time was that the balance of power in Western Europe between Soviet land forces and NATO land forces, we were outnumbered three to one. If the Soviet Union in its wisdom decided to invade Western Europe and, you know, remembering that was still something that was a possibility, even in the 1970s, we were likely to lose unless we could do two things. Outgun them, in other words, shoot three of them before they shot one of us, simple arithmetic. Or, operate at night, because that gave us, plus the duration of the human being to cope, thirty-six to forty-eight hours with two night periods which they wouldn't be able to cope with. So, the two major programmes I was involved with was what's called night vision equipment and a laser system that allowed you to find the range and position of a target, in other words another tank, a Russian tank, a Soviet tank, and fire at it and then hit the next one, and hit the next one within about

forty-five seconds. Because in the next forty-five seconds they'll have seen where you are, pointed at you and you probably wouldn't exist anymore.

And these were Centurion tanks were they?

Not by then. No, they were… were they? Yes they were Centurions, yes. So, got involved with that and the next generation of battle tanks, which became the Chieftain. So I was involved in developing a laser range finder system that could detect, could determine the range of a tank without itself being detected. That was the other thing we needed to do, because as soon as you fire a laser beam at a tank it has things on it which say I've just been hit by a laser beam and they'll know where it came from. So if you could detect, get the range and position of the tank without it knowing it was being ranged on, in other words a covert laser range finder…

How did you do that?

Using very clever signal processing, a deep knowledge of how the atmospheric physics worked. It was a combination of the physics of the atmosphere, because you're obviously, are propagating lasers through it, some very clever signal processing, knowledge of how lasers worked, digital signal processing, which was not computing, it was proper DSP, so there was a rack full of it, nowadays you'd put it in your phone. So we made prototypes. We ended up having one made by a now defunct company, Ferranti, so I spent many happy hours on planes to and from Edinburgh where they made the prototype for us. Which showed that it was actually feasible to pack this thing into a, what was then called a squaddie-proof packaging and get it into the tank. Never actually happened because by the time we'd actually got it developed it was fairly obvious that land battle in Europe was pretty unlikely and so the need to have this force multiplying effect disappeared, but nevertheless, we had a patent on it at the time.

And the Russkies had nothing like this?

Nothing.

And they couldn't operate at night?

They started to have that capability, but basically our electronics industry was way ahead of theirs. Partly electronics, partly electronic materials, which again, Malvern was in the lead on, and the fabrication facilities. I mean they didn't have the computing facilities, the precision manufacturing. They did some seriously smart things, you know, they did some things which, knowing what they didn't have, they capitalised on what they did have and if you read some of that history you can see that some of their aerodynamics, some of their aviation was gobsmackingly good. But some of the micro-electronics and some of the signal information processing just wasn't. And they knew it, I mean…

And the Americans didn't have it?

We worked with the Americans. The Americans took a, I mean typical British view that we thought about it a lot and worked out how to do things cleverly, what they did was throw money at it and do it by brute force. Now, if the Americans had put the American land mass, land forces in Europe, we wouldn't have had this force multiplying thing. But of course, that wasn't part of their culture, specially after the war. So they weren't going to have a huge army permanently stationed in Europe and of course the Germans were very unhappy about having that sort of capability, the French were where the French were, so it was really left to the Brits and the Dutch, to some extent the Canadians who were there, but you know, the numbers were not on our side. I'm not telling you anything that isn't a matter of history, but you know, at that time it was a really sort of important dynamic.

[0:23:20]
How big was Malvern, how many people?

Oh, at its peak it was about five and a half thousand people.

Five and a half thousand?

Oh, it was big, yeah. Oh yeah. A lot of, I mean I've only told you about that bit, there was a huge amount of radar work, airborne and ground-based radar, supporting the naval radar work which was done down at Portsdown on the south coast. So we were basically the systems integrators of modern sensor signal processing using modern electronics, modern computing during the seventies and eighties. And we did a lot of civilian work on microwaves, which then got exploited in mobile phones. A lot of the early microwave stuff came out of Malvern.

You were fourteen years there?

Mm.

[0:24:01]
And during those fourteen years there you began to see the disruption of companies like Ferranti and Plessey.

Yeah. Towards the latter end of that period, yes, yes.

How do you feel about that?

Well, clearly we needed to downsize our defence industry and rationalise it. Unfortunately, historically you can see that the way in which defence procurement was driven was that they neglected the fact that prototype development, if you don't do prototype development, you have to buy what other people, other countries have developed, and the phrase that was used, I'm afraid, by the then Chief of Defence Procurement, was we'll just buy from the shelf. Not realising that actually someone has to put on the shelf what you want to buy and if you're not in control of what is on your shelves you'll buy whatever is there.

And pay the price.

And pay the, (a) pay the price, but also pay the consequences with regard to differentiating the capability that comes from buying that and if everybody can buy off the same shelf you don't end up with military advantage, as a result of the kit you

buy. You may get advantage of better trained people, better will, more political cover, whatever, but in terms of kit…

But not that type of advantage that you'd been able to build with Ferranti…

Correct.

… to hit those three targets without them knowing they would be hit by lasers within, how many seconds was that?

Forty-five.

Forty-five seconds?

Yeah.

Bang, bang, bang.

Yeah. Yeah, yeah.

So, you can't buy that off the shelf, you have to do it yourself. That type of capability disappears when the Ferrantis of this world disappear.

Yes, absolutely. Yeah. Now, some of it, some of it is still there because we've kept some of it in our aviation capability. The Royal Air Force managed to keep all the night vision, night flying capability and it is sadly, being used right now in the Middle East. And I was party to that particular programme with a colleague from the Royal Aircraft Establishment, because the air force got wind of the fact that the army were capable of doing some of these things at night with what was called thermal imaging and they said why haven't we got…

Thermal imaging?

Yeah. Why haven't we got that in our aircraft? So Jeff said to me, 'Why haven't we got it in our aircraft?' So I said…

Jeff who?

A man called Jeff Fellows, who was in charge of, he was the Superintendent of the division at the Royal Aircraft Establishment responsible for avionics. So I said, 'Well, why haven't we got it in the front of our aircraft? You've got an aircraft, why don't we work together to make it happen.' So we did. Over about an eighteen-month period we took the kit, lashed it all together, lots of other things were taken out of the aircraft to make room for the, you know, but it flew. And they flew it and flew it at night with no lights, 200 feet, 400 knots in the dark, absolutely in the dark, and you could see everything. So, he said, we'll get someone from Whitehall to come and do this. So they got the Chief of the Air Staff who still had a pilot's licence to fly a fast jet, and he went up in it and came down and said every aircraft in the air force must have this within two years. Bom. Job done. And as a result, night flying at low level at high speed is now normal for the Royal Air Force.

Who built it for the RAF?

Oh, a whole range of different companies did the integration. Marconi were very heavily involved because they did a lot of the systems integration, but obviously British- I was going to say BAE, but it wasn't BAE then was it? British…

The Aircraft Corporation, BAC?

Was it BAC? I can't remember now. But the Jaguar was the first aircraft that we prototyped all of that on. So yeah, it was the days when you had this strategic research and development capability focussed on defence and doing the integration of technologies and systems, sub-systems that came from all over to provide a capability that made a difference. And indeed, without that, the Falklands would not have been a successful operation. We were all involved in the Falklands, all, I mean you asked me how many people at Malvern, I think there were 15,000 people in the defence establishments and those 15,000 all got behind getting the Falklands sorted and all of

us did lots of various things, some of which is still not in the public domain, which made a difference to whether or not we were successful, because the Prime Minister having said go do, everyone said, uh, how? Well, we just did. But that was a standing army of capability that isn't there now.

[0:28:35]
I just want to double-check then on the role of Malvern, it seems that then you were multi-arm, were you?

Yes.

You were interacting with the navy, with the RAF, with the army?

Yes. Yeah, we were a tri-service organisation.

Tri-service organisation, okay. Let me ask you a question from that experience that you've had about today, because it seems to me that what you've been looking for is some type of technical advantages with technology. What do you think about having two aircraft carriers that have no planes on them at the moment?

Well, it's a way forward. I mean the planes are coming, they exist and in fact I was only reading in the news this morning about some of them being delivered to the US Air Force. So- and the inter-operability between the aircraft between the United States and us is, in spite of everything else that's going on, a very important factor. So I'm not too fussed that they haven't got the aircraft on them yet. I'd be fussed if in a year or two they're not there, but they're coming off the production line and the pilots are being trained.

But aren't these very vulnerable assets, aircraft carriers are incredibly vulnerable assets…

By themselves. By themselves.

… and you've got to surround them with a lot of other things. They're a battle group, which means that a vast amount of your budget is gone.

The Royal Navy certainly has to be very careful that it doesn't use anything, any rest of its budget doing anything much else than protecting those assets. And of course, you know, if the mission – I mean it depends what the mission of the Royal Navy is – if the mission is protecting trade routes, which is quite a dominant issue right now, then that's not too difficult to do because the sophistication of the threat is in the league of what we've just talked about. If on the other hand it's defending the coast of this country against invasion or a major blockade from a much more powerful potential enemy than we're talking about at the moment, then that's a different business. And everyone has always said we wouldn't do that by ourselves.

[0:30:40]
You rose to be Deputy Director.

I did.

Which means that you must at some point in that process have begun to manage people rather than the technologies and your own brain.

Correct.

What was that transition like?

It was interesting because the first group I had, and I look back sometimes and think that's probably the most fun job I had, because it was the division in which I'd worked. And it was thirty-five people, thirty-five very bright people who I knew all of them very well, I'd grown up over the previous six or seven years with them. So that gave me, (a) they knew I, they knew I knew their business, so I learnt how to let them get on with it but provide them with the context in which I knew they would succeed, because I'd been there myself and obviously to an extent I must have succeeded otherwise I wouldn't have been promoted. So, I learnt pretty quickly that you weren't managing the people, what you were managing was the context in which

they were going to become successful. Obviously you helped them, you mentored them, you dealt with their stresses and strains and some of their idiosyncrasies and occasionally you had to be fairly tough about that. But that didn't appear to worry me particularly. We actually were very good at being exposed to professional training, for managing people, managing projects, managing money, all the things you have to do once you get into a management position. So I look at what I did and I went through the right sort of education, they didn't make a big deal out of it, it's just it was those ticks in the boxes you had to have otherwise you weren't going to go any further anyway. And that all became part of the job. The Ministry of Defence was very good at that time in making sure that its professional people were capable of being professional.

[0:32:29]
You then moved, '87, to GCHQ in Cheltenham.

Yes, the thing I missed out, which is in 1986, I spent a year at the Royal College of Defence Studies.

Right.

Which, as a potential two star, I was a one star in their language at that time, but forty-one, it was very young, very young to go to RCDS. I spent a year being educated in how the world works geopolitically around defence, intelligence, and that was crucial to everything else I did and a lot of other things that I did outside defence following that. So forgive me, I should have put that on the- it is in my bio, but it's not in that list of things.

No, it's fine. It's fine. Did you… were they using you as a teacher as well there?

At RCDS we were all asked to give talks about what we did.

What did you give talks about?

Star Wars, which I'd been involved in as a member of the UK team participation in the Strategic Defence Initiative, as it was called, Reagan's missile defence system, which should have shocked the rest of the world. He was going to spend three and a half billion dollars, which at that time was a hell of a lot of money, combating the long-range missiles from the Soviet Union. So I was a member of the team that looked at what we could do.

Do you think that was doable, Star Wars?

No. Did they know that? No. Did it cause them to be worried? Yes, because they didn't know whether it was possible or not. If it was, then the whole idea of mutually assured destruction or détente or balance of power was shot to pieces. So, and that's what happened. I mean if you read the history of how the geopolitics of that was managed, which I wasn't particularly exposed to at the time, but I picked up some of and have picked up a lot more since, is that those conversations of maintaining just enough imbalance that both sides get worried but not so much that anyone does anything silly was what it was all about. Interesting watching what's going on right now. Not in that domain, of course, but in a different domain, in the domain of trade. So no, actually if I may, the other little story in there which showed how these things come to pass, I said earlier I was involved in the night vision systems, and one of the night vision systems we had was for aircraft which didn't have thermal imaging, less sophisticated fighter aircraft and transport aircraft, surveillance aircraft, they couldn't fly at night either and during the Falklands one of the things we were very worried about was whether or not the Argentinian navy, which was quite primitive, but nevertheless quite capable, would sail out of port and attack our task force as it sailed south. We had no air cover, we were miles from anywhere, we only had the air cover that the Harriers on the one aircraft carrier we'd got was capable of providing, and that was not going to be enough to deal with a naval force that might come towards us. So we flew Nimrod aircraft out of Ascension Isles on the other side of the Atlantic, refuelled twice, to do daylight patrols up and down the Argentinian coast looking to see whether there were signs – electronic signs, visual signs – of the Argentinian navy breaking out. Now I knew nothing about that until the record was written up and published not that long after, and then it disappeared, they didn't say any more about these patrols, just that they stopped apparently. Of course we know

that the Argentinian navy did break out. RCDS, I met a guy called David Emerson, who was Group Captain in the Royal Air Force, he was actually an Air Commodore by then, and I said, we were talking over coffee, and I said, 'What did you do?' ''I ran the Nimrod squadron that did the surveillance off the Argentinian coast. I said, 'That must have been painful'. He said, 'Well, it was till those night vision goggles arrived'. And I'd supplied those night vision goggles from my laboratory on Easter Monday in 1983. They disappeared into the system and I never heard or saw them again, six sets of night vision goggles, and he said, 'Oh, it was you. You probably saved my life'. Now, that suddenly brought home to me that you're doing this stuff in the laboratory with techie kit, but actually, if you stuck it on the head of a pilot…

It's got a cutting edge to it.

… then they can fly at night and do the job properly.

And save his life.

And save his life. That was a very sobering coffee.

[0:36:47]
So you did move to Cheltenham, GCHQ?

Yeah, I went there in the end of 1987, by which time again, knowing your history, the Soviet Union was already beginning to crumble. Chernobyl had happened in 1986. In fact I've just finished reading the history of Chernobyl and it was destabilising the Gorbachev government in Moscow because of the awful way they looked after the consequences of the radiation that came out of Chernobyl, and by 1989 it was basically all over. So yeah, I was tasked, because I was an external person to GCHQ I knew enough and had been cleared to know quite a lot about what GCHQ did, but not its deep entrails of course. And the then Director, Sir Peter Marychurch, said basically we want someone to come in and start changing – start changing – what we have been doing since 1945, which is look after our situation with regard to the Soviet Union, to something else, but we don't know what it's going to be. So we've got to

be ready to be much more dynamic than we have been and your job is to get the technology and the systems sorted for that. No pressure then.

How did you find GCHQ in '87? The leadership was flexible.

Yeah.

What about the…

It had been very, very isolated. Remember, it had not even been avowed as to what it did until all the strikes, which I remember, you're right, I'll put a date on it, I think it was 1982, '82, '83, something like that. So even by the end of the 1980s it was still a very secret organisation that no one would talk about what it did and yet those of us who came from outside knew there were telecommunications technologies, computing technologies that were going to arrive during the next decade that would completely transform the way in which communications of the world worked. And GCHQ's role, which is, you know, is now public domain of course, is to gather intelligence from communication systems. And not only the communication systems that are open, but actually more importantly, the ones where people are trying to keep secrets. Because they're trying to keep secrets because they're trying to do nasty things to you or things that they think you shouldn't know about. So the culture was completely inward-looking and we don't do things outside, we don't talk to anyone outside, we do it all ourselves, we've got a lot of capability, a lot of people, a classified number of people to do what we need to do, and we've got a lot of skilled people and so you come in and you disappear into this black hole. In fact a lot of people called it the Black Hole of Cheltenham. And part of my job of course was to bring in the knowledge of what was happening outside, expose them to what that might do and then start saying are we actually going to be able to handle what we need to deliver, which is intelligence for the country. We weren't there to break codes, we weren't there to develop technologies, we were there to provide advanced intelligence about threats to our national wellbeing. And so how you do that had to change because we had to become much more aware of developments outside that actually, you look at it and you think, well if we'd done that inside we'd have classified it secret, now it's been thought about and developed outside and someone

hasn't classified it as secret, it's everywhere. And that transformation took a little while for people to get their heads round that they didn't control the way in which all of this stuff was developed outside in the outer world, that electronics and telecommunications in the computing world had grown now to a stage where it was so widespread that it was going to have a huge influence on everybody's life everywhere in the planet. And it's quite difficult to remember what the history of the world would have looked like in that time at the end of the 1980s from where we are now and the conversations, even listening to *Today* this morning about 5G networks and…

[0:40:53]
Let me ask you specifically about that. It's going to be announced later today perhaps, should that Chinese company be allowed to put its equipment in the next 5G?

Yes.

Why?

Well, partly because we haven't got many other options because we managed not to maintain a capability for the last thirty years to do it ourselves. Secondly, we've already got quite a lot of their equipment in the mobile systems and in other systems in this country, and indeed, so has the United States in spite of what they say. Thirdly, if you've got systems where you know that they are potentially going to be used for purposes other than what you think they're going to be used for, you watch them like a hawk and you see what is being done with them. And if you discover what is being done with them, you discover why they wanted it where it is, and they'll know that. So it's a measure, countermeasure game that goes on right the way through what we already do. So, sorry, you're not going to keep secrets for very long any more, you're not going to be able to stop infiltration and implanting of software and hardware into devices, we know that. So it's better to know where it is and what is being done, what it's there for, and if it starts being used for nefarious purposes, what do you do about it? Do you blow the whistle on it or just watch it and make sure nothing that is really precious gets anywhere near it. It's a cat and mouse game. And it's a nonsense to think that you can do anything other than exploit the technology.

The flipside of course is if you believe that high speed communications, mobile communications is core to our productivity enhancement as an economy, then that's what you do. So, you've got a balance between national security and economic effectiveness, we've always had that, this is just part of that chess game.

But one of the, I believe it's called Five Eyes, is it not?

Correct.

Which means Canada, the United States, the United Kingdom, Australia and New Zealand. These closely co-operate a lot of their surveillance processes, GCHQ talking to the NSA, etc, etc. One of those, in fact the biggest one says, don't do it.

Correct. So there's another, this is even more sensitive. So you say, so where would I go if I don't use Chinese? American. It comes back to your trust relationships, and I won't say any more.

[0:43:35]
Okay. Were you appointed a Chief Scientist and Director of Technology from the get-go?

Yes.

GCHQ.

Yes. I was the sixth person to hold the post after the end of 1945.

What were the major obstacles you faced?

I've already indicated one, a lack of recognition of what was coming down the road with regard to the development of telecommunications. Second was the way in which everything was structured internally was, I sort of took a view that you collect signals from wherever you collect them, you filter them, you do whatever maths on them you need to do to make it more readable than it might otherwise be. You then put it

through some machinery to filter out what's interesting, you put it together with everything else you've ever known and you produce reports. Now I've just described an end-to-end system. It was blocked into compartments which didn't talk to each other at all, certainly not, right from this end, right the way back there, yes. We've just read this; we now need to know that. But in the middle there was no sort of flexibility of the way in which everything was put together.

So it was still like the huts in Bletchley?

Dead right.

You don't talk to them, they don't talk to you.

Yeah, and just as an exemplar, I got all my immediate charges, because I had two and a half thousand people in my total charge, but obviously through a proper hierarchy, so I had six direct reports and I got them all in my office and I said, 'So my predecessor, what did he tend to do in the meetings like this?' And they all looked at each other, d'you know, 'I don't think we've ever been in the room together before'. And that told me, I said, 'Right, okay, now let me just reflect on that', because that told me a huge amount about exactly what I've just said, that everything was like the huts, no one knew. And there were good reasons for that and so I started to say well, let's work out how we get a better end-to-end systems view of how everything works without prejudicing the need to know what is going on operationally day to day now, down in the bowels of the machinery, because that's the bit that's really sensitive. The principles of how we make it better is something we can talk more holistically about. It took me probably three or four months to get that through everyone's head, that that was a really good thing to try and do. So that was the first thing. As an example of things coming out of the woodwork, mobile telephony was just about beginning to happen, late 1980s. They were still brick-sized machines but everyone who knew about electronics could see the battery was going to be the issue but actually the electronics could be made much, much smaller. And I said mobile devices, mobile telephony is going to revolutionise the world of communications. I got studies done by big consultants to make sure it wasn't just me saying that. And I took it to my own top-level directors and they all said, no, no that's not going to

happen. And I remember distinctly we had a joint NSA/GCHQ directors' meeting and I sat down and my guys were sitting there saying, oh dear Brian, you know, it's going to be embarrassing. And then the director of NSA said, 'That's really interesting Brian, and what is really helpful is you've just told us pretty well everything we'd come to exactly the same conclusion and we didn't know how we were going to tell you'. At which point all my own guys said, ooh. And mobile telephony, so I started the process of how we dealt with mobile telephony, and I'm not going to go into the detail of that of course, but if we hadn't, now it is a seriously important part of the machinery of intelligence gathering as everyone sort of knows, thanks to Mr Snowden. So that was one of the things I really did help with. There were a number of things to do with how the Soviet Union collapsed, which I won't go into, but those were operational emergency things really, as you can imagine.

Because there were some nasty, some nasty chemicals, there was some nasty technology just available, you could pick it up anywhere from the Soviet Union, ex-Soviet Union.

Yeah, and there were people…

And there were people who knew what to do with it.

And there were people doing nasty things, as everything destabilised, and so we were very conscious of the fact we needed to try and gather information quickly so that whatever was looking as if it was becoming unstable, we dealt with very quickly. But then right at the end of my time there, Iraq invaded Kuwait, which was another thing we didn't see coming. We saw, in retrospect we could see some signs but they weren't strong enough to blow the political whistle, but then when it did we had to react really fast, so again, the machinery was there to do all that stuff so we put in place the necessary to help the invasion. I'd left by the time we re-invaded. I mean I'd already committed to leave and that was that.

[0:48:27]
Were you able to get the quality of staff you needed at GCHQ?

Oh yes, yes. I mean people who were interested, it was beginning to become visible as to what it was about and there was a lot of speculation, a lot of books being written and the, so that cachet of being at the sharp end of doing this type of work attracted some seriously good brains. It had always attracted some of the best mathematicians because of the code breaking stuff, but we attracted some of the best electronics guys. And I broke the mould by doing more external work and with contractors who I knew from my RSRE days had got some seriously good capability. So a few pockets of industrial capability were developed, which have grown now to become part of their armoury.

[0:49:19]
And you left in '91.

I did.

Why?

I was forty-five, I'd been there four years. Forty-six. No, I was forty-five when I left. And when I went there, I went there out of the Ministry of Defence on a secondment of three or four years, so I'd done my three and a half years. But during that time all of the defence establishments that I referred to earlier had been privatised. Well, they were in the process of being privatised. The Defence Research Agency, they'd all been victims of what was called the Next Steps Agency Process, which Mrs Thatcher had put in place, which was a move towards privatisation, and all of them were taken apart and disassembled.

And you do mean victim?

I do mean victim, because I, well I'll say later why I think that is the case. Because that conversation is now current, or at least the reverse conversation is current. So when I talked to my – and as I said, using military language because that's how things were graded – as a two-star position, I'd done two two-star positions; one at Malvern before I left and one there, and there were three three-star positions and one four-star position in MoD and I knew that from conversations I'd had with various people that I

was certainly slated to be one of the three stars and then would bid for one of the top jobs, which was either what was then called Controller Establishments, Research, basically looking after all the establishments which had now gone, or Chief of Defence Procurement, which now was a job that was very much in the industry and they were looking for industry expertise, not the sort of expertise I'd got. Both of those positions, well the CERN job went, the four-star job was abolished, there was only one three-star job and the Chief of Defence Procurement job was now much more industrial, so I had no career.

Can we read from those stars a position that a general would be in?

Yes.

Is that like being a one-star general?

One star is a brigadier.

A brigadier. Two is?

Major-general. So I'd been a major-general, air vice marshal equivalent, for four years, five years.

And the third would have been?

Air marshal, lieutenant general. Nowhere to go. I had nowhere to go. And Don Spiers who was my reporting officer, who was the four star – no, he was one of the three stars, sorry, one of the three stars – said, Brian, there's nowhere for you to go. I then talked to Lord, now Lord Butler, Robin Butler, who was the head of the civil service, and he said, no actually, we don't move people at your level between departments. Because I said, look, I know a lot about very sophisticated IT, because I did by then, as you can imagine, GCHQ is one of the most sophisticated IT operations in the country, not that you could talk about it. And at that time the Health Service, National Health Service was beginning to say, we need to do better with IT. So, I said, I could do something for… No, he said, we don't move people at your level

between departments. And after he said it three times I thought I'd better believe him. So I left and got a job, I was offered all sorts of jobs, as you can imagine, because you know, where I'd been was a significant place. I probably made the wrong choice, but I went to KPMG as a partner to try and set up an information security practice, because I could see that unless the commercial world woke up to the fact, it wasn't just going to be GCHQ that was going to be interested in what they were doing, it was everybody else was going to have the capability to find out what they were doing by electronic means. So you needed good information security and obviously I knew about that because I'd been a threat to everyone else. So I went to KPMG in 1991and it didn't work, I mean I just didn't make money, and being a very hard-nosed commercial operation, again if you look at, people don't talk about the early nineties as when there was actually quite a dip in our economy, and KPMG like most professional services organisations, pretty ruthless with regard to if you're not bringing in the cash, you're not going to stay, so I didn't. But I'd learnt a lot about being a consultant, so I then went and became my own consultant for a year and a bit and then got a job as Head of IT at the Wellcome Trust, which was the largest medical charity in the world, which attracted me because it's a science-based organisation and being a scientist that was quite attractive, and it needed a modernisation of its IT function.

[0:53:47]
What did it have when you joined it?

Oh, old-fashioned mini mainframes, AS/400s, I think. And it needed, it wasn't in the PC era, it had got a nice guy, had no idea how to modernise his systems, so that was what I was brought in to do, and indeed did. But on the way, as an aside, they asked me to look after the IT development and well, the programme management of the IT development of an investment that they were making at a place called Hinxton Hall, which is just outside Cambridge University, where Wellcome Trust was going to invest in the human genome mapping programme. And so there were 400 scientists who were going to go there and analyse human DNA. And they said we need seriously good IT and we need someone who understands that to programme manage getting it in. So I did that.

What did you spec for that then?

Oh, it was, these were very significant workstations so you're talking about – it sounds ridiculous now – 100 megs to every desktop and all the necessary contention back into a whole bunch of AlphaServers, which were – and outside of course, into other places. And actually, one of the things you say, I said, so that's the spec of what you know you need, plus all the sequencing machines, of course, which are online. So I said, so I went to the contractor who was doing the networks and I said give me the differential costs for this, ten times this, a hundred times this and a thousand times this. A thousand times this was 25% more. So, I said, well do that then. So I said to the Trust, because they're rich, and I said because I know that these guys have underestimated what they're going to do. The history of the DNA thing was the Americans wanted to do the Human Genome Project and then commercialise, patent it, so they could make money out of knowing. And the Director of the Wellcome Trust and everybody else in government said we're not going to let that happen, so we've got to do it quicker. So I think within eighteen months of us getting that in they'd used my thousand times, but they knew that actually I'd left – I'd also put in enough empty tubes for fibres to be blown through the buildings so they could put another two or three thousand times in without too much fuss. No one ever came back to me and said well done.

Whose workstations did you pick?

Oh my god, that's a good question. I don't know that I did, but I certainly would have supervised. Were they Suns? I think they were Suns.

And the operating system was Unix?

Yes. Oh yes, yes. Yes, I mean all that end of science was Unix, yes. Big debate as to whether Linux was going to be used, but no, they were mainstream Unix, yeah. And everyone had grown up on big Unix boxes, so yeah, DEC Alpha, which was a worry because DEC was going out of business at that time and the supportability of DEC Alphas was going to be a tricky issue. And to be honest, I don't know what happened, because they went off into a black hole and did their own thing. Because

they also then got heavily connected, not only to Cambridge, but to EMBL – the European… something Bioinformatics Lab – which was, can't remember where it was, somewhere in, it was in Munich, I think. So the whole network of Europe got its head round this genome mapping project in order to counter the American threat of privatisation of the knowledge, which we saw as absolutely countercultural. Ha! Timely stuff again. So I was exposed to a whole bunch of different computing then. But then I left the Trust, not in a very pleasant situation actually. I don't know, to this day I don't know why the finance, they brought in a new Finance Director who I think thought he knew a lot better than I did and he basically felt that I should leave, so I did. Somewhat under a cloud, but everyone was gobsmacked, I mean all the people I knew then, I still know.

Did he outsource it?

He started to outsource it, which was totally the wrong thing to do, because it was a very specialist organisation. He left within six months after I left, so I think someone said, ah, what have we done? Anyway, they're okay, I mean the Trust is, yeah.

[0:58:10]
Outsourcing is often – well, I've often said it as well and other people have – it's the Financial Director's revenge on the IT people.

Yes, yes. Well, I tend to say it another way round, which is if you don't know how to manage it, you certainly won't manage it when you're outsourcing it. You should only manage things you know how to… And you need a different skillset to manage outsource than manage the function itself. So I then went into consulting and Clifford Chance became one of my major clients through a recommendation from a colleague and…

These are lawyers?

It's the, it was at the time the largest law firm in the world. So, when I joined them, actually I joined them because they'd had a security incident. You may enjoy this story. I was about to go- I was still doing consulting for government, I was going into

the DTI office in Victoria Street, and I'd got my mobile phone in my hand – not quite a brick one, but a fairly big one – and I was about to turn it off when it rang. I mean literally I had my finger over the- and it rang. 'Oh, you don't know me, I'm the General Manager of Clifford Chance, your name's been given to me by one Richard Susskind, who I know is known to the company, as someone who might be able to help us with information security.' So, I said, 'Yeah, Richard had mentioned, but not yet'. 'Ah. Well, we've got an incident and we wondered whether you might be able to come and help us.' I said, 'Well, I'm about to go into a meeting but I could come in tomorrow'. He said, 'It is rather urgent'. So I said, 'This meeting will last an hour, I could probably be with you by about 5.15'. 'Excellent', he said. So I pitch up and find they've got a hacker crawling all over their systems from outside. So I asked them all the relevant questions very quickly and they went away and squirreled away, did things which I thought you should have known how to do this without me asking you those questions. Hm. And within four days they'd hammered everything down, they'd found out who it was, the police had gone and raided his premises and found he was ripping off- it was an IT contractor who'd left a hole in the system, he was sucking out all the software that the firm had bought for him to do the job he'd been doing, he was sucking it out so that he'd got his own toolkit. *Phff*. They ended up not throwing the book at him because of reputation, it wasn't that serious, he hadn't sold any client data, I think if he had they would have had to have done that. So, but lesson learnt. So they then said, hm, could you do an information security review of the whole of our organisation? Yes. Big consulting job. Then they announced – so this was early 1988, I guess – and they then said we've got in train the idea that we're going to merge with an American law firm and a German law firm and we really need to understand what the implications would be for all our IT systems. So it'll make a firm of seven and a half thousand people, best part of a billion pound asset – well, not asset – income, would you be interested in being the systems integration, director of systems integration for the merger? Yeah. Put a number on the table, realised immediately I'd put too small a number on the table, because this is a City law firm, right. But it worked. And so up until the end of 1999 I did all that planning and then planning the execution of the systems integration across those three firms. And they said, oh, we really need to have 1st January 2000 as the date we go live, and I said, not from an IT point of view it wouldn't. As it happened, I'd been chairing for the

Institute of Electrical Engineers, the IEE as it was then, now the IET, I'd been chairing their working party on the millennium bug…

Let's come to that in a sec.

So I knew about the subject.

[1:01:54]
Sir Peter Ogden has made his contribution from Computacenter to the archives and he says the worst people to deal with are lawyers because they always said, oh we're completely different, we don't want standardised software. Did you find that among the lawyers?

Yes. And I said, so what makes you think your word processing, basic word processing and your email is any different from anybody else? And I argued them out of that. Gloss on the top of the word processing, yes, absolutely, but basic letters, blah-blah-blah, no, sorry, it's the same. And when I showed them what the price was that they were paying out of there, the partners' share, they started to realise that was a price they would quite like to nip a little bit off. So…

[1:02:35]
So we're into Y2K.

So, I mean so I did a big audit of the whole of the firm to make sure we were okay. But I knew from all the stuff that I'd done with the IET, I picked up loads of really good ideas on what you had to do, and applied it and we didn't have any problem at all.

Consultants were shovelling cash into their pockets as a result of Y2K.

Yes, they were.

It has been put to me that it was a scam.

It wasn't.

It wasn't a scam?

No, there were real things that were found, they weren't as bad… What people don't talk about is all the corrective action they took and they never value that, because it was only tweaking a bit of software here and there, but actually if that had gone wrong and everything had been paralysed- and it's like a lot of failure, you know, you don't know what the cascading effect's going to be down value chains and supply chains of loss, because remember e-commerce was just beginning to happen. So, you know, you would have lost trust and confidence in this company. Well, they didn't see the bug coming so we're not going to trade with them again, so you could imagine that could have happened. There were lots went on under the bonnet that people never talked about as to what they corrected. A lot of people discovered their system configurations they didn't know, and one of the things we did was find out what your system configuration is, make sure all your operating systems are up to date, make sure all the version controls are right, make sure all the connections are right. Who's accessing your machine is right, because those are the people who import bugs that you wouldn't otherwise know about. So there's a huge amount of systematic scrutiny, what you would call nowadays basic housekeeping, which is much more routinely done now. And a lot of people, particularly in the finance sector and in other engineering and in defence got their act together in advance and discovered all sorts of things that would go wrong, not necessarily millennium bug things that would go wrong, and as a result the whole quality of IT came up. Now is that an audit that anyone would talk about in millennium bug terms? No.

Alastair MacDonald and fellow CBE, he was in charge at the DTI…

Yes, he was.

It wasn't then called the DTI, it had some, an acronym, and he was in charge of it and he says I was watching television when New Zealand, when it started in New Zealand and the lights didn't go off and the planes didn't fall out of the sky and the telephones still worked and the toilets flushed.

Yes, I imagine he was on the hot seat.

And he sent them home. He sent the team home.

Yeah, yeah. Well, actually we watched Tokyo, because we didn't have an office in Australia or- our furthest east office was Tokyo. So we waited for Tokyo to go through it all, and then Hong Kong actually, we waited for Hong Kong as well, and similarly went to sleep, if they're alright, it'll be alright. And it was. I mean there were one or two blips, but yeah.

[1:05:11]
Now this takes us to 2001.

Correct.

Yes. Where you decide to leave, but somewhat…

Mutual consent, actually. Yeah, I mean 9/11, I was on watch during 9/11, so that was a fun thing to be at, because we had to make sure we were safe on that day, that afternoon. I was sitting in a tower block there, literally there because that's where our offices were.

Where?

Aldersgate Street. The big thing on the roundabout. So I was on the seventeenth floor – another anecdote – watching what was coming on the web, listening to the radio. And of course the news was coming in all over the place, and then we heard that the Prime Minister, Tony Blair had said, grounding all aircraft in this country, because we didn't know. And I looked out the window, and aircraft come into Heathrow from the west, come in and do turns over the City, come in on the northbound and on the southbound, we were right underneath the turning point for the northern approach turning to go in. And I saw one aircraft coming towards me and I thought, if I see another one, what do I do? I didn't. So, and of course we had a big

American office in New York City, which was in Midtown, in what's called the Pan Am Building, which is on the southern side of Midtown, and they heard on the news about the first aircraft, they ran to the wall and watched the second aircraft fly right over their heads, go straight down Park Avenue and straight into the building, they watched it live. Yeah. And then of course were told to get out and the whole of Midtown evacuated and all ended up in a complete traffic jam. And my IT director stopped on the fifth floor, picked up all the back-up tapes, put them in a bag, so he'd got a complete data record of the American firm, before he left the building, which I thought was pretty heroic, because at that time no one knew. I'd already issued an instruction to the world, get back-ups out, because we didn't know whether this was a global attack. So my first reaction was data. Buildings, people – people they can handle locally, data they're not going to handle locally without my instruction, so my instruction flashed all over the world was, get the data out of your buildings and get them into a safe somewhere. Which everyone did. Of course it turned out not to be necessary. Next morning Mike, having got home, which took him about seven hours to get home that night, drove in at 4 o'clock in the morning in a van, went and picked up as many PCs as he could in the van, took them into our building and then said to Merrill Lynch, who were our biggest client who'd been taken out, we've got PCs on the internet, do you want to come and work from our offices. And everyone said, cor, where did he get that idea, that's brilliant. The lawyers hadn't thought of that. So going back to your comment about lawyers being difficult to work with, actually the IT people in law firms, as long as they keep the lawyers away, are fine. It's the lawyers who do have this issue of saying is this different. So that was a bit of a ramble around that, but it was one of the episodes that I sort of recall minute by minute.

[1:08:24]
You didn't move immediately to Cranfield, did you?

No, I didn't. I did another period of consulting. Getting out of Clifford Chance was by mutual consent because I had a world job, because we'd set up Clifford Chance as a world firm. At the end of 2001 the market again started collapsing - seems to be things with a one at the end, I've got to watch next year - and as a result of that, they said oh, we're going to go back to regional operation, we really don't need this global

team, we really don't need what you do. So I said no, you don't do you? And we negotiated a way out. Which was a pity, because actually, talking to the IT directors in all the other firms, the other magic circle firms, as they're called, they were in awe of what we were doing. They hadn't got anything like the range and reach.

Did you find significant cultural differences between Germany, the UK and the US in Clifford Chance?

Absolutely huge.

How did you solve them? Well, what were they and how did you solve them?

American, some of the least nice people – I'll put it politely – in America, I'd ever worked with, I discovered in America and because I'd got IT directors in each one of those countries, to a large extent, specially in America, Mike handled that. He'd grown up in American law firms, he knew how to handle the people whose attitude to other people was less then polite a lot of the time. But they were rainmakers, what's called rainmakers, so if they brought in three million dollars on their own bat in legal fees, the firm wasn't going to argue with them about their style. In Europe and the UK, we were a bit more argumentative about that, that was a bit unacceptable. Germany was very interesting because we had a guy in Frankfurt who looked after the German operation, but he then to an extent was looking after everything but France.

Was that your choice?

Yes, to an extent in that the, when we merged, they'd got, the German firm who originally merged, they'd got operations in Eastern Europe, we hadn't from the London firm, so that's what came as part of the package. Where we'd got an operation was in Spain and in France, so we didn't – I had to play that off because the French guy was seriously good and he didn't really want to play with this guy in Frankfurt, so we came to an accommodation. But the guy in Frankfurt, I mean again, an episode to just indicate how tricky it was at times, because the German system was run very much in a Teutonic way, if I can put it like that, and there was a virus that went around called the Love Bug, which we picked up, almost everybody picked it

up, and there were well designed procedures for what you did and, you know, we blasted all the servers and within twenty-four hours around the planet we were clean, and then we weren't again. And then we did some diagnosis and discovered it was coming from Germany, because everything was networked. So I rang Mike and I said, Michael, it would appear that you still have the Love Bug and you're infecting everybody else, could you tell me when you're going to do the patches that I sent out an instruction to do two days ago? 'We do patches at ze end of ze month.' So I said, yeah, but this is sort of happening real time and, you know, it really needs to be done now Mike, Michael, if you would. 'We do patches at ze end of ze month.' So I became a little more Teutonic. I said, 'Michael, please could you do them now, this afternoon please. I'm going to send an email right now to your managing partner telling him that I have instructed you to do that. And if I don't see that that has been done by the end of the day I will disconnect Germany and I will tell your managing partner that is the case'.

It was done by the end of the day.

It was done by the end of the day. Because he knew it wasn't an idle threat, I could disconnect Germany and then there would be all hell to pay. So, how do you deal with it, escalate, polite, less polite, and it worked. Because oh, if you're ordering me to do it, that's different. Asking you to do it, no. Ordering you to do it, yes. I should have known, but actually doing it the British way was the right way to do it because we got on alright afterwards. We smiled. So, it's like sledging in cricket, you know, the third time doesn't work. So…

[1:13:23]
So they didn't need, they thought they didn't need a global operation?

Yeah. So I left and I was doing quite a lot of stuff with professional bodies, with the British Computer Society, with the IET, and actually put my name forward to be President of the BCS. I wasn't elected to be the candidate at that time and the real irony is that same day, as a result of a dinner conversation at the IET, I had a phone call from Sir David King's office, who was the government Chief Scientific Adviser, said Brian, when you were talking over that dinner, there were loads of things that you

talked about that sound really, really interesting and some of the stuff you've done no one else has really had that breadth and depth of experience, and you're a scientist by background. Would you be interested in applying for a job in the Department for Transport? I can't guarantee you'd get it, but…' you know. So I did, and got it. So, one of the things I learnt, I'd already learnt, but you know, is network your way around and be nice to people.

[1:14:22]
You're not much of a butcher are you?

I haven't had to be, although I did at Clifford Chance on one occasion, yeah. It's got to be a pretty – I'll try and find; I'll work around to…

It's got to be pretty egregious for you to…

Yes, it has.

… get your hatchet out.

If I say this particular individual – I must be careful because actually I was ticked off by someone from here, literally from this building - but this person I'd hired and he was about to hire his mistress as his project manager. Sorry. And when I examined the process of that hiring I discovered he had cut all the corners to make sure it happened, and then I discovered that he was misusing the firm's funds, after the event, as it happened, but you know, and the fact he didn't groan and moan particularly vigorously about it told me, caught.

Yeah, but you're not able to walk into a room and say you ten are fired because…

That's not me.

Because we just haven't hit the numbers.

That is not my…

It's not you, is it?

It's not me, no. No, I'm a collegiate, collaborative person who enjoys the team. And if people don't want to be team players in my team, then it probably becomes self-evident after a bit that they're not going to be very successful. But that isn't me firing them, it's them working out that they're better placed to go and work somewhere else.

[1:15:51]
So now you're dealing with big, not only transport, but infrastructure issues.

Yes.

That's really where I'm trying to get, you're beginning to build an expertise around not only the technology in them, but the bigger picture of what this infrastructure needs to look like.

It's how the world works, basically. And I knew how the defence and intelligence world works because I'd been at the top table, right? And I'd seen bits of the finance industry from the law firm and I'd been in bits of academia from various other places. So by the time I get to this position in the Department for Transport I was back at the government top table, but with a whole raft of different attributes. And indeed, Dave King asked me in the interview, what do I bring to his party, and I said being a polymath. And I said I know it's not a particularly fashionable discipline. He said, in this job it is, because that's what you've got to be able to do, is get on with everybody, understand where they're all coming from and try and synthesise what it is they're about.

So let me ask you an infrastructure question, and you know exactly what it is, because this new government is going to have to make a decision on HS2. And your decision, Professor Brian Collins, is build it or don't build it?

Don't build it.

Why?

Well, not as it is. You increase the capacity of the railway system between the north and the south, but I think what you do is put a big pause on it being called HS2, because it's not high speed, and you say now I'm going to develop the capacity for improving the rail communications between Birmingham, Manchester, Leeds and London and I want to see what the demand is, as to where those first links should be put. And everyone had said, even in the early days in 2007/8 when I was working with Andrew Adonis, because he was my Secretary of State, why are we doing the link to Birmingham first? Because everyone'll say that's London-centric. If you do Birmingham/Manchester/Leeds first, everyone'll say oh, that's where the economy's got to grow because that's where the productivity, all the people are who aren't being as productive as they should be. The south-east is productive. And, no.

What role does IT then play in that? An increasing?

Oh, increasing, it's a digital railway. Just like the Queen Elizabeth line that we're sitting on top of is a digital railway, and everyone is saying it's the first digital railway, and dammit, we've built it in a tunnel which has made it really really difficult.

And it's not working. It's behind schedule.

Ah, that's not the same as not working. As a programme, it, the governance of the end-to-end programme wasn't put in place appropriately. I mean I've analysed a bit of it and I'm not deep in studying it, but I do know the guy who left as Chairman, because I know him quite well, and I know one or two of the project managers and I've said as much, that they thought about the civil engineering, built the tunnels. That's bad enough, that was a really difficult job. Then we'll think about how we'll put a railway in it. Wrong. They should have thought about how do we build the tunnels and put a railway all at the beginning. And it really brought home to me when there was a TV programme, a series of TV programmes, the last one was about all the civil engineering just about is done, all the tunnels are lined and waterproofed and all the rest of it, and the track bed's in, now we need to get electricity in. And they

showed a picture of these guys pulling a cable that must have been that diameter, as you can imagine it would be, through a tortuous serpentine set of cracks and gulleys and whatever, to get it from the surface down to the railway track. As if, oh, we've got to get electricity from the surface down to the railway track. Like, why are we building this thing? And they hadn't thought that, oh, why don't we have a shaft down which you put the electricity cable, like you have in most buildings above the ground, you have a service shaft and ducts, right?

So it's a digital…

It's the lack of integration.

It's a digital train?

Yes. But it's not been governed from end to end as a digital railway which happens to go through tunnels. It's been governed as a civil engineering contract, massive three contracts, then let's do railway, let's do digital, all separated from each other. So the big issue is no systems thinking, no system or systems engineering around the whole thing end to end. And what the military and the intelligence communities know, and I put a tweet out about it only yesterday, there was no description of the concept of operations of how is it all going to work, tell me the story of how it's all going to work. And if they'd done that, they'd have thought, oh, we need electricity. It's up there, how do we get it down there, we'd better make that easy because that's not going to be very, you know. And you would have described in great detail, and you'd have spent two years doing it, how that worked. HS2 needs exactly the same thing, going back to your prior question, because HS2 was seen as a vanity project by the then Secretary of State, and everyone said, so speed? It's not going to do the top speed for more than ten minutes between London and Birmingham because it's either going to be accelerating or decelerating. So it's not high speed. Go to Manchester, bit more sense, Leeds, a bit more sense. Actually, Birmingham/Manchester/Leeds, not a lot more sense really because they're close enough. All the parameters that you look at for high speed rail, you look at them in Spain, in France, in China, you need urban populations which are more or less the same size and you need a distance of 350ks in order to justify that high speed, because it's accelerating or decelerating.

And we are not a big enough country to justify high speed unless you do London to Edinburgh in one go.

[1:21:34]
There seems to be, among many people, I think I'm one of them, an assumption or at least an impression, that the public sector in this country is pretty bad at IT projects and we would point to NHS and a number of others. Do you feel that it is and if it is, what is it?

I think there's two things. One, the media go after public sector failures of any sort, IT or otherwise. They never give public domain visibility to those things which are successful, it's not good media, it doesn't sell papers or news programmes. So I think I'd temper, first of all, the allegation that it's not very good. Secondly, because the Public Accounts Committee and the scrutiny bodies in Parliament have an obligation to scrutinise the expenditure of public money, how it has been spent and whether it's been spent well is a matter of public visibility. If you go and talk to a large company, like Shell, and ask them, they don't have that public scrutiny applied to them and if you talk to them and say how well do your IT functions work and how well do you do these things, they say, mm, now you come to ask… And quite often it's not as well, not only is it's not necessarily a whole lot better, although the profit motive that is always in the business case is quite often a stronger driver than the public good case for the public sector cases, they don't document it anything like as rigorously as public sector has to do because it's public money, the Treasury insists on it, there are rules. So because there's a record you can see how well it's been done or it hasn't been done. If you go and talk to the private sector there isn't that, so there isn't a record of how well it's been done or not done. So I don't think it's anything like as bad. Second thing, I would say, is I think we've managed to lose an enormous amount of the expertise on the client side of the procurement activity. So – and indeed in today's paper, people are talking about the public sector becoming more of an intelligent buyer, an intelligent client in the procurement of IT, and a lot of other things, I might add, sophisticated things, because at the moment they're not. They're informed. I mean there's a phrase that's used, informed, intelligent and expert. It's very expensive to be an expert buyer but occasionally you have to do that. If you were buying, you know, very special drugs you probably have to be an expert buyer,

you have to know exactly what it is you're asking for. But if you collapse everything down to informed, then you get what you pay for. And when IT is such a critical factor in the development of and operation and delivery of public services, then you would argue that you should be an intelligent customer. And the Infrastructure and Projects Authority Chief Executive gave a speech yesterday morning, said exactly that.

[1:24:36]
You mentioned that some of the public sector organisations were privatised and also they became victims.

Yes.

I wanted you to expound on that please.

So the route to privatisation was a dogma that was driven out of the Cabinet Office and to some extent the Treasury, who saw this as being a, as they always would, a spending reduction. Put it in the market, the market'll do it more effectively, we spend less public money. No evidence to that was actually an assertion that was, you know, viable. So in that sense the people who operated these laboratories, and I was Deputy Director of one and went through some of the early conversations before I went to GCHQ, because no one actually thought to privatise GCHQ, thank heavens, that we actually weren't a voice that was going to get listened to in those conversations about the privatisation of the laboratories. Now I only know about the one I was at, but I've read something of what happened in other ones and it was very similar, that they had no voice, they weren't even asked. It was assumed that this dogma that came out of the centre was the dogma that was right and so all you've got to do is execute this plan that we've now put in front of you. So it was done to you, in that sense I'm using the word victim.

[1:25:55]
Okay. What mistakes have you made in your career?

One is the one that you just touched on, which is not being strong enough occasionally when I can see early enough that things were going wrong, and I probably was not brutal enough, not firm enough, decisive enough in dealing with it. I preferred to find a way round it until it really- and occasionally came back and bit me and confronted me and then I dealt with it, but looking back, I could have been a bit stronger. I think I, it took me a while [laughs] to realise that actually the way I could put together an argument concisely was a valuable skill, which I hope I've just done. And…

Oh, I think you have. I think you, for instance, very early on your explanations of heat testing and so on were very, very clear and you've used that, and therefore that's…

But I couldn't, in the early days…

You couldn't have done that.

I was not as good at it as I am now. If you've worked with Ministers who have a ninety-second elevator concentration span you learn how to get what you want to say to them really quickly. Example. David Willetts, Lord David Willetts, one of my most favourite Science Ministers, was my Science Minister as I left the civil service in 2011, and as I was leaving, we knew who my successor was going to be but he wasn't going to be around for six months, so David, as I was leaving his office in 1 Victoria Street, said, 'So what are the three things I ought to be worried about in the next six months?' So I said, 'Cybersecurity'. He said, 'Yeah, get that', that's sort of core to industry and core to the wellbeing of the nation as we go into cyber land bigtime. 'And the second one' I said, 'Our cities'. And he said, 'Cities?' I said, 'Yeah'. I can't remember the exact number now, but it's something like 65-70% of the United Kingdom live in urban areas, a significant fraction of that is in what we would call cities, you don't have a Minister for Cities. It's where most of the GDP comes from, most of the people live, most of the wellbeing crises are, most of the demographic issues and social care…' 'Shut up' he said, 'I get it'. Six weeks later Greg Clark was made Minister for Cities. Now I don't know, I've never asked David, who I see periodically, whether actually that was cause and effect, but he immediately got that

there was no central government oversight of cities and now, you know, cities are quite a visible phenomena. So…

And number three?

D'you know, I knew you were going to ask me that and I can't remember what the third thing was. Oh, it was climate change. It was climate change, yes. And just the whole lack of coherence of government policy over that.

[1:28:53]
In 2011 you moved from civil service into University College London.

Yes.

You're now the Professor of Engineering Policy at University College London. A final few questions. What is the quality of students that you're seeing?

Excellent. Excellent. I mean, UCL is in the top ten on most ranking tables in the world, with Oxford, Cambridge and Imperial. But you see four British universities in the top ten, given the scale of where the population is, it's going to be very difficult to maintain that capability for the next twenty or thirty years. But at the moment we are attracting some of the brightest and the best and some of the young people give me hope for the future because they actually get it. They're not on ego trips, they see all the big issues that are out there: climate change, demography, resource scarcity and the impact of all of that on ecosystems and how we live, and food. And at twenty-six, twenty-seven, they are doing the Cold War thing that I did. So, you know, I think that is the equivalent of what we did. And actually, a lot of the techniques and methods and approaches that we had with regard to how we got our way through that could be applied to how we deal with getting much better collaboration on a global scale on climate change in particular. So, and what is equally interesting is the strapline UCL has is, London's Global University, so we get students from all over, and we make a particular issue out of mixing them all up and yet respecting their cultural advantages and differences to the benefit of everybody. So everyone gets a really good, all the

students get a really good understanding by being in a mix of what is going on in the rest of the world at a very formative age.

Have we too many universities and too many undergraduates?

We've got too many things we call universities. Post the, let's have 50% of our population go to a university…

Was that a good policy?

No, no. Not, 50% do higher education, yes. But calling it a university in the traditional sense of the word university – I'm going to be a bit parochial about what the word means – as a place that does academic scholarship, as opposed to a place that does some of that but more vocational development of knowledge and capability and skills, that's where I think we've moved things too far. So, all of these universities' business models is they have to aspire to be like Oxford, Cambridge and Imperial and UCL and it's rubbish, they can't do that. So yes, we have too many, but we don't have too much tertiary education, it's just not appropriately oriented.

[1:31:41]
One last question, and it's rather a big one for the future. Some people have said to me that they are deeply concerned about the development of artificial intelligence, and these are not stupid people, these are people who say we are beginning to do things in artificial intelligence that we don't really understand. Is that your view, have you got a concern there?

Yes, a concern, but are we dealing with it as best we can? I mean Professor Nigel Shadbolt, Sir Nigel Shadbolt, is a very good mate of mine, I've known him for twenty years, he started one of the big research programmes on AI in 2000 and I chaired a steering group at that time. He's now Master of Jesus College Oxford and runs the AI Oxford operation. And he's Chairman of the government Ethics Committee, which is one place where some of the governance of the undesirable consequences should be talked about so that we have mechanisms in place to cope with them. If you look at some of the stuff that went on in medicine when people started talking about stem

cells, we were way ahead of the rest of the world in putting in place governance mechanisms to try and influence the possibility of stem cells being used inappropriately and what we are trying to do, we're in fact emulating that, that is being used, and I've been party to the conversations, not appropriate that I should have any input to it, that that is being used as an analogue of how we intercept in advance, we do a precautionary principle on those sorts of anxieties. So anxious, yes, because it is a big area of unknown, but we've faced big areas of unknown in the past. When we build nuclear bombs and nuclear power stations we didn't know how the nuclear physics worked. Chernobyl. I mean, you know, I've just finished reading the history of Chernobyl and I'm appalled to find that actually the Soviet Union built this thing and didn't realise how, didn't realise actually under all conditions it worked. Under all conditions. Important factor in nuclear power, you have to go through all the possible ways in which this thing might work or not work, concept operations. So, I'm not over concerned as long as the A star team is addressing the issue. If in any way the governance of the outcome of all of this is devalued or made more, made mediocre, then I'd be more worried. And of course there are bad guys out there who'll try and exploit it. We can see that. But we now have, you used the word surveillance, I get really upset about the use of the word surveillance, because surveillance to me is I know exactly what I'm looking at, and I know from the work I've done in the past that actually what is happening at the moment is we're doing reconnaissance. It's seen as a two-layer thing: surveillance and targeting. There's a three layer, it's reconnaissance. When you go out in the street you are aware of what's going on around you. You're not doing surveillance; you're just sort of reconnoitring the context of the street you're in. And if something, you hear a siren or you hear a vehicle or you hear a bicycle bell, that's surveillance, because you're immediately interested. And then targeting is you get out the way or you stop, or whatever, it's a three-stage process. Reconnaissance is fine, it's what everyone does all the time to stay alive. In the data world we've allowed that word to not get used. That's what GCHQ does, it's why it gathers as much as it can, because that's the space it is doing reconnaissance on. And having done the reconnaissance it then looks to see whether there's anything in it which is untoward. Surveillance. Oh god, we need to deal with that. Targeting. And for me, AI is similar. We're doing reconnaissance of how it gets used and if we find something that is inappropriate, and some of the election things that we've seen, so what's going on in North America at the moment, may well

be taking that reconnaissance and turning it into surveillance and targeting. So, I think we've gone through a number of technologies which have had that sort of impact on us and if you look at the history over the last, the whole of the Industrial Revolution, all of those things of a different nature have caused anxiety in the fabric of society. Steam engines, locomotives. There's a lovely quote I know from the development of the railway, the railway system in the 1840s, is some aristocrat somewhere whose land was about to be, not taken, but nearby, said, 'It'll allow the masses to travel at will'. [laughs] Which is perfectly true, and that was an anxiety that the aristocrats of the country had at the time. So, yeah, it's part of evolution, I guess.

When you were in defence you got a number of stars didn't you, because of your rank?

Yeah.

Well, thank you Professor Brian Collins CBE, for a five-star contribution to the archives today.

It's been a great pleasure, thank you.

[1:36:49 recording ends]