



Sir Martin Sweeting

Interviewed by

Tola Sargeant

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At

Surrey Satellite Technology Ltd,

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SPEAKERS

Tola Sargeant, Sir Martin Sweeting

Tola Sargeant 00:00

Tola, it's the 12th of June, 2025 and we're at the offices of Surrey Satellite Technology in Guildford, Surrey. My name is Tola Sargeant. I'm the CEO of Archives of IT, and I am joined today by Professor Sir Martin Sweeting, Executive Chairman of Surrey Satellite Technology Limited. Martin has a long career in the UK space sector, inspired by the Apollo era of space exploration. He invented the microsatellite in the 1970s whilst a student at the University of Surrey, built it pretty much on his kitchen table, as I understand it, and somehow persuaded NASA to launch it. Martin then went on to found Surrey Satellite Technology with just 100 pounds and four employees in 1985. The business, which is celebrating its 40th anniversary today, was sold to Airbus for 50 million pounds in 2009 and is now a world leader in small satellites with a turnover of some 80 million pounds. Welcome, Martin, thank you so much for joining us today, and I am delighted to talk to you as you celebrate Surrey Satellite's 40th anniversary. Quite an achievement. Before we get into the story of your career and the space sector, I wondered if we could start by talking briefly about your early life and how it all began. You were born in the early 1950s in Highgate, London, I think. What was family life like back then?

Sir Martin Sweeting 01:37

Well, yes, I was. I was born in Highgate and, well, I suppose in those days, there was no social media, and therefore, looking back, I was really quite unaware of what was going on in the wider world. I think life focused very much on school. And I was very fortunate, because despite living in London, we actually enjoyed quite a large garden. And so I spent ...and my father had basically let it run wild, so it was a bit of a jungle. So myself and my younger sister, who's four years younger than I, spent actually a lot of time just out in the garden making, you know, stuff the kids did in those days, and that's actually, more or less, you know, I think of school and that as the two sort of elements of life at that time.

Tola Sargeant 02:30

Did you come from an engineering background? Was there engineering in the family at all?

Sir Martin Sweeting 02:33

No, my mother is an artist. Was an artist. My father was really a literary gentleman, and absolutely no idea of science whatsoever. My maternal grandfather had a mechanical background, and my paternal

grandfather was a bit of a Victorian entrepreneur, but not particularly in engineering or science, but he did lots of little things, which today look sort of fairly obvious, but he built a wind turbine to power his house before they had electricity and things like this. So I had that sort of, that was in the in the genes, going back a little bit, but certainly my my immediate family, my mother and father, had no idea about science. So when I got interested in electronics and things like that, you know, they just sort of let me get on with it.

Tola Sargeant 03:25

And what age did that start, your interest in electronics?

Sir Martin Sweeting 03:29

Actually quite young. I remember really getting interested in my electric train set and how that worked. And so I suspect that was probably when I was five or six years old. And I started to try to see what else I could do with the electric train set, rather than just let the trains run around. And so I started sort of dabbling in, well, yeah, dabbling you know, looking back, knowing absolutely nothing about electronics or anything like that, just you know, by trial and error, trying things out. And eventually that led on to something which was quite interesting. I noticed I had my parents bought me a transistor radio, and I noticed that if I tuned the transistor radio around and listened on another radio at one point, I got a whistle, and I realised, without knowing what was happening then of course, that one of them was communicating to the other. So it sort of got me interested in communications. And I was given for a Christmas present or something, I think from Woolworths, you know the old idea of having two cans and a bit of string, and then I sort of played with that a bit. And then my parents bought me what was a little sort of Wired telephone. There was probably 100 foot of wire, and if you shouted at one and you could hear something at the other, and that whole idea of remote communications somehow fascinated me. And today of course, we have the internet and everything else. Nobody even thinks about this. But in the 1950s the idea that you could talk to somebody at a distance without using the telephone was something that sort of caught my imagination, and that's really what triggered my whole life, actually.

Tola Sargeant 05:17

Yes, and what about space in particular, were you interested in that from an early age?

Sir Martin Sweeting 05:23

I don't... I don't think I was aware of space, actually, until quite late on, even possibly, really, when I was at my secondary school, I suppose, and for the moon landings. I think that's what awoke me to space. Prior to that, I had been really interested in radio, and I became a radio amateur. Again, you know, the attraction...

Tola Sargeant 05:48

And that was at Primary School was that?

Sir Martin Sweeting 05:49

Well, no, that was at secondary. That was at secondary school. Primary School, it was still the two cans and this piece of the string and replaced with a bit of wire eventually, but nothing much more than that. And then later on, again, I got exposed to the fact that there were radio amateurs, and you could talk to

people around the world, which, again, in those days, was quite different. In the Cold War, you could talk to somebody in Russia. It was quite exciting. And so I probably spent three or four years sort of involved in amateur radio. And then the Apollo moon landings happened, and then that sort of linked the two things together.

Tola Sargeant 06:26

That must have been amazing to see that.

Sir Martin Sweeting 06:29

Yes, it was. I can remember standing up and seeing Neil Armstrong coming down the ladder. I had a chance to meet Neil Armstrong later in life, which was sort of quiet something. So you see those two events. But yeah, so it was that that got me interested. And then I started reading Arthur Clarke's short stories on space and things, and that sort of just grew. But it was always this combination of, and I still have this fascination with communications and space and those two things sort of married.

Tola Sargeant 06:57

Perfect timing. Which subjects did you enjoy most at school? Can you remember, again, going back that far, were you always into sciences and maths?

Sir Martin Sweeting 07:07

I was, I was, curiously, I was actually better at English than I was at the sciences. I always was. I was very good at physics. I was not very good at chemistry, because I don't have a good memory. So everybody else could remember A plus B goes to C plus smoke or whatever the chemical formula was. You know, I could never do that. So I never really excelled in chemistry, physics somehow clicked. Maths was hopeless, because again I could, I could never remember the sequences, it just didn't click. So it always took me a long time to work it out from first principles, which got there in the end, which was very good, but hopeless in an examination environment. And the same with chemistry, you know, I could answer questions that other kids couldn't answer, because I could do it all from first principles. And they would just say, well, we haven't seen this before, so we can't do it. Whereas I would say, well, I've never seen it before, but I'll work it out from first principles. But of course it took a long time, so I never excelled at that. So English was actually my strongest point, and physics and Latin, curiously,

Tola Sargeant 08:13

Ah so languages, yes...

Sir Martin Sweeting 08:15

And yet I was, I was actually quite good at Latin, but hopeless at French, because I had a hopeless, hopeless French teacher, and I had a really good Latin teacher, and I think it just demonstrated to me the importance of having the right teacher. If you click with a teacher, it makes all the difference in the world. And I had a good physics teacher, and I think that's what helped that. And had a hopeless maths teacher, and I've lived to regret that the rest of my life. But it just goes to show, there's a lesson in there...

Tola Sargeant 08:47

Yes, even if you're not excelling at school in maths and chemistry and things, you know, you can do well... anything.

Sir Martin Sweeting 08:53

Yeah, and again, looking back one the interesting things was because I knew I didn't have that type of of, you know, retentive memory, which just looked at something and memorised it, and there it was. I had to do everything again, let's say, going back to first principles, deriving it, which gave you a great flexibility to adapt to new situations, but wasn't terribly suited to the examination process, where you had a limited time to do stuff and then later on in life, that ability really paid off, despite the fact that I could barely add up... well I could do more than barely add up but you know...

Tola Sargeant 09:39

What about computers because obviously we're quite interested at Archives of IT, in computing itself. Do you have any early memories when you first came across computing?

Sir Martin Sweeting 09:49

Yeah, I did, because I was at secondary school at that time, and I suppose I would have been maybe 17, roughly ish and um, and somehow, and I can't remember quite how, I made a connection with City University who had a computer. And again, I forget how it happened, but I managed to wheedle my way in to being able to use this computer to compute the distances between two radio stations for some reason, and it was very crude. You had, by today's standards, you had to work out your programme, punch it onto cards and it wasn't a question of with a keyboard. You had to have some strange finger combination on a on a mechanical puncher. And I would produce this and produce a little programme. I would.. living in Highgate I would go up to City University on the underground, put this in, go back a day later to find that I put a comma in the wrong place. And had to repeat and eventually, very laboriously, managed to get this very simple programme to work. And I, for the life of me, now, I can't remember how on earth I managed to wheedle my way into it, or what the connection was, but I did, and that was my earliest experience of computing.

Tola Sargeant 11:09

Things have changed a little bit since then.

Sir Martin Sweeting 11:11

They have a bit! And later on is... and of course, that was an important ingredient. Later on, when I got into satellites.

Sir Martin Sweeting 11:23

You would notice I had, I went to a prep school called Normansal. And that was a very curious prep school because it... and unfortunately, now it's closed... but it had no rules. And this, I think, was also a fairly formative part, because...

Tola Sargeant 11:39

And was this in the '50s?

Sir Martin Sweeting 11:44

It was 58 ish to 60 ish, I forget now. And my parents had decided, because I was a bit of a snively young kid, I think, and my parents decided that I needed to be toughened up. So they thought they'd send me to boarding school. And they went around and had a look at all these boarding schools. And then they went to this one, and they said the kids there looked really happy. So I was sent there, and my parents had no idea. But actually, the secret of their success was you had to turn up to lessons. Other than that. You could do whatever you wanted. And we would go and live in a grass hut in the grounds and wander off around the grounds at three in the morning, and things like this and that, I think, also was quite an informative part, because it somehow taught the degree, I know, of self reliance or independence or something,

Tola Sargeant 12:29

And you're presumably doing the sorts of things that are learning processes when you're out at three in the morning, building your hut...

Sir Martin Sweeting 12:36

Yes, exactly. And most schools would have not allowed that. And my parents, I never told my parents, so they never knew. They would have been absolutely horrified I'm sure. But it was a it was a wonderful experience in that regard, because it was, you know, it's always a bit like the sort of Swallows and Amazons type of experience. And again, that taught me a lot without realising it.

Tola Sargeant 13:00

Well it's like running around the garden as a child as well, isn't it. Without that, you lose so much.

Sir Martin Sweeting 13:04

Exactly, yeah, and I just feel today a lot of kids don't get the opportunity to do that. Anyway, no, that was an aside.

Tola Sargeant 13:12

What about A levels then? So moving from prep school to secondary school, and A Levels, what subjects did you do you do at A Level?

Sir Martin Sweeting 13:21

Well, I did. I started out, they looked at me and decided that I should do physics, chemistry and biology. And I thought, yeah, okay, I quite enjoyed biology. But then I said, well, I want to do Electronics and Communications. And they said, well, if you want to go to university, to do that, you've got to have maths. And so your maths not so good, to be frank. So biology is a lot better. And I said, well, that's not much good. So I did swap from maths, sorry, from biology to maths. And so I did physics, chemistry and maths. And because I did one year of biology, that meant I had to spend another, an extra year at school. And so I then spent had a bit longer to do physics and chemistry, and then the maths. And I just just about squeaked my maths. Chemistry was fine. I did the A and S levels in sorry, in physics and chemistry was a was reasonable, and maths was a squeak.

Tola Sargeant 14:36

And then you came to the University of Surrey, just down the road from here in Guildford, which was quite new at the time, if not brand new?

Sir Martin Sweeting 14:45

It was brand new. And in fact, it was a curious, a really curious coincidence that I came here because, having got my A levels, I then applied for university at Manchester, UMIST, which at the time, was the place for electronics. So I was very pleased to get in there. But I had a very good school friend who lived in Guildford and their family, and I came down to visit them the summer before going to Manchester. And one afternoon, we were a bit bored, and my friend said, well, yeah, and I said I don't know what to do, and he said well there's a new University being built, shall we look at it? And I thought, err well I'm not sure. But we couldn't think of anything else. So we walked down across Guildford and came into the university. And it was literally a building site, not very many buildings. And while we were sort of poking around in this, the door opened and the elderly gentleman came out. So yeah, what are you lads doing here? And I explained I was going to UMIST. And he said, and Manchurians please forgive me for this, he said, "Aw yeah, you don't go to Manchester", he said, "it's up north, it's dark and rainy, and you won't understand what they say," he said, "Why don't you come here it's a brand new university? You'll have a real opportunity", and so on. And I thought about it, I thought, well, yeah, why not? So on the spur of the moment, I said, okay, done. And I chucked in my place at Manchester and came to this new university, which nobody had ever heard of. Didn't really exist. But somehow there was something about it that just make me feel this was an interesting environment. And literally, it was the first year... the University was built upon Battersea technology. Sorry, Battersea College of Technology in Battersea, London. And so a lot of the staff came from there. The other academic staff came from industry around the country. And importantly, it was also - Battersea being the University of free Poland during the Second World War - So there were a lot of very qualified Polish technicians and lecturers. But none of them had any baggage or history. So they all came into this new university, completely greenfield site, but also the staff they were all new to each other, more or less, and so... And again, in hindsight, this was a really important juncture, because later on, when I started thinking about building satellites, they didn't have any baggage, any heritage, they didn't have a reputation to protect. And so they were much more open to crazy ideas, putting it frankly, which, had I gone to Manchester, and I'm sure I would have been compartmentalised into the things. But yeah, even looking back now, I can't quite believe that I took that decision literally on the spur of the moment almost without any evidence.

Tola Sargeant 17:30

Sometimes fate does amazing things doesn't it, looking back, and obviously, you're still here in Guildford 40-odd years later.

Sir Martin Sweeting 17:36

Yep, and I never expected to be. I mean, I always assumed that, yeah, I'd be here for a few years and then be off. So, that was one of the critical, you know, if serendipitous, events that happened. So I, you know, I ended up in Surrey, and it was literally not very many buildings, there was nowhere to eat, and I actually had to sort of camp out with my friend's family for the first year, because there was nowhere to stay, no accommodation. And in the second year, it started to take shape. So it was really well, it wasn't exactly a greenfield, a muddy field site.

Tola Sargeant 18:09

And were you doing anything related to space throughout your degree or in your PhD after that?

Sir Martin Sweeting 18:16

No, I, at that time, I was still really focusing on what I call amateur radio, which is shortwave communications. And so we had a radio club here. We set that up. And of course, it was a new club, so sort of built up friends and things around that. And then it sort of thought, well, maybe we could start to track some of the early, very early, satellites. Basically, it's a communications problem, so we built up some very crude equipment to track the early American and Soviet spacecraft and try to decode the transmissions and see if we could decode the images that they were sending. Now we see satellite pictures every day on the news now and nobody thinks about it. In those days, getting a picture from a satellite yourself, you didn't see it on television, I think, but getting it yourself was sort of pretty amazing. So we sort of built up our homemade equipment to do that, and that's where this combination of radio communications and space started to take shape.

Tola Sargeant 19:23

At what point did you think I want to actually build the satellite?

Sir Martin Sweeting 19:27

I suppose. Well, it took stages. Because first of all, I started tracking the American and Russian satellites. Then I realised there were actually a series of amateur radio satellites, and one of those amateur radio satellites was running into trouble, and needed somebody in Europe to keep poking it, basically to keep it going. And the American radio amateur said, hey, you've got this station for tracking these other satellites. Why don't you help us out with this? So we set up this which allowed us to communicate with that satellite in two directions. And so we had three or four years of of, of - which actually turned out again, to be rather essential training of how to communicate with a satellite that's misbehaving. And then at the end of that, I thought well, this is sort of interesting, and it was just at the time when the very first micro computers were coming available on the mass market. And I thought, well, yeah, it should be possible to to build a small satellite using some of this modern micro electronics, and that would sort of be interesting thing to do in my spare time. I was doing a PhD at that time on radio communications, nothing to do with space, right the other end of the spectrum, and so in my spare time, I would do this. I mean, I probably should have spent more time with my PhD. But luckily, my supervisors, academic supervisors in the university, were very tolerant of this, and encouraged me, I suppose. I mean, they were more than tolerant. They actually were supportive. And they thought this is an idea. And again, it comes back to this point that the university was new. They had no reputation to lose. Everybody was sort of here. The technical staff would chip in, the academic staff would chip in and help and and so the whole thing that sort of grew from, from that.

Tola Sargeant 21:25

Did you ever think you'd actually be able to launch a satellite? I mean, at the time, satellites presumably were the preserve of the USSR and the and the US and NASA.

Sir Martin Sweeting 21:36

And that was it, yeah. And the reason I thought it might be possible, is because there had been, since the late, sorry, mid 60s, there had been a series of amateur radio satellites, which had been constructed in the US and also a little bit in Australia, so and these were groups of enthusiasts who basically worked for NASA, actually, and in their spare time, they built these little satellites and NASA launched them as piggyback payloads for free on there, where they launched a big satellite. So I, having spent, you know, a couple of years helping them out with their misbehaving satellite and got to know them, I said, Well, yeah, we'd quite like to do that in the in the UK. And so they were very helpful, and they provided, you know, quite a lot of support. And importantly, these guys worked for NASA. So when our project started to take shape, and I said, well, actually, we will do this, in addition to sort of giving us a bit of guidance and experience, they also introduced me to the launcher people in NASA. And it was sort of, again, interesting, because the again, this would have been 1977 ish, I guess '78 and the Apollo era had sort of come and gone, and all the excitement in NASA on Apollo had sort of died down. And a lot of the people in NASA were saying, I'm not quite sure what we're doing now is not, it's not very interesting. And then in their eyes, you know, these Brits come over with this crazy idea of doing that and they said, well, yeah, that's sort of fun. Yeah, we can't believe it's actually gonna work or anything. But yeah, they're British and sort of cute. And yeah, and a bit of a laugh and yeah, we'll help them. And so, so, so we made very good friends with some key people in NASA, and the people that they contracted their launch to, McDonnell Douglas, who rather took us under their wing and sort of said hell, we'll try and help these Limeys out. And so it grew from there. And they said, well, yes, we can, we can probably fit you on one of our rockets. You know, if you make sure you don't fall apart

Tola Sargeant 23:33

As a free payload?

Sir Martin Sweeting 23:40

As a free, as a free, free piggy back. And so that's how it really started,

Tola Sargeant 23:47

Amazing. And can you remember that first launch, the first time your satellite went, I mean you must be able to?

Sir Martin Sweeting 23:53

Oh yes. I mean, yes, it was. And I mean building it, it was literally built on the kitchen table. Parts of it, not all of it. It's about the size of a small fridge...

Tola Sargeant 24:11

Ok, a sort of under-the-counter fridge?

Sir Martin Sweeting 24:13

Yeah, under the counter, so a big washing machine type size, and it weighed about 70 kilos. So yeah, about washing machine size. And yeah, which meant that you could actually physically handle it. You didn't need any fancy equipment to do it. We built a clean room in one of the university laboratories, going down to B&Q and buying wood and polythene and putting it together and using a vacuum cleaner running in reverse to keep the dust out, and things like this. So it was and yeah, I remember the launch.

And in fact, it was quite interesting, because when the NASA folk would come and visit us from time to time and see how we were getting on, and I don't think they were actually convinced that the satellite really existed. But yeah, the first launch, I definitely remember. I wasn't able to go. You had a difficult choice. Do you go to the launch site and watch the launch, and then you have to come back to UK, which would take a day or two, in those days from West Coast of America, and the satellite was sitting there, going round and round and round, waiting for you, or you stay here, and when it's launched, you can communicate with it. So in the event I stayed here, and one of my colleagues went over to watch the launch. So I - and because there's no TV in those days...

Tola Sargeant 24:15

You couldn't live stream it on your mobile phone...

Sir Martin Sweeting 25:06

No, no mobile phone. But what they did manage to do is the Americans very kindly set up a telephone link so I could actually hear the countdown, and then they reported as things went. So it was, and of course, trying to think whether, you know, will the rocket work or not, or, you know, will it come off? And then, you know, obviously, once it's they say, yep, it's released into space. And, oh, that's really fantastic. Well, the next thing is, how do we find the thing, you know, and how do we track it? How do we get it to work? And by today's standards, you know, we really... it was very, very crude and difficult. String and sealing wax, you know. It really was. So, so the big challenge everybody thinks these days, you know, building a satellite is the difficult bit, actually, yes, it is hard. The really hard thing is operating it successfully in orbit, because the satellite flies over for only 10 minutes at a time. You only see it four or five times a day. Most of the time is out of range and doing its own thing, or not. And you communicate through this sort of crackly telephone line in those days to it, if you like, with lots of errors and so on. You can't see it, you can't press the reset button. You know.

Tola Sargeant 26:43

Even an international phone call in those days would have been a challenge.

Sir Martin Sweeting 26:47

Yeah, absolutely. So, and that's where the years previously of doing the work tracking the American and Soviet satellites and then the amateur radio satellites really paid off, because we had all of that experience, which we then applied to communicating with our own satellite, which was difficult, it was a real challenge.

Tola Sargeant 27:09

So you launched your first satellite - first two satellites maybe? - and then decided to form Surrey Satellite Technologies Limited?

Sir Martin Sweeting 27:17

Well just, just before that, we launched the first satellite, actually it worked, much to the surprise of everybody, and actually it was really good, because it encouraged... er we had a huge audience of schools who were tracking it, because we deliberately designed it so that the transmissions on the

satellite could be picked up using a very simple VHF receiver, which was affordable, easy to be bought those days, and you could link it into the very first of the home computers called the BBC Micro.

Tola Sargeant 27:47

Oh gosh, yes, I remember that.

Sir Martin Sweeting 27:49

And if you did that, you could then see the telemetry coming down, and the kids could then, as well as us, understand what was happening on the satellite. And then we learned on our second satellite, skipping that for a minute, we could upload, like a new a weekly news sheet. Now, if you think in those days, before the internet, people around the world could pick up the satellite and they would download this news sheet every week. And this created a huge interest, and was sort of, sort of before the internet evolved. It was sort of, we used to get lots of postcards and letters coming in and from people all around the world who picked this up and downloaded it, and then we could put this onto the new sheet and transmit it, and it would be picked up worldwide. But after the first satellite, just for a moment, going back to that, that was working fine. And one day, our friends at NASA rang up and said, look, you know that actually, surprisingly worked quite well and was sort of fun, and we enjoyed working with you. And we just happened to have a slot on a second rocket if you want to take it up. And so without really thinking, I said, well, yeah, absolutely, we'd love to. We learned a lot the first one, we certainly could do a better job on the second one. And they said, well, that's great, but the bad news is, you've got to be ready in six months, and it'd taken us three years to build the first one.

Tola Sargeant 29:11

Oh my goodness.

Sir Martin Sweeting 29:12

So cutting a long story short, essentially, we had to work literally, day and night for six months. And to be honest, we were still building it when we arrived at the launch site, and we had NASA banging on the door saying, you know, we want to put you on the rocket. And I was still there saying well just a minute. I need to do just a few more little tweaks so and it was physically and psychologically very demanding for the team, because...

Tola Sargeant 29:42

How big was the team? Was it you and a few mates?

Sir Martin Sweeting 29:45

Well no, a bit more than that by then. There were mates, you know and everybody, plus plus the people in the university, technicians and academics, who were helping. But the core team, essentially were working from round about 7.30 in the morning until 3.30 in the morning, and then we would have three and a half hours sleep, and then start again, seven days a week, all the way through for six months. And when you look at the photos of people at the end, they basically look like Zombies, including me. But we did it you know, by the skin of our teeth, and that satellite is still actually transmitting today. It's got a little bit cooked with radiation. So so we, you know, we used that for disseminating these new

sheets and things like that, that no longer is available. But one of the other interesting things we did on it was to... there was a kids' toy called Speak and Spell.

Tola Sargeant 30:40

Yes, I remember it well, yeah.

Sir Martin Sweeting 30:41

Oh indeed, wow. And what we did was we took the chip out of that and put it in the satellite. And so when the satellite worked out its temperature and voltages and currents, it would then feed that into that chip, and then it would speak it in this robotic voice. So you could then have kids with the radio, even without their BBC. And as it flew over, you could hear the satellite, going, you know, 'the temperature is 48 point degrees centigrade'. And so a lot of school kids and radio amateurs would track it, and they use this to write it down. And the sort of ultimate thing on that was the Russians and the Canadians, for reasons I never quite understood, decided they wanted to ski from Russia to Canada via the North Pole. I never asked them why, but they did, and they set off. And what they found of course in the North Pole, compasses don't work, because they just point down. And this was before GPS and all that. So while they were skiing, they didn't know where they were each day, so they didn't... they couldn't sort of correct whether they were heading for the North Pole or somewhere else. And the Russians contacted us because they'd heard about our work, and they said, look, the ski party has a little beacon which bleeps all the time. We pick it up in Moscow. We can compute where they are, but we can't tell them. So if we send you the coordinates every day, can you put it into your digi-talker, and they can listen, and you'll say you are 90, 87.3 [degrees] North and so many West. And we did that for about six weeks, I think it was, and this ski party used this to plot their way all the way across. And when they got to the North Pole, the Russians said, Would you like to go meet them at the North Pole? And I thought, wow, that's sort of interesting, but I thought hmm you know this was during the height of the Cold War. Is this really advisable? And so I took advice from Her Majesty's Government, who said, probably not advisable. Why don't you send somebody else? So I sent one of my colleagues who went there instead.

Tola Sargeant 32:49

Did he come back?

Sir Martin Sweeting 32:50

He did come back, and eventually he married a Russian lady as well, actually, but that's by the by. So that was a really interesting sort of experiment, before all the internet, before GPS and Sat Navs and everything, which was that second satellite, and it's still transmitting today, in a slightly sort of aged way.

Tola Sargeant 33:14

I guess you've lost the Speak and Spell?

Sir Martin Sweeting 33:18

Yeah, we lost the Speak and Spell. It still transmits its telemetry, but the numbers are garbled. It's been cooked by radiation.

Tola Sargeant 33:26

It's an amazing story, though.

Sir Martin Sweeting 33:28

Anyway, yeah, so anyway, that was really what ended up. And then after having built a second satellite, they said, well, actually, this is sort of fun, and we really could do a lot more than this. But it was just at the time that Thatcher had cancelled the UK space programme, the launches and everything, and the university said, well, look, we've helped you and supported you financially as well to do this. We can't keep doing that. And what I didn't say, the first two satellites were very strongly supported by British industry. I went out to all of it, went around British industry and and badgered to them, to the until they gave me bits, or let me use their equipment, or their test facilities or or whatever, both industry and also the government establishment sites, the Royal Aircraft establishments and GCHQ. And you can only do that twice. It's very difficult to go around and do that a third time, because people say, 'well, yeah, you've had your fun. Go and get a proper job'. And in fact, I was told that, okay, you've done that, go and get a proper job. And I did have a few interviews, and I decided, well, I'm not sure, a proper job really suits me. So I came back and thought, what are we going to do? And I thought, well, I think there is, there was some early interest from international players. They said, What you're doing is quite interesting. We can't afford to do space like NASA and so forth, but maybe you could help us take our first steps into space. And so we said, well, we going to have to set up a company to do this, because otherwise, you know, you've got to manage these relationships, and the university wasn't really set up to do that type of thing. So that's why we formed Surrey Satellite Technology Limited.

Tola Sargeant 35:09

And it was a spin out from the university?

Sir Martin Sweeting 35:10

Yes, I mean, it was a university company, essentially. And I suppose it was 40 years ago, almost today, that, yeah, we, we we thought we'd go and find an investor. So we went down to speak to an investor in Wiltshire and said, look, we're thinking of setting up this company. Would you like to give us, you know, invest in it? And talking to them, it didn't really sound like it was going to help us, so we thought, well, why don't we just start anyway, with a, you know, with whoever we can muster, and we've got to think of the name of the company. So we were driving back along the motorway and thinking, well, what should we call the company, this and that and the other? And I said, well, I think Surrey gives it an identity, so let's have it Surrey something. And then we thought well it's satellites, so, you know, Satellite. And then we thought well, should just be Surrey Satellites or whatever. And they said, well, it's not science and it's engineering, so we thought well it's sort of technology. So that's how the Surrey Satellite Technology Limited came. And, yeah, that's, that's how the name came.

Tola Sargeant 36:10

And it's still with us forty years later.

Tola Sargeant 36:12

[Laughs] You might owe him a drink or something!

Sir Martin Sweeting 36:12

And it's still here, amazingly. And so it started out just literally, with about four, four people. I asked the university, I said, well, can you... we need a little bit of money and sort of a bit of a bank loan, if you like? And I said, well, I'll put in 100 pounds, but then I didn't have 100 quid, so I borrowed 100 pounds from the Vice Chancellor in order to put it in. And he claims I never paid him back. I'm sure I did!

Sir Martin Sweeting 36:19

Yeah! But anyway, eventually they did okay, because they sold the company for a lot more than 100 pounds. So that's how it started, and it was literally just very small. And of course, in those days, university spin outs were not quite common, not common. And in fact, to be honest, other academic institutions, that will remain nameless, rather looked down their nose at Surrey and said, look, you aren't real academics. You're sort of actually making things when you're doing something, rather than contemplating the nature of the universe. And so the whole idea of actually making something was considered not really, not really what academia is all about.

Tola Sargeant 37:25

But the business grew organically? You didn't ever take any VC or private equity investment or anything like that?

Sir Martin Sweeting 37:31

The University insisted, probably sensibly, they felt if they just left it to me, you know, perhaps I was a bit too wild, and so they they had a consulting company who took a small shareholding and in return, sort of advised on how to sort of structure the company as a company. And they stayed with us for quite a number of years. They didn't do a lot, but they did give us a little bit of credibility when we were out talking to customers and things, because it wasn't just the university company, it was a university company with a quite well known consulting company associated with it, which gave us a little bit of street cred, I suppose.

Tola Sargeant 38:22

Opened a few doors, maybe.

Sir Martin Sweeting 38:24

Yeah, but the university was the major shareholder throughout.

Tola Sargeant 38:28

And I gather Elon Musk showed an interest at some point? Can you tell us a little bit about what you were doing with him and his conversation?

Sir Martin Sweeting 38:36

Yeah. I mean this fast forwards about 10 years, and the, I think it was right year, 2000 roughly. And we'd done quite a few contracts. We've done, we did a contract, we built satellites with South Korea, with Portugal, with Thailand, for the French. I think from what I can remember in that period of time. So, yeah, the company was sort of motoring reasonably, I guess we would have been 100 people by that

time. And I went to the US to attend the, what was then the National Space Symposium in Colorado Springs, which is a big gathering, predominantly of DOD people in the US. And one day, I was sort of just having breakfast sitting outside, and got a phone call - that time. We did actually have mobile phones, just about. Crudely. And said, look, we got this chap who he was, somebody I knew, sort of remotely not very well. And he said, Look, this chap come to see me, and he he's just made some money, and he's really interested in space, and he wants to put a greenhouse on Mars to show NASA that you could do this type of Mars mission quickly and at a fraction of the cost. And nobody will listen to him. You know, it's crazy, crazy, but we thought you would be the sort of - you know he didn't actually say so but the implication was...

Sir Martin Sweeting 39:56

Exactly on the right wavelength, possibly crazy! Would you mind talking to him? I said, yeah, sure, yeah, happy to talk to anybody. And so we, so the next day, Elon flew out. I think at that time, he had his own MIG jet as well. He flew down to Colorado, and we had breakfast together, sitting outside and and he said, I'll do this. I want to show I want to get onto Mars. Want to show it can be done. So I said, yeah, great. I said, well, yeah, I'm happy to help build a greenhouse and show that you can do something, you know "greenhouse", inverted commas. But I said, the problem is, how you gonna get there? NASA is about the only show in town, really. And, yeah, I can't see them playing ball. I said, we've been using the Russians, because at that time during the 90s, we were using the Russian decommissioned nuclear missiles to launch our satellites. There's another interesting experience. And so I said go and talk to them. So Elon went and talked to them, but he didn't get on with them, and nor they with him. They just weren't on the same wavelength. So he came back said, oh, this isn't going to go anywhere. I'm going to build my own rocket. And then he said, well, the university, at that time was starting to say, look, you're getting a bit big for the university, and you need more money, and we don't have money to make you grow. You need to invest and you're taking on projects which have substantial liabilities, and if they did go wrong, the university doesn't have money. You know the only things they've got are buildings and students, and they wouldn't get much money for the students! So they said, we've got to make a change of ownership. And Elon said, well, look, I'll come in as an investor on this and see if we can navigate this. So he's he joined us, and he sat on our board for, I think, from 2006 to nine, so three, four years. And of course, that's just when SpaceX was just starting. People weren't really taking it very seriously, and he was trying to build it all up. So got to know him quite, you know reasonably well at that time. And that was interesting, interesting time. I'm just going back prior to that, as I mentioned that we launched from the Russians. Spent quite a lot of time in Russia during the '90s, which was after the fall of the Soviet Union, but before Putin. And it was a really interesting time to see that country, and also to see the technology that they had on their missiles and so on. And we used their sort of repurposed missiles, SS 18, to reprogram software, so it didn't come back down again, but to keep going up and drop us off in orbit. And it was very, very, very capable launch capabilities. And really interesting to work closely with them.

Tola Sargeant 40:07

You were on the right wavelength?

Tola Sargeant 42:40

You launched from Russia?

Sir Martin Sweeting 42:44

From Russia, from Russia, from Koretz and from nearby Canur. And yeah, it was really interesting working with them and also listening to their view, because it was just after the Cold War. You know I spoke to the people who designed these missiles in order to land on us and to listen to how they viewed the Cold War from their perspective, as opposed to our perspective, was fascinating. But anyway, that was whole different story. Yeah. So Elon was yeah, he was the shareholder I forget, with the percentage, I mean, 10, 15% of them I forget. And he helped guide us through the transition. We had to find a new owner, and we actually took, I think, nearly nine years trying different potential mixes. We went out to the market and said, look, you know, look for people we had, you know, offers. None of them really sort of felt right. Let's do it again second time. Still didn't feel right. To the university's great credit, they said, we will stick with it until we find the right one. And eventually we had, you know, it was a dozen or so people, and Airbus gave the best guarantees of looking after us, if you like. They weren't the highest bidder quite, but the university and the government, at the time, said, no, this is a, you know, the best mix. And then Elon - Airbus wanted to buy 100% - so Elon then sold his share with a profit and he'd go on to do other things.

Tola Sargeant 44:26

[Laughs] Yes, he has certainly been busy since!

Sir Martin Sweeting 44:31

Yes indeed! And he very kindly invited me to his, one of his weddings, which he held in Scotland. And it was, it was great fun. And then later, with his, his his second wife, then Talulah Riley, who was English, curiously, went to school right next to me.

Tola Sargeant 44:50

Oh, gosh, yes?

Sir Martin Sweeting 44:51

But not at the same time. And they, he had his birthday party for her up in the Tower of London and and he said, oh you've got to come in in mediaeval gear. And I thought oh how do I get from Guildford to the Tower of London in mediaeval gear? So in the end, I just went on the internet, I hired a Black Adder costume. And then I thought, well, I'm just going to go on the train and the underground. So there was I sitting on the train and underground as Black Adder and, do you know, nobody batted an eyelid! Sorry, that was a bit of an aside. So, no, so, you know, it was fun.

Tola Sargeant 45:29

Yeah, yeah. Fun. And investment. And, you know, just the right type of person, presumably, at that point in time to help.

Sir Martin Sweeting 45:36

Yes, he did, yeah, he did. He helped a lot, actually. And, again, he sort of gave, I think, he supported the university, and that sort of vision that he had, and that sort of rubbed off on us as well. So and

we've seen, I mean, he obviously hasn't, he's moved on into a whole different scale of things to us, but we've kept in contact off and on since then.

Tola Sargeant 45:59

And coming back to Surrey Satellites. I wanted to talk about the Surrey Space Centre too, which I think you're still involved in at the university? And the ties the university remain quite close?

Sir Martin Sweeting 46:11

Yes, I mean, I think the, again, the trick here was that when we formed the company, it actually was sort of, you know actually lived inside the academic research team. And it was a small bit of it, because the research team, research team was, I know, perhaps 30 people. By that time, 30 to 40 people, and there was a company of three or four people. And then slowly the company grew. We were cohabiting in the same building. And this was really another one of those sort of serendipitous but key things is that, because of the close interaction here, we shared coffee facilities and everything else. There was this interplay between the academic research and the commercial exploitation, which is very difficult to do if you just set out with two different groups and say, right, get together and collaborate. But because it grew up this way, we found that that synergy was extremely effective. It allowed us to have new ideas from the research team and then exploit them, and then the results of that exploitation fed back into the research. And it also allowed us to do training programmes and so, and it still is, one of our major projects is, or products, is training developing space nations to develop their own safe Space capability. So we could bring in a team of perhaps a dozen engineers from, and we did it from from South Korea, first, from Thailand, from Algeria, from Nigeria, Portugal, Malaysia. They come and live with us for a year or two, learn how to do something, then go back, and having that academic environment allowed us to do that, where a company would find that very difficult. So this living together worked very well. Eventually we outgrew that, just physically, but it still continues. And so the the academic team, then sort of has its own academic focus. The company had its own sort of commercial focus. And so the academic team formed, eventually the Surrey Space Centre, which was essentially academic for research and teaching. But we keep this close synergy, because that really, when you look around the country, it's quite difficult to see other examples of where that's worked and it really has paid off.

Tola Sargeant 48:27

I wonder what you're doing differently. I wonder what the secret to that success is?

Sir Martin Sweeting 48:31

I'm not sure it's a magic ingredient other than co-location, because what we did notice is when we outgrew the campus and we moved, which is about one kilometre away, we might as well have been on the backside of the moon. Because you think about, and I still find that today, I think, oh yeah, I love to go and chat them. It's going to take me 10 minutes. Got to go drive across park the car, go and see somebody...

Tola Sargeant 48:56

You lose those water cooler moments.

Sir Martin Sweeting 48:57

Yeah, precisely. And, you know, I've always argued very strongly for co-location, and we've never managed to recapture that. So now we have to work quite deliberately at it. I mean, fortunately, we have that sort of genetic material in our relationship, so we can build on it, but it's much harder. It takes a lot more effort and isn't as effective as it was when we were cohabiting.

Tola Sargeant 49:25

I mean, you have that continuity as well. There cannot be many businesses in the UK, or anywhere, where the founder is still involved 40 years later, and, you know, very actively involved. So you must be doing something right.

Sir Martin Sweeting 49:41

I love your judgement. Yeah. Yeah, it is and if you said one magic ingredient it is co-location.

Tola Sargeant 49:50

Anything you'd do differently over those 40 years?

Sir Martin Sweeting 49:53

That I would do different if I replayed it? People ask me this, and when I stop and think about it, the answer is nothing. And that makes me think, well, that's a bit either conceited or foolish. There must be something you do. Of course, there are lots of little things that we do. I think probably the one thing that I feel we haven't ... could have done better, is that it's easier an academic environment, was more difficult in a commercial environment, to cater for extremely capable, able people who have a difficult personality. Shall we say? You know, though, there, we've had a number of those over the time who have been extremely capable in their own sphere, but cause a lot of collateral damage around the company, just not, not maliciously, but...

Tola Sargeant 50:52

Over 40 years, that's bound to happen though.

Sir Martin Sweeting 50:55

Yes, so we probably had half a dozen of those sort of people. And in the end, they've all had to sort of move on out because you know whilst I could cope with it, a lot of my colleagues found that just too irksome or infuriating.

Tola Sargeant 51:14

Not in the best interests of the business...

Sir Martin Sweeting 51:17

Yes well um, you know if you come along and sit behind somebody and say, well, that's not the best way to do this. Yeah, you should be doing that, and they're right. You can do that once or twice, but if that's your modus operandi, it's for people who perhaps, perhaps aren't operating at quite that level and maybe don't have the right self confidence to fight back, they can find that very difficult. And I think just thinking about it that's the one thing that I feel, you know, I wish I could have found a way to make use

of that, because some of these people had really remarkable capabilities, and did, and could have continued to, make a huge contribution, and we somehow didn't manage to keep it.

Tola Sargeant 51:58

That said, I've been watching on LinkedIn and things your sort of 40 year anniversary celebrations, and you seem to have a lot of employees who have been here a very long time. So I mean with that loyalty, you must be doing something right? Why do you think people stay so long and enjoy working here?

Sir Martin Sweeting 52:20

I think it's an exciting area. It's pretty taxing, you know, because we don't sort of drive people hard to make money - we should make money, of course - but I mean, we want to do something different, so we try to do things that other people aren't doing, and therefore it's difficult, and therefore you tend to work pretty hard, actually. So it's exciting, challenging, but it's quite hard work. The other thing, and actually this is something that COVID has interrupted unfortunately. Perhaps it goes back to something I would change. Up until COVID, I met and with every new person that joined the company, we'd sit down, we'd have an hour, sometimes in a group of three or four people, and just talk about the company, what they're doing and whatever. So I got to know them as individuals, and then even with a company of 300 and you may recall, I don't have a good memory, so I'm really bad at names, so but you know, I would know them, and I better talk to them. I know roughly what they're doing and that personal interaction, I think, was very important. COVID broke that spell a bit, and it's proving really quite difficult, even several years after COVID, to re form those links with the people who have joined since then, because it's quite a few people, and you can't sort of catch up sensibly. So we're trying to find out other ways to do it. But I think up and up until COVID, that was an important ingredient, because they had a personal link to the to the to the company, and to me and others in the company, and that connection is really important. And interestingly, at some point I don't forget 10, I suppose, 10 years ago or so, the company was growing, and we grew up to nearly 600 people. And I felt at 600 people, there were people in the company I didn't know or recognise, and I didn't like that, and I also felt that the company was getting into a different mode of operation, and so we deliberately allowed the company to shrink back to and the optimum was probably in the 300 to 350 400 because at that, you can have a relationship with individuals in the company to a greater or lesser extent, obviously, depending.

Tola Sargeant 54:46

You recognise them...

Sir Martin Sweeting 54:48

Yeah, we recognise them. They know you, and the communication within the group is reasonably effective, and it doesn't become too impersonal. And I think that's about the optimum size of the firm.

Tola Sargeant 55:00

I can see actually right throughout your history and the history of Surrey Satellites, you've had really close relationships with schools and with education and with university. If you were talking to young people today who are just starting out, would you recommend a career in the space sector still? What advice would you give so maybe somebody at primary or secondary school?

Tola Sargeant 55:22

Something that you're passionate.

Sir Martin Sweeting 55:22

Well, my first bit of advice is, whatever you do, if you have the choice, choose something which you're interested in, something that stimulates and not everybody will find that, of course, you know, but if there is something that you're interested in that will make your, you know, I sort of feel I'm really, really lucky, because I don't think I do a day's work in the sense of, you know, I come and do things because I enjoy it. There's good days and there's less good days, of course, but yeah, I'm doing something I really enjoy, and fortunately, I get paid for it. Now not everybody has that opportunity. But if you can find something that you that you're interested in, because that will make life easier and you'll enjoy better. Should you go into space? If you find space interesting, and it's a challenge, yes, because space is definitely, is already playing a huge part of our daily lives, and it's going to play even more. And I've just finished a study for the Royal Society, looking at space in 2075 you know, and kids today, all things being well, are going to be alive in 2075 and space is going to have a huge impact on on everybody's life, whether you're in space or not. Yeah, space is a good, good thing to get into, but do something that you're interested in.

Sir Martin Sweeting 56:17

Passionate, yeah, not everybody can be passionate about it. Maybe I am lucky there. Certainly if you find it interesting, then, in a way, every day is enjoyable.

Tola Sargeant 56:54

We'll come on to the future in a minute. But I don't think a lot of people actually realise how important space and satellites are to our everyday life now. I mean, maybe you could just say a little bit about that?

Sir Martin Sweeting 57:08

I mean most people don't realise how dependent we are on space, because every time you switch on the light, actually all of our utilities, electricity, gas and communications, coordinated and timed by from space, you know, you have get into a car, use your sat nav. That's all coming from space, combined with, you know, 5G and what have you. You know, we rely on space for for weather, for communications, clearly, the internet. Yeah. So yeah, if space stopped, actually, our life would come through pretty well, a grinding halt almost immediately. And you know, we would be in serious trouble within a few days. So it's absolutely embedded in our everyday life, and it's only getting more so.

Tola Sargeant 58:04

And of course, there are many more satellites in orbit now than there were 20 years, or even a couple, even a couple of years ago, thanks, in no small way, to Elon Musk, Starlink, SpaceX. I mean, what impact is that having on your satellites, on the industry generally?

Sir Martin Sweeting 58:24

Well, I guess there's two ways. I mean, first of all, it's providing another layer of communication. So we've had geostationary satellites, and we've had landlines and fibre and so forth, and we've got this network in the middle. And now the communications that we use is a mix of all of those. So, and I forget where Elon is up to, it must be seven, 8000 satellites now, or eight, 9000 maybe. So that's a huge number of satellites. And if you just look at the number over the years it's increased hugely in just the last three, four years. One of the side effects of that is, is the congestion. Space is big, the number of satellites is still relatively small compared to the number of bits of debris. There's about a million pieces of debris, probably, let's say, 1000 maybe 12,000 satellites, something like that, 15,000 satellites in total, including all the previous ones. So the chances of debris interacting and hitting on these satellites is much increased.

Tola Sargeant 59:32

Debris is anything that's come off another...

Sir Martin Sweeting 59:35

..old satellites, bits of old rockets, spanners that astronauts dropped, and even little flecks of paint or something size a nut or bolt, the size of a pea, travelling at 20,000 kilometres an hour makes a huge impact on something. So even the little bits of debris are really important. And so what we've seen is that whereas 10 years ago, we would get warnings of a potential collision once every few months or something. Now we're seeing it once an hour or so, and we have to decide, do we manoeuvre out the way? Do we leave it or whatever? And so that's from the satellite point of view, and also from astronomical, scientific observations on the earth. Now there's all these, this sort of cutter in the sky which is interfering with astronomical observations. So this is the environmental aspect of that is quite important, and we need to make sure that when our satellites get the end of their life, they're they, they're disposed off in an appropriate manner. So it is a key issue, but it's one, fortunately, that people are waking up to, but policy and regulation hasn't caught up with it yet.

Tola Sargeant 1:00:45

So that's one of the areas where there's likely to be investment and startups trying to do something to capture the debris and help. Any other areas that you think stand out as of interest, or if you were starting out now in research or business, what areas of space tech would you be thinking about?

Sir Martin Sweeting 1:01:06

Yeah, I mean, just to go back to debris for a minute. I mean, we did a very interesting and again, this is sort of things we like to do this first of a kind, we built a satellite and we said, well, if there is debris, we want to be able to capture it. So we tried, we built a satellite to demonstrate two methods. And there's nothing new under the sun, the Romans did all of this, you know, 2000 years ago. So we had a satellite where we ejected, we decided to bring our own debris, so we ejected a little baby satellite off it, and then we used a Roman net, deployed a net to capture it and then to bring it back. So if we had this uncooperative bit of space debris, you could capture it in a net, just like the Roman gladiators did. And then the other one is, if it's a huge bit of debris and you can't get a net big enough, then we had a spear. So we had a harpoon, which then would go into it without creating more junk, and then we'd pull it in. So we launched a satellite, we put a video camera on it to watch these so you can actually go on the internet now and see this. If you do 'removeDEBRIS' and it will come up, and you can watch the

video of the satellite actually demonstrating these two things. Now that then subsequently was picked up by a Japanese company called Astroscale, who then are in the process of developing a commercial business to do this. The problem is, like a lot of environmental stuff, who pays for the cleanup? And at the moment, that's not clear, because it's expensive. You can't clean all of it up, you know, it's just not practicable. So it's a question of, how do you remove bits of debris which pose the biggest risk, and who pays? And that's a developing thing. So, you know, that was a relatively new bit of commercial development, but if you say, what would I go in if I was starting again now?

Tola Sargeant 1:02:49

What excites you the most?

Sir Martin Sweeting 1:02:50

I think it's the applications - and AI covers a wide range of things, so it's machine learning, AI approaches and so forth. So it's this type of advanced computing process. How do we manage space traffic control, if you like, more effectively? How do we utilise the space environment in terms of making better use of the imagery and so forth from satellites? How do we now move manufacturing into orbit so you know, the space station has showed us, the International Space Station, has shown us we can make new materials, new pharmaceuticals, but they're in tiny quantities. Can we now start to do this at scale, by in-orbit manufacturing? So those are the immediate term things that I think, you know, I'd be looking at.

Tola Sargeant 1:03:38

And if we look further ahead, you mentioned the Royal Society report, which you led, looking to space in 2075 that's 50 years away. If you were to polish your crystal ball and look into the future, what do you think we'll be talking about in 2075?

Sir Martin Sweeting 1:03:55

Ah - the opening opening statements on the report is, we are not trying, well, I'm not trying to predict the future because we'll get it wrong. There's no doubt, absolutely no doubt. However, what we can ...neither are we saying we should do this or shouldn't do that... but what we're saying is just look at where we are today, and look at the direction of travel of our technologies and what we're doing, and if you project those ahead as best we can, these are the sorts of things that might come out of it. So for example, I've already mentioned in-orbit manufacturing, space tourism around the moon, a human base on the moon, rather like we have on the Antarctic, possibly commercial activity on the moon for exploitation of materials, putting up scientific instruments on the moon, later on Mars. A lot of this will be done robotically initially. So build all the habitats with robots. But then, if you have people working on the moon for extended periods of time, there's all manner of ethical and sociological issues that you need to look at and legal. So it's not just the technology. We have to be thinking about the ethics. If we do go to Mars, which won't be in the near part of that, but you know, if, as we get towards '75 maybe we will be able to have a human outpost on Mars. The moon is a day trip, so if something goes wrong, you can nip back - a little bit more to it than that, but you know broadly. But Mars isn't, it's 18 months probably. What happens if you have children born on Mars? They will have physiological implications. What are the ethics of that? You won't be able to stop it. But how do we deal with it. If you have a human workforce on the moon, how do you organise that and safety, and more, all of these things? So

we were sort of trying to say, if these things unfold as we suspect they might, can we start thinking about them now so we'll be better prepared for when they happen? And sort of thinking back to the '80s, when the internet was beginning to be formed, if we thought about the implications for society, hopefully we might have made a slightly better job of being prepared to deal with it. So for space, and as I say, teenagers are going to be living through this, at least. How can we be aware of this evolution? And as it evolves, we can say, well, we ought to be thinking about this for the next step and so on. And so the purpose of the report is basically to try to get people to stop and think about what space might mean for them as it evolves, and hopefully, naively, hope that they might, we might, get slightly better.

Tola Sargeant 1:03:59

Make us a little bit more prepared.

Sir Martin Sweeting 1:05:39

Yeah, a little bit more prepared, because and it won't be exactly as we put it, absolutely no doubt, but at least if you're aware, and thinking about it, and I don't think we are at the moment, then I think, yeah, we'll be better, better off.

Tola Sargeant 1:06:37

It does impact every area of our life. Yeah, hugely important.

Sir Martin Sweeting 1:06:50

It does. I mean, just like digitalization has transformed society, this will have a similar effect. So let's not sleepwalk into it.

Tola Sargeant 1:06:57

A huge area of opportunity that we need to be aware of.

Sir Martin Sweeting 1:07:00

And getting back to your question about youngsters, what should you get involved in in space? Space is not just building bits of satellites. It's everything from finance to safety to policy to legal to ethics to medicine, all of that is in space, you know synthetic biology. So you can be a biologist in space, you can be a lawyer in space. You don't... it's not necessarily just the technology... and sociologists, how are you going to organise societies that have to work so remotely?

Tola Sargeant 1:07:36

Fascinating stuff. Thank you ever so much, Sir Martin, that has been a fantastic conversation.

Sir Martin Sweeting 1:07:43

It's been enjoyable. Thank you for listening to me.

Tola Sargeant 1:07:48

Oh no, thank you for sharing your story with us!