



CSIRO Oral History Collection

Edited transcript of interview with Colin Adam

Date of interview: 15th August 2018

Location: Colin Adam's residence in Melbourne, Victoria

Interviewer: Professor Tom Spurling



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Dr Colin McLean Adam *BMetEng (Hons), PhD (Qld), FIEAust, FTSE*

Summary of interview

Dr Colin Adam was born in Melbourne on 6 October 1943. His father was an electrician working in the Royal Australian Air Force as a Technical Instructor. After the war, the family moved back to Queensland where Colin's father worked as a technical teacher at The Scots College and the Post-Master General's Department. Colin's paternal grandfather was a marine engineer who tried in vain to interest Colin in a career in the merchant navy. Colin's father had to move around South East Queensland to gain promotion in the PMG so Colin went to a number of schools. He recalls the influence of Miss Kennedy at Coorparoo State School who encouraged him to read widely. His longest period at any one school was at Camp Hill State High School where he graduated as the top male student.

Colin describes his experiences as an engineering student at the University of Queensland, his year working as a civil engineer at the Hydro-Electric Commission in Hobart and his decision to do a PhD in metallurgical engineering back at the University of Queensland, where his work linked to the needs of Comalco Aluminium Ltd.

Colin talks about his first academic position at the University of Auckland, Department of Chemical and Materials Engineering where he continued his metal physics research, his sabbatical leave at Iowa State University in Ames to understand the agricultural equipment industry and at Buffalo, New York to look at the metallurgical industry based on hydropower out of Niagara Falls.

In the next part of the interview, Colin talks about his long and varied career in the US. He started as an Associate Professor in Mechanical Engineering at the State University of New York, Amherst, then as the Program Manager in Advanced Alloy Development, Pratt and Whitney Aircraft, Government Products Division, West Palm Beach in Florida and finally, as Director, Metals and Ceramics Laboratories, Allied Corporation, Morristown, New Jersey.

Colin recounts his meeting with Dr John Lowke, who was then Chief of the CSIRO Division of Applied Physics, and his subsequent appointment as Chief of the CSIRO Division of Materials Science and Technology in 1987. This includes some reflections on his family life in Morristown and their desire to return to Australia. In 1988, he was promoted to the position of Director of the newly formed Institute of Industrial Technologies where his brief was to improve the industrial relevance of the work of the Divisions.

In this part of the interview, Colin outlines his work on the CSIRO Commercial Practices Manual, his interactions with the Board and with senior company executives. This section also includes an account of the origin and management of the CSIRO-Boeing alliance.

Colin then talks about his time as Acting Chief Executive of CSIRO following the death of Dr Malcolm McIntosh and his interactions with the Department of Finance over property matters.

The interview ends with a discussion of Colin's post-CSIRO activities and the success of his venture capital firm, The Principals Group.

NOTE TO READER

Readers of this interview transcript should bear in mind that some editing of the transcript, including additional material in the form of footnotes and endnotes, may have occurred at the request of the person interviewed.

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Please note that the printed word can never convey all the meaning of speech, and may lead to misinterpretation. It is strongly recommended that readers listen to the sound recording whilst reading the transcript, at least in part, or for critical sections.

Introduction

This is an interview with Colin Adam for the CSIRO Oral History Project, Oral History Collection. I'm Tom Spurling and it's the 15th August 2018. We're doing this at Colin Adam's residence in Glen Iris, Melbourne.

Thank you very much Colin for agreeing to this interview. Could you please confirm your understanding that Swinburne University of Technology owns copyright in the interview material and that access to the material will only be given in accordance with the instructions you give us in the rights agreement.

Yes I understand that.

Family background

Thank you very much Colin. What we'd like to do now is talk about how you became interested in science and engineering and some of your early experience. So, you were born in Melbourne, were you?

My father was in the Air Force here during the Second World War as a technical instructor in electrical trades. He'd been trained as an electrician, and ended up in Melbourne teaching electrical fitters at two places, at Frankston and at Ascot Vale.

After the war?

No, during the war. I was born in 1943 in Melbourne, and as soon as the war finished my father went back to Queensland and accepted a teaching position at Scots College in Warwick, where he had been a student. He remained there for, I think, about three years and then accepted a position as a technician in the new PMG, I suppose, because of his electrical training and war time experience. He then remained working for PMG, and became essentially a technical-school teacher within the PMG, and he worked for them for the rest of his career.

So, that was in metropolitan Brisbane?

Yes there were two PMG technician training schools in Brisbane, one at New Farm and one at Chermside, so he taught at Chermside. I guess my interest in science and technology was to some extent influenced by his background and training. He'd trained as an electrician but his father was a marine engineer and his father, my grandfather, I think was very interested in me joining the merchant navy. He used to invite me to his ship, which had its annual inspection in the dry dock in South Brisbane and I'd get invited to have lunch with the chief engineer, my grandfather, and the captain. We'd then proceed down the Brisbane River from the dry dock to Hamilton docks, where I would disembark. I now think all of that was about getting the various captains to act as referees for me to go to a naval college, but that was a long way from my mother's aspirations for me. And the really interesting thing about those ship-board dining experiences with my grandfather is that my father was never invited. So, I found that really curious.

So, that grandfather was your father's father, but your mother was the one who believed that you should aspire to something more than a seafarer?

Well, I think my mother believed in education, and I was a reasonably able student.

Your mother - what did she do; did she work at all?

She and a couple of her girlfriends started a hairdressing business in Warwick, which was pretty successful, and they ran that until my mother was married, but she suffered from asthma terribly and was a chronic asthmatic, frequently hospitalized. So, I spent half my life not with my parents, but with my aunt and uncle on a sheep property between St George and Thallon, "Woodbine" in SW Qld, or with my grandmother in Warwick. So, I really, in a sense had a couple of sets of parents growing up, and I guess in many ways my feeling about having to be independent probably stemmed from that rural experience.

And did you have siblings?

I have a sister who is four and a half years younger than I am, but probably the person I was closest to while growing up was my cousin, Shirley, my aunt's daughter. She was four years older than I was, and I think in many ways we were psychologically closer than I was to my own younger sister.

Many of the influences in my younger life had something of an agricultural background from my mother's family, and an engineering background from my father's family. In many ways their views about life were quite different, so I got a pretty good glimpse of these two worlds growing up, and made a decision when I was 16 that I wasn't going to go on the land, which my uncle had hoped I would do. I said I was going to university to study engineering. I had "a strong mind and a weak back" and it seemed that going to university was a lot better choice.

So, you went to state schools, did you?

I went to several different primary schools because my father, in order to get promoted, went to various places in south west Queensland; initially from Warwick, to Stanthorpe, St George, Dalby, and back to Warwick Intermediate. He then eventually ended up being appointed to the PMG Technician Training School in Brisbane. I finished my primary education, and went to high school in Brisbane. My longest period at any one school was at Camp Hill State High School. I graduated from there as the top male student, but a young lady called Robyn Ford got a better matriculation pass than I did, so she was actually the high school's top student that year. She later became a school teacher.

I was always interested in mathematics. I recall getting particularly high marks for mathematics all through high school, and so doing engineering seemed to be a fairly natural fit. The people that influenced me a lot were one of my primary school teachers, a Miss Kennedy at Coorparoo State School in Brisbane. I went there for 18 months. She was a particularly fine teacher, and encouraged those of us sitting in the back row to bring a book to school to read when we had completed our set work. She was the daughter of a Presbyterian minister, so she believed in hard work and all the rest of the subsequent attributes that flowed from that. She was unusual, I suppose, in that she had an honours arts degree teaching primary school and we got a particularly good education at that school.

When I went to Camp Hill High School, I was influenced by a couple of teachers; the Principal, Sam Hoskins, who taught us mathematics, and also Len Meara, who was our applied mathematics and physics teacher. He was studying for a master's degree in Physics at the University of Queensland at the time, and I found him particularly encouraging. So, I thought going to university probably wasn't a bad idea. Once you've crutched your first few lambs, as I did at "Woodbine" with my uncle most August school vacations, the novelty wears off. I decided that a career on the land was probably not going to be all that exciting.

Engineering at the University of Queensland

Were you the first person in your family to go to university?

Yes; one of my aunts went to UQ and did a year of an arts degree, but that was part of a teaching scholarship, and I don't know whether she ever completed her degree, so technically I was the first one to complete a university degree. So, doing engineering at the University of Queensland was interesting, and we had some outstanding lecturers, particularly in applied mathematics.

And you had a Commonwealth scholarship?

Yes, I had a Commonwealth scholarship.

Why did you go to mining, and did you decide to go to mining and metallurgical engineering?

Well, no, I had originally elected to do Civil Engineering, but after a lot of drawing-office time decided that I really wasn't particularly well motivated. I took a year off and I went and worked for the Hydro-Electric Commission in Hobart, as essentially a laboratory technician in their Civil Engineering Laboratory at Moonah. I worked with a group that were testing dam designs, making models of proposed dams, loading them with mercury in rubber bags, and measuring dam-wall deflections using modern strain-gauge technology.

So, that was when?

1964.

A gap year with the Hydro-Electric Commission in Tasmania

So, you took a year off from high school before you started university?

No, I completed first year engineering and then I went to Hobart for a year, worked for the Hydro-Electric Commission, and that pretty much convinced me that I didn't actually want to be a civil engineer. That work seemed pretty formulaic. Structures were all designed to a set of rules and standards. There didn't seem to me to be much freedom of initiative or intellectual creativity.- I mean, that's probably not universally true, but that was my perception at the time, and in thinking about what was going on - remember this was a time when "The Australian" was first published. We were beginning to have some insight into the fact that we might actually have mineral resources here that were world class, and so I thought that mining and metallurgical engineering would be new, interesting and different from my early perception of civil engineering.

I wrongly assumed that we would have a very successful world-class secondary manufacturing industry, based on and growing from our natural resources. That of course didn't come to pass, or it did in part, but it didn't continue for very long and so I returned to the University of Queensland and studied mining and metallurgical engineering. I could have graduated as a mining engineer, but I decided I had lived in the bush for long enough during my early life. Going to work in places like Broken Hill and Mount Isa didn't seem to me to be all that appealing. So, I decided metallurgical engineering was probably a career that suited my long-term interests. I was interested in new engineering areas, and research, and I was fortunate enough to be offered a PhD scholarship after I graduated.

PhD in metallurgical physics

And your thesis was on phase relationships in iron, aluminium alloys. That sounds to me a bit like physics?

Yes, it is essentially metal physics.

Metal physics, PhD.

It was in part sponsored by a deal that was done between my PhD supervisor, Dr Len Hogan, and Comalco Aluminium Ltd. Comalco were, like every growing company in Australia at that time, short of good staff and so they sponsored a couple of us to look at the two main impurity elements that wind up in aluminium alloys; silicon and iron. Both initially derived from the bauxite refining processes in producing alumina, but also as impurities from the Hall-Heroult cells.

I looked at the aluminium-iron side of the phase diagrams and my good friend David Jenkinson looked at aluminium-silicon, so we did PhD theses on two different alloy systems, but in some ways using relatively similar techniques. That thesis work involved a couple a trips a year down to Bell Bay, and in a sense we were briefing people in Comalco on ways in which they could improve a whole range of issues to do with the solidification and casting of aluminium alloys for their export industries.

So, in that period up to 1970-1972, the future for secondary metallurgy and manufacturing in Australia looked pretty bright. I think there was a certain degree of optimism. There was access to international markets. I think the productivity of the Bell Bay smelter was high, and they had good people working there, so it was an interesting and challenging time.

So that gets you to the ingot stage?

Yes.

And you're thinking beyond that?

The chemistry of the ingot controls microstructure during solidification, and then subsequent metallurgical processing, so it was the dawn of a realisation that the subsequent structure and properties really relate to the way in which the individual alloy solidified. Unless you control the initial solidification of that ingot, you can make life very difficult for yourself in subsequent thermomechanical processing. A lot of that work at Comalco was to

try to get the alloys to be relatively pure, but also to control the solidification rate during the period where the ingot is made, so that you have the right impurity microstructure as a precursor to going into whatever thermomechanical processing happens after that.

And so, you finished your PhD and you did a post-doctoral period at the University of Queensland on an ARGC grant, supplemented by a Comalco grant?

Yes. Professor Eric Hall came up and interviewed me for that ARGC post-doctoral scholarship. I felt at the time that he and I had a similar view about the world of research and universities.

So, he was from Comalco?

No, Eric Hall, was Head of the department of metallurgy at Newcastle. He did his PhD, I think, at Sheffield and there's a very famous equation -the Hall-Petch equation- he's the Hall of the Hall-Petch equation, which essentially relates mechanical strength and properties to the grain size of the alloy. It's a well-known relationship that he and his PhD supervisor published.

Eric Hall must have decided that I was an appropriately qualified person to continue in a career in metallurgical research, and a short time after, Comalco management said, "Well, we want somebody to run a laboratory in Melbourne. Do you want to take that job, or do you want to continue on as a post-doctoral research fellow?" The salaries were pretty similar and I really struggled to decide, should I go, set up this laboratory for Comalco, and in the end, I decided I wanted to remain an independent researcher, so I took the ARGC Fellowship and worked again on more solidification related research on alloys. I'd branched out into looking at more of the effect of the transition metals and solidification of aluminium, so I published work on aluminium cobalt, aluminium iron silicon, and aluminium chromium alloys.

During my PhD thesis time, a Professor named Angus Hellawell, came out from Oxford and essentially lived with us in the department for six months. I think it was probably because the University of Queensland didn't have a great deal of confidence at that time in the teaching staff in the department to have appropriate high-level research standards. So, in that era, you had an external examiner essentially living with you, almost on a daily basis in the lab, but not supervising you as such. It was just really making sure that you were the "right stuff", and so Angus Hellawell did that for both David Jenkinson and for me.

Lectureship at the University of Auckland

When you were a PhD student?

Yes, so Angus and I became relatively good friends after I had my PhD. He wrote to me to say that the University of Auckland was looking for a metallurgy lecturer and he'd be happy to support my application. What I didn't know was that he's written the same letter to one of his students, Roy Sharp who was then at MIT on a Post-Doctoral Fellowship. And so, the pair of us applied for the same job at Auckland University. That particular summer, one of the lecturers from the Auckland department was climbing on Mount Cook, Terry Briggs.

This was the summer of '72-73?

Yes, '72-73. He died of peritonitis on Mount Cook and so suddenly, the department, instead of just having just one vacancy, had two. The head of department, Alan Titchener, then went to the vice chancellor, Colin Maiden, and explained the situation, that they had one vacancy and now they have two vacancies, and as Alan Titchener subsequently told the story, he said, "It was impossible for the department to separate these two candidates."

Half the department thought I was the appropriate candidate because I had a somewhat more practical and engineering background from my work with Comalco, the other favoured the applicant who was a classical Oxford scholar, and who really was a very fine scientist. So through Terry Briggs' unfortunate death, Roy and I were appointed at the same time to that department. It was a bit of a powerhouse in a way, so I ended up then getting a significant research contract with Comalco Ltd. During the five years I was in New Zealand teaching, I ran something like a \$10,000 a year research program, doing quite a lot of solidification work and electron microscopy for Comalco, largely because they didn't have an electron microscope in the lab at Thomastown. So, there are Roy and I -

So, did you get that, or was the electron microscope already in the department?

So, you didn't have to set that laboratory up?

No. The electron microscopy laboratory was already set up. Professor Alan Titchener, it's said, got the cheapest JEOL electron microscope anywhere in the world, because there were a number of people in Australasia looking to Alan's decision, and if Alan decided to buy that particular microscope, there were three or four others waiting, so he managed to get that. So, no, they had a very fine electron microscopy laboratory there when I arrived.

And it was the early days of computers then, so was the crystallography work you mentioned - that you were doing - required Fortran computational analysis and so on, so did Auckland have good computing facilities?

Yes, they were very good, largely because the professor of electrical engineering had decided that he'd spend a lot of money on computing facilities. I think he could see that that was a part of electrical engineering for the future, and also for engineering design. Most of that crystallography work I did at Queensland on a GE225 mainframe. I'd have to say though that that program took four hours to compile and run in 1972, and the staff would only run my solution between about one am and five am. When I got my first desktop computer in USA and I ran that program - this is on an 8086 chip- it ran for less than a second, so that's a measure of 10 years of evolution of computing.

I know it's very interesting.

I think in a way, I was one of the new generation of engineers that was computer literate, which as I found when I moved to the US, to be somewhat unusual.

And can I just ask about New Zealand and why it is was – (A), why was Auckland so good in terms of the amount of money that spent in this and (B), what was the interest in New Zealand in aluminium?

Well the first comment I'd make is that New Zealand had decided they would have only two engineering schools, one in Auckland and one in Christchurch, and so the resources for those schools were actually quite substantial. Almost all of the people that taught in Auckland had very, very significant university experience at the best universities elsewhere. For example, there were a number of Oxford scholars that were in the generation ahead of me, Professor Bogle, for instance, brother of the Bogle Chandler fame.

Yeah, Gilbert Bogle he -

His brother was head of electrical engineering. They had been at Oxford together. Alan Titchener had gone to MIT, so they were engineers who came back to New Zealand, had substantial international experience, and had very high standards from those universities. I think, wisely, the government decided NZ was going to have two very good engineering schools, but the really critical factor in Auckland was that Alan Titchener had built a 12-storey engineering building and all of the engineering departments were housed in that one building.

We had essentially two floors each, but the senior common room up on the 12th floor that had commanding views over the Auckland harbour, was where everybody met for morning tea, lunch and afternoon tea. As a consequence, it meant that there was a high degree of collegiality between the various disciplines in engineering that didn't exist in, I don't think, in any Australian university of that era. So there were two first class engineering universities in New Zealand and I don't know the situation today, but of that era they were really high calibre – both staff and undergraduate students.

The civil and mechanical engineers for instance instead of teaching what you would call normal structural design, decided pretty early on that they would look at the stresses on yacht masts and rigging, and all the rest of nautical structure, so all of their stress analysis was done on nautical parts. This meant the students really had an insight into a whole lot of engineering in an area that they could identify with, because many of them were sailors. So, there was a lot of cleverness in the way in which the courses were built around practical applications of known principles.-

The staff in mechanical engineering in the sub branch of aeronautical engineering were one of the first groups in the world to apply aerodynamic analysis to wind flow around buildings, so they had modelled all of the architecture, all of the building structure in Wellington, and then pretty much avoided the corridors of a hundred miles per hour winds, because the buildings had been designed with aerodynamic flow in mind. Now, this is early on. This is before computation fluid dynamics. It's an era when a lot of that had to be worked out empirically from a wind tunnel data. So, they were quite capable and innovative people, I thought at the time.

And that was a department of chemical and materials engineering.

Alan Titchener had a great deal of foresight in realising that materials engineering or metallurgy wasn't going to stand alone in New Zealand. It had to be incorporated into something else to survive the inevitable boom/bust cycles of industrial engineering employment. In Australia that is pretty much what happened, in that all the metallurgy

departments collapsed subsequently for that very reason. Broadly-based engineers, trained in complementary disciplines, like chemical / materials, or mechanical / materials, can find suitable professional positions whereas the more narrowly trained specialist disciplines are unsustainable. Auckland University Department of Chemical and Materials Engineering has graduated some 40 engineers pa for over 40 years now.

So, I think about that time - what you said about the government deciding about engineering, triggered the thought in my mind. I think that was the time that Arthur Williamson left chemistry in Otago and went to chemical engineering in Christchurch.

Possibly.

And so, he became the professor of chemical engineering.. When were you married? Did Elizabeth go to Auckland?

I was married at the end of 1968 - while I was still a post-graduate student. Elizabeth at that stage was Senior Science Mistress at Brisbane Girl's Grammar School teaching senior chemistry and mathematics.

Right and so Elizabeth went to Auckland with you?

Yes, - Timothy was born in December 1972, and we left when he was five weeks old, so we arrived in Auckland in the beginning of 1973 with a five-week old baby, which I think in retrospect was tough on Elizabeth, but she's more than capable. She handled it all in her stride, and even worked part-time teaching high-school chemistry and mathematics in Auckland.

So, you were there in Auckland for five years and then you went off to State University of New York in Amherst. Why did you do that?

No, well, I took a short sabbatical and I wanted to achieve two things. The first period of that, I went to Iowa State University because I wanted to have a look at the agricultural equipment manufacturing industry around the mid-west. There were a number of world-class manufacturing plants like John Deere, for instance, Caterpillar, Alcoa Aluminium, FMP Ltd, that have very large manufacturing plants in what they call the Tri-state area between the corner of Iowa, Illinois and Wisconsin. The world's largest aluminium rolling mill, for instance, is in Davenport, Illinois, just across the Iowa border, so I was pretty interested in that scale of manufacturing, and I took a short sabbatical there. I also was interested in what was done with the hydroelectric power in the Buffalo area of New York State, and spent two semesters at State University of New York at Buffalo (SUNYAB) at Amherst.

So this was a sabbatical from Auckland University?

This was a sabbatical from Auckland, , with no intention of leaving New Zealand, so I spent a semester in Iowa, then went to Buffalo NY to essentially have a look at the metallurgical industry based on the hydro power out of Niagara Falls, both of which I thought were relevant to New Zealand. Now, you asked a question earlier about why was the department in Auckland interested in aluminium alloys. Well, Comalco Ltd in a joint venture with two Japanese companies (Sumitomo Chemical and Showa Denko), built an aluminium smelter at

Bluff in 1971, in the southern part of the South Island of New Zealand, so there was an aluminium industry in New Zealand, using the hydro power from Manapouri to essentially run that smelter at Bluff, and using Australian-sourced alumina from Gladstone.

It's still there, is it?

Yes. It is still a very successful operation, producing the world's highest purity aluminium I believe. And contributing some NZ\$4 billion pa to their economy. One of the reasons the department was interested in hiring me, also, was that the decision to build the smelter meant that graduates from the department would eventually be working for Comalco at Bluff. Over the years, the smelter has subsequently employed many of Auckland's graduates.

Anyway, getting back to that experience in America, from Buffalo I went down to spend Christmas 1979 in Florida with Jerry Griffin, who'd taught in the Theoretical and Applied Mechanics department at Auckland. He was working for Pratt and Whitney Aircraft, and we'd become pretty good friends during our time in Auckland. We went down to Florida that Christmas as a family, and I met another employee of Pratt and Whitney Aircraft on a tennis court, having a social match, who invited me out to visit the jet-engine company- he said, "Oh, you seem to know a lot about metallurgy. Come out to our plant." So sometime after Christmas I went out there with Jerry, who was managing a jet engine fan / compressor group. They offered me a job on the spot to manage an Air Force alloy development research contract. This period was at the height of the Cold War when unprecedented investments were being made in all forms of military development.

This is in New York?

No, this is in Florida, West Palm Beach. Jerry Griffin was a graduate Caltech. His PhD supervisor was the famous applied mathematician, Julius Miklowitz, and he had gone back to the States to work at the euphemistically called the Government Products Division in West Palm Beach, but it was essentially making military turbine engines, and developing new turbine technology. What I didn't realise was this was really the beginning of the height of the cold war. The Americans had decided they were going to outspend the Russians, and they were hiring anybody and everybody that had any relevant experience in areas that were related to weapons development technology. I was probably one of several thousand engineers that were hired right throughout the US to get involved in that high-tech arms race.

Iowa State University and University of Massachusetts Amherst

So, I just got a bit confused about the timing. So, were you at Amherst NY - you went from Auckland to Amherst?

No, I went from Auckland to Ames, Iowa State University, Department of Mechanical Engineering in November 1977.

So what year was the Florida experience?

'79 to '82 it says in this. Let me just say that in -

We left Auckland on the Thanksgiving of 1977 and so I was at Ames from late 1977 and part of '78. Then from '78 and a bit of '79 we were in Buffalo, so it would have been in '79 that I went to Florida.

Okay, not January?

Amherst, that's Buffalo NY?

It's where the university is. It's a suburb of Buffalo.

Okay, as Associate Professor in Mechanical Engineering?

Yes.

And then you pretty well straight away got the job at Pratt and Whitney in Florida and you stayed there for three or four years?

Well, it was a real dilemma. Fortunately, Professor Alan Titchener was in the States on his sabbatical leave, so I had a chat to Alan about what should I do, and anyway, Alan being Alan wouldn't actually tell me. He said, "Well, Colin, I know what I would do under the circumstances." What he did, however, was tell his wife to tell Elizabeth that he thought Colin ought to take that opportunity in Florida. So, he wouldn't say anything because he was conflicted. He was my boss. I was seeking advice from him about something that he probably thought was not going to be in the department's long-term interest. So, he rightly said nothing, but his wife fed the information back to Elizabeth that Alan thinks Colin ought to take this job at Pratt because it's just too good an opportunity.

Pratt and Whitney, Florida

Did you like living in Florida?

The work was fantastic. Florida was, I mean it's redneck country, let's be honest. It's like living in Innisfail or Townsville, terribly humid summers. You live in air conditioning during the summer time but for a young engineer the work was just fascinating and stimulating. At any time, you have a bright idea about something that could be done better or differently, and you'd get a contract from the Air Force to do that. So, it was not difficult work in a sense, and it was an era when there was plenty of money and not all that many original ideas. It was almost the antithesis of the life you led in the university where there plenty of good ideas but no money, so it was the other side of the coin, to some extent. There was an emphasis on development, rather than basic research, but the research background helped me enormously because it informed a rational decision about what would inevitably work in practise.

And you've got a certificate signed by General Alexander Haig.

Something like that, yes. He was at the time on the Board of United Technologies, and US Secretary of State (1981-82). He presented me with a Pratt & Whitney Employee of the Year Award – basically, for doing my job.

And I noticed during that time you attended the Pratt & Whitney Aircraft staff program management course, so were you identified as a future manager?

Well there were 12 PhDs hired at that time, so it was a reasonable assumption.

You were the program manager at that time.

I was, but there were 12 PhDs hired at that time, largely because USAF were not convinced that the current PWA staff in Florida had the right type of educational credentials and research experience to handle new complex engineering development. The company decided they would throw us all in the management deep end, and I think out of that 12, probably 10 really didn't want to stay in industry, and were not psychologically equipped to manage developmental risk. They didn't think the way a progressive team leader of a group of highly qualified individuals would - so a lot of them for one reason or another left. Well, I left too, but I left Pratt and Whitney Aircraft for a whole range of different reasons.

We were in the era where there was quite a lot of gamesmanship in securing funding for various projects and not a lot of it was honest, and so since I had reached a position of seniority in the company, I started to see some of the things that were being told to the Air Force and the Navy weren't strictly true. I had a bit of a moral dilemma about the integrity of all that. I can remember saying something to Elizabeth about it and she said, "Well, there's no point in talking to me about it. You need to talk to your boss about it." Well my boss was an ex-army major, a real southern redneck, and he thought getting the money was the objective, and whether you deliver on the results or not was a secondary consideration. "Give it your best shot, Colin," he'd say.

But in fact, you did deliver a lot of good science and engineering in that position in Pratt and Whitney.

Absolutely. We had produced some high-temperature aluminium alloys suitable for fan and low-pressure compressor applications, and some extraordinary bearing alloys for turbine bearings, using the company's Rapid Solidification Technology. Consequently, I got invited then to join the Defence Advanced Research Projects Agency's Metallurgy group led by Prof Morris Cohen and Prof John Hirth. They were the authors of the text books that we studied as students, so to suddenly find I was rubbing shoulders with them in the committee sense, for a young engineer, was a bit heady; but nonetheless, that group pretty much made representations to Defence about modern materials development programs and it was really, I suppose, working on those committees that I got to know Morris Cohen, - which is why I was interested in what Morris wrote about me as a referee.

He was at that stage probably the most eminent ferrous metallurgist in the world.

And where was he, Colin?

MIT, Boston. There was a good mixture of academics, as I said, John Hirth from Ohio State, Morris Cohen from MIT, the vice president for research at TRW who had been a professor at MIT. It was an interesting group, well-respected and influential in recommending secret project funding.

They were high level people, switched on. Basically, all of them had a history of significant graduate student work over many, many years, so they were well chosen to really represent the interests of high level materials technology in the defence forces, and almost all of their recommendations got funded by DARPA. DARPA didn't have to go to Congress for approval of their budget. They had a "black" budget so whatever they wanted to spend, or whatever they needed to spend, was spent. So, it was really a very, very interesting time to be involved in that. As I say, it was a really a consequence of the cold war but most of the work remains classified, and unpublished.-

So, you went to - in 1982 you went to Allied?

Well, I got headhunted, essentially. I'd got to the point where I was going to have to fall out with the guy who was ultimately my boss's boss over issues that I thought were to do with integrity. Then I got a telephone call from a head-hunter saying that Allied Corporation were looking for someone to act as manager of their metals group, was I interested? I said, "Oh, well, yeah maybe." So once again I got appointed to a position that I never really applied for, and so I ended up going to Allied Corporation.

Allied Corporation, Morristown, New Jersey

And what city was that, sorry?

That was Morristown, New Jersey.

And as Allied - was your impression that Allied Corporation was a more - were the ethics of the business in Allied different from Pratt and Whitney or did that

Very different. The new chief executive of Allied Corporation was Ed Hennessey. He had been second-in-command at United Technologies, and he was a very fine chief executive. He had also gone within a few months of graduating as a Jesuit priest, so had very high personal standards. He was well liked and highly respected.

Now, rumour had it that he had fallen out with his boss at United Technologies, Harry Gray. They didn't see eye to eye, so Ed Hennessey left and was the new chief executive at Allied Corporation. He had put the word out, apparently, to say we're going to diversify this business. We are no longer a chemical company. We're going to get into automotive and defence and I want you to hire some of those young bright guys from aerospace, places like Pratt and Whitney. So, I was hired through a head hunter because Ed Hennessey had essentially said, "We need different sort of people running R&D in this new corporation." Ed Hennessey had done a very clever deal with Bendix Corporation and by the time I joined the company, Allied had the same market capitalisation as BHP, about \$12 billion. About a third of it was specialty-chemicals, a third was automotive, and a third was defence, so at Allied I just continued the sort of work that I was doing with the defence people.

So, the metals and ceramics laboratory, was that basically a laboratory aimed at the defence industry or automotive as well?

Well, all three – defence – largely aerospace, automotive and specialty chemicals. The most significant development from that laboratory had been the discovery of the unique

properties of metallic glasses as soft magnets, and during the time I was there we completed most of the research in that area, built a pilot plant, and scaled-up to a production facility. Now, all of the modern electrical transformers are made out of Allied metallic glass; iron-boron-silicon alloys. The company was really looking for somebody with a metal physics background, but also some management experience, to essentially deal with the inevitabilities of scale up of technology out of a laboratory into prototype development and a production plant.

So, you started off as the Manager in the materials laboratory and then you were promoted to the Director of the materials and ceramics laboratory. What would have been your next move?

Vice president for technology. In fact, in resigning from Allied, I upset internal plans because my boss, Lance Davis was promoted to senior vice president shortly after I left, and so I would have taken his job as vice president for corporate technology, but that was not to be - I think Elizabeth had decided that she really didn't feel safe in America, and would like to return home.

Allied was a fabulous company to work for, it really was very good, and as I said earlier, - well you alluded to it Tom. I'd done some management training at Pratt and Whitney because they believed that if you were going to manage people, you'd better learn some of the skills that managers need, so I was exposed to a lot of that philosophy there. When I went to Allied, part of our performance package was to spend a month each year on management training, and consequently 30 per cent of my annual performance bonus was based on the achievement of that form of training. You could elect not to do it, but you'd forgo a third of your bonus. This was real money!

So, I used to take a week-long module 3 or 4 times a year from the American Management's Association, and pretty much completed an MBA by the time I'd left Allied. A week-long module here and there on various topics- and it was quite open for us to choose whatever areas we thought we were perhaps somewhat deficient in, or didn't quite understand well enough. So, I did most of the AMA modules during that period in one form or another, and I found it very stimulating and insightful.

And did you, in that Allied Corporation's metals laboratory, did that have links - did you maintain links to Boeing, obviously, but also to the university so the -

Yes. I still worked with Boeing. We developed a pilot-plant to make prototype forged parts of aluminium-lithium alloys, and with some novel alloys for defence applications. I remained on that DARPA committee, so even though I'd resigned from Pratt and Whitney, Morris Cohen and John Hirth thought my insights were valuable so even in that period I was at Allied I was still meeting with that DARPA committee on a variety of materials-related developments. We used to meet a couple of times a year. They'd have a week somewhere or other in US. I think the most luxurious place we stayed at was La Jolla in California. It involved staying at reasonably good hotels, with good conference facilities, and there was an agenda put together. We interviewed people and listened to presentations from companies. It was quite insightful; at the time I was also an editor for Metallurgical Transactions, so in a sense I was reviewing a lot of recently published material that was about to hit the press in Met Trans.

And during both the periods that you were in Auckland, in Florida and in Morristown, you kept having papers in academic journals and patents?

Yes, but the trouble was, Tom, most of what I was working on was classified “secret”, and some “top secret”, so I didn't publish much from Pratt and Whitney onwards. There'd be a few general conference proceedings, including one that was cleared for a NATO Conference at Amberg, Germany. We published that as a book.

And quite a few patents?

Yes, well, the rule at Allied Corporate Technology was that your worth as a research employee was the number of papers you published to the power of your patents. So, if you've got 50 publications and 20 patents then 50 to the 20th power is –quite a lot.

Pretty good.

A fair “order of merit” as far as the company was concerned, and I'd keep getting awards for patent inventions, and all the rest of it. As well as an Employee of the Year Award from Pratt and Whitney Aircraft, I received Inventors Awards for various things at Allied – and a Chairman's Medal.

And so, in July of '86 you decided to apply for the job of chief of the newly formed – the new division of materials, science and technology.

No; well the background to that, is during the previous northern hemisphere winter, John Lowke visited Allied, and stayed in our house for two and three days. I took him into work, and let our staff show him around the laboratory, and talk to various people about what they were doing. John had worked at Westinghouse Research Labs in Pittsburgh at an earlier stage in his life so he was, – I'd have to say he was extraordinarily impressed, by the work he saw at Allied and apparently, came back and said to Keith Boardman that he'd met this young Australian in Morristown, and he'd be perfect for chief of division.

So it really was the approach from John Lowke that was influential in my returning to Australia. I'm sorry that some of my Personnel File is missing, because John, I think was also in contact with Professor Ian Polmear who was the chairman of the review committee that was putting the two bits of the material science divisions together into a new CSIRO Division. Ian Polmear came to an Aluminium conference in Washington, DC later in that year, and he talked to me about “Would I be interested?” and I said, “Yes, well, possibly,” but when I started talking to Elizabeth about the possibility of a couple of CSIRO jobs, Elizabeth explained that she was very interested in returning home.

So, I think my reason for returning to Australia were really prompted by Elizabeth's desire to get back to a more “civilised and saner” society. I think she was uncomfortable about many aspects of American society that I, in my normal day to day life, was not really exposed to. She was really, I think, pretty upset about the way inequality existed in such a rich country, the fact that there were a lot of people that didn't have health cover. They couldn't get medical attention when needed, and many middle-class Americans attitude to guns seemed to her incomprehensible.

So where is Morristown?

40 miles west of New York City, New Jersey.

So, it's essentially a part of that greater New York metropolitan area.

Yes, it is in a separate state, of course, and there are many green belts between Morristown and NY City. Morristown was traditionally the area where the rich people from New York City had their holiday houses, about 100 years ago, so there are a lot of places in Morristown on an acre, or a couple of acres, where people would come out from New York City for the summer, and they'd spend the summer out in their country estates in Morristown. We lived on a few acres on a golf course there, at Longwood Road, Morristown.

Got lots of poor blacks?

No, not really, not in Morristown. Some, but not a high number of the local population.

But Elizabeth saw this contrast?

Well, places like Newark, New Jersey, are confronting. Elizabeth would say that if she was walking down the street and she saw a couple of black guys, she would cross the street in order to avoid them, because she felt unsafe. There was no particular reason for her to feel unsafe, but the other thing that I hadn't realised was that in driving Timothy at night she felt very insecure (Tim was a young violinist, and he belonged to a youth symphony that practised in a little place about 30 miles north of Morristown called Lakewood) and, particularly in winter time coming home – Elizabeth would take Tim up there after school for orchestra practice and then she'd drive home.

She said, "If anything happened to me on the side of the road, there is no way I'm going to be able to help myself," so she felt very vulnerable in that sort of environment. Now this is before mobile phones and all the rest of it. I hadn't realised how her domestic life was really so different from mine. There I was sitting in my office in Morristown. I could look out my window and Morristown Airport. We had a dozen corporate jets down there. If I wanted to go to Wright Patterson Air Force Base, in Dayton, Ohio, I could go down and get a plane, and it would take me there. So, it was all very different.

And so, you believe John Lowke made you aware of the position?

Yes, John Lowke really, I think was responsible for bringing me to CSIRO's attention. It might have been Neville Fletcher who called me, because Neville was then Institute Director, shortly to retire due to some restructuring recommended by the McKinsey Review of 1986.

He was the Director.

Yes, but I understood that he didn't want to do that job. He'd said to me that he was really uncomfortable –and didn't feel very comfortable doing the sorts of things he would have to do. The organisation was moving in different directions. The Divisions were no longer autonomous. The Board I think, after the McKinsey Review, was probably very critical of the people who were in most of those positions. I had my choice of a job in Sydney or a job in

Melbourne. And on one of my trips out here, I visited both labs. I went through Applied Physics and I just thought it was like an old man's retirement home. I could not believe it. I just could not believe that the people there, and the way the place was run.

John was the Chief?

He was the retiring chief. He had notified his intention to step down as Chief of Division. He wanted to pursue his own individual research. He was sick of the politics. He was sick of trying to get people to do things that they didn't want to do, and he wasn't able to force them to do it. But I thought that, in a sense of intellectual honesty, I was a lot closer in my scientific training and background to the skillsets in materials science in Clayton than I was to Applied Physics at Lindfield, and I didn't really see myself as a physicist, although I probably was an accomplished metal physicist, was really a developmental engineer. I felt that I could make a lot more sense of what was going on in a division of material science, and how it might assist Australian industry.

So, we note here that this is in July 10th, 1986 that you applied. It was in the 24th November that you met up with Neville Fletcher so it was quite a long time from the letter going to them to the interview.

Well, I think there was a lot going on in the unification of those two divisions, too, in Melbourne. I think there was some committee ambivalence, and Ian Polmear had a report to write. They wrote it. It had to be reviewed and accepted by the CSIRO Board, and so I suspect there were a lot of internal processes that had to be followed.

They had to be gone through. That's correct. And Ian Elsum notes that to his note to Neville Fletcher you were scheduled to meet Dr Polmear at 10 o'clock on the 26th of November, 1986. And he notes "He is one of the top prospects for the foundation chief of materials science and technology" so that was his note but I think it's about time that we had a break here now.

[music]

Chief of the CSIRO Division of Materials Science and Technology

We're back to talking about Colin's career in CSIRO. So you applied for the position of Chief of Material Science and Technology, and you were offered that position and I thought the sentence in your application form was a very interesting one where you say that your - a personal assessment of my university research experience combined with eight years industrial research management provides me with insights relevant to the future directions in which CSIRO might materially assists the evolution of new business ventures for Australian industry.

Well, it's probably what I still believe.

There's a period of negotiation between you and the organisation about various things, but by January, they offered you the job and you had various negotiations and you started the position sometime in February?

No, I visited Clayton briefly in March, but returned permanently in July 1987.

Okay, the formal offer came in February and - let me just get the file - and you signed it in March of '87 and you started in July.

Yes.

Okay, and the notice went around in March of '87 that you were coming, and from May of 1987- for an initial period of seven years from May 1987, is what this letter says and various people wrote you letters and so on. So, when you got to Clayton, you'd come from a very successful laboratory, materials laboratory in Morristown. What was your impression of the organisation and what were the first few things that you did as the chief of this new division?

I'd inherited divisions with two quite different cultures. The old "high science" metal physics / tribo-physics group was essentially where the brains trust existed; That part of the organisation had a culture that was very, very different from the part of the division that had been put together by John Anderson, which I think was in response to the first energy crisis, where they were looking at things like catalysis and essentially ways of using material science, largely for catalytic applications. So, I found those two groups, where it had been recommended that they combine, because in a sense, they had very similar technical skills, had very, very different cultural approaches to essentially whatever they were dealing with. There was some commonality in the equipment used by both groups, but neither had considered what contemporary Australian industry needed, nor how to go about finding out.

Well it says you had three groups, didn't you, because you have the John Anderson catalytic chemistry group, the old tribo-physics metallurgy group, and the chemical physics spectroscopy group.

Yes, the chemical physics and the metal physics group had actually melded, and they had similar commitments to high level scientific research, high level publications, and were well respected all around the world for their science. The group dealing with dislocation imaging and electron microscopy were very well regarded worldwide. The Ceramics group, ably led by Mike Murray, was an exception, and was probably closest to delivering some useful technology with good industrial applications of partially stabilized zirconia (PSZ) ceramics. They were well known internationally.

I found it interesting that the people involved in the catalytic work had no real experience in the petrochemical industry, for instance, so how were they going to get this science taken up or adopted by, let's say, an oil refinery? I suspected that they never thought about it. Now, I had some detailed insight into that industry, because one of the companies that we had acquired in one of the merges at Allied, UOP (Union Oil Products, Inc) actually had a range of catalytic scale up and developmental processes, the largest of which was a quasi-commercial oil refinery. They had pioneered catalytic research, however, most of UOP's work was not known to academia since most applications were within refineries and petrochemical plants, and remained unpublished.

UOP was commercially subscale compared to the oil refineries being built in the Middle East, but nonetheless, they could go from an experimental laboratory to a small bench scale pilot to something that would run at production rates of about let's say a kilogram a day, and up through five stages of developmental evolution into a full scale oil refinery. As a

consequence, that group had a worldwide customer base in all of the refineries, because when they came with a new development, they could actually prove that it had been operating in a refinery, and it was adopted by Exxon or Mobil or whoever. They were a very fine advanced-technology catalytic development company, but unknown to CSIRO.

So, I was really scratching my head and I found it very difficult to see how the work that was being done by that group could ever be adopted. Alan Reid had decided that he wanted that catalytic group, essentially to go to North Ryde, and he had some people there who had oil industry experience. I think the first real confrontation that I had with Alan was over the fate of that group, and whether that group ought to be managed by the people in North Ryde, or whether they're going to remain in the division of Material Science and, of course, Alan accused me of boundary riding and I responded, "Well, I don't believe that in this day and age we're into slavery. I'm very happy for people in the division to make decisions about their own welfare, and where they want to work, and what they want to work on." At that point, Karl Foger had a job offer from Berkeley and he was tossing up his fate, whether he'd stay in CSIRO or go. I wrote a note to Keith Boardman and said, "Look, I don't think is a quarrel that either Alan or I can resolve. You're going to have to adjudicate". Can I ask you to meet with Karl Foger and have a talk to Karl about the work he wants to do, and whether or not he ought to stay in CSIRO, or whether he ought to go to Berkeley." And so, Karl Foger flew up and had a conversation with Keith. It wasn't very long after that Keith Boardman called me up and said, "Those guys are going to stay with you, Colin." I'm not having them work for Alan Reid." And of course, that made life very difficult for me and Alan because Alan was the new Institute Director, and I was Chief of a Division. He believed he outranked me and therefore I ought to play his game. I did, however, arrange for Alan to visit UOP in Illinois to try to educate him about the futility of CSIRO's current catalytic work.

Yeah but you weren't in his Institute, though, were you?

No, so I had some independence.

No, you were in the Neville Fletcher's Institute of Physical Sciences.

Well, exactly, or whoever was going to be appointed to that Institute, because in that sense it was still going through the final stages of McKinsey restructuring. The thing that I found most surprising about the division was that nobody really knew what their objectives were, and if you read David Rivett's book, I think his view of the organisation was that there are national-scale problems for which solutions (by having scientists work) should be amenable to basically delivery of national-interest objectives. I could find no evidence of any of that kind of thinking going on inside the Division.

So, the first thing I set about doing was asking the staff to fill out a sheet of paper to tell me what were they working on, where was it leading, and what did they hope to achieve by pursuing their line of work. The results were fairly confused, with no indication that any support from Australian industry existed, with the possible exception of the PSZ work.

So, your application had a manifesto, in a sense, of what materials are, and to see industrial R&D would be like in CSIRO in where you outlined your views of the - essentially what you summarised David Rivett as saying that somehow or other we've got to have the

organisation had to find big problems and use its research to develop or assist large scale businesses, and so that was a constant theme of your writing.

Well it must have made sense at the time, Tom. Whether or not we were able to do it, yes, that was the mission. It was really about mission oriented research, with an outcome, and objectives that were basically going to set the scene for what might happen industrially over the next several years.

Management philosophy

So Colin you've spoken about doing studies of management in the United States and learning quite a lot, and actually enjoying it. You come over to CSIRO and you're put into a position as Chief. It's about management of science and management of people. Do you have reflections about that time about the role of chief and what it should - what a good chief of CSIRO should be doing and you went to try to fix the situation that you saw.

Well, I suppose so. I must have made those sorts of statements and I suppose my actions over six or nine months or so demonstrated that philosophy. It was probably clear to Keith Boardman that that was the case, otherwise I wouldn't have received the call from Keith six or seven months after taking over chief of division, to ask me to take on the role of the Director of the Institute of Industrial Technologies. The presumption was that whatever I'd done in materials science, clearly ought to be done in these other divisions. I think my view is that I encouraged a few people who had the respect of their colleagues to become what I called a program leader, and for them to start formulating some important objectives.

People like Allan Morton, for instance, with just wonderful scientific credentials, and basically a very decent human being, were well respected by everybody, so I encouraged people with those sorts of personal attributes to take on a leadership role amongst a group of their colleagues, and to try to define a few "deliverables" that would meet the criteria that I'd outlined there.

So, in essence, scientific management is about getting people to all sign up to the same objectives. By contrast with Alan Reid's view of life - which is almost a military approach that, "I'm the boss, - You charge the machine guns," to my approach, which was to try to get reasonable people to look at the data, to think about things in a collegial fashion, agree on some important outcomes or objectives, and then get them self-motivated to do something that made sense to everybody, rather than essentially forcing that issue through. Most of what I saw in America was about people doing sensible things because they actually got everybody to share the data set, and so my thesis was that intelligent people who have access to the same data set will generally come to the same conclusion. I have often quoted "research management" as being an oxymoron.

And so, sometimes people think about the role of chief as being scientific leadership and sometimes people leadership. I'm hearing that you tended to emphasise people leadership.

Not entirely. I think you need to do both, but fundamentally, there has got to be a very high level of scientific insight. If you don't have that, you end up making some pretty silly decisions. In my view, there was nothing fundamentally wrong with the contemporary

science in our Division. So my general belief was that we had the science about right, so you could then start to make some sense out of what I'd call broad industrial - economic objectives, and if then the economics were right, if you then needed a political decision, that political decision rested on good scientific principles, some degree of economic sense, and the politics then ought to sort itself out. I could see that in CSIRO we were, really in a quasi-political environment, because decisions were being made in many ways that contravened those early two principles, and I guess my assessment today of our energy situation is that in spades. My main objective was to get staff to take a more optimistic view of their capacity to deliver important outcomes.

So, can we just get back to your period as the division, you came to the organisation in July of 1987 and it was in the middle of a great re-organisation - the McKinsey restructuring, people were finalising what divisions were going to be, it was a time of great change in the organisation. How much involvement did you have in that, in the processes?

Almost nothing.

So that had happened or was happening and you came into the division, material science and technology.

Almost as a consequence of the McKinsey Review, I think the McKinsey Review had finished by the end of '86, it was being implemented early '87.

No, no, it was implemented - it started in '88, the first of January 1988 and -

There was an earlier McKinsey Review time then before that,

But then there was Pappas Carter review

That was much later.

But the Institute of Industrial - the new Institute started on the first of January 1988.

Yes, they did, but the McKinsey restructuring preceded all of that.

Yes, they recommended it and there was a process of debate- by the time you got there, you were still the materials division and material science and technology in the old Neville Fletcher Institute and I noticed that the letter that Neville Fletcher sent out to people advising of your appointment was to Bob Brown and Dave Solomon, Dr J R Eady.

John Eady, yes.

Bob Ward, Greg Tegart and Graham Spurling.

Those latter two were on the CSIRO Board, Graham Spurling and Greg Tegart,

And Professor Cahn and Dr Yoffe.

I don't know those two gentlemen. I've never met Dr Yoffe, and I probably met Robert Kahn at a metallurgy conference somewhere, but I have no real recollection.

Okay, so did you get the impression that in a sense that your - you're in the wrong group in the organisation. The Neville Fletcher Institute was a sign of pretty much the physical science based Institute and the other institute in industrial technology in a sense was more of your home, wasn't it?

I had the impression that Neville Fletcher had either been invited to resign, or had decided that the new CSIRO was not going to be comfortable for him, and he had said almost as much to me. I had dinner with him and his wife in Canberra, and I formed the impression that he was finding some difficulty with the current McKinsey Review process. The expectation that the organisation should deliver something of use to the nation was really just too much for the Physical Sciences divisions, with their commitment to high-level research, and virtually no industry contact.

I later formed a view that Neville had foreseen the demise of the Institute of Physical Sciences as a result of the McKinsey recommendations, and that he would not be able to lead an Industry-facing group of Divisions. He didn't know how to do it. I think he was ill equipped to deal with that type of future because it was not really part of his experience base, whereas I suppose during the several years I've been in the States, I'd been thinking about those issues almost on a daily basis.

Director, Institute of Industrial Technologies

So, this is where your career in CSIRO and my career in CSIRO intersected. You came to be the Chief of Materials Science and Technology, and you came to Clayton in May of 1987, and by sometime during the next six –or so months, the organisation appointed the Directors of the new Institutes.

Yes.

And so, did you apply for that job?

No.

So, they said, "Will you apply?"

No. I received a call from Keith Boardman who essentially said, "We'd like to appoint you," and I was stunned.

Were there interviews?

No

You had some interviews?

No, no. I'd have to say I was shocked at the call from Keith.

Because Dave Solomon was the acting director of the old institute.

He was, yes.

And I guess that there was some expectation amongst the troops that he would probably be the new director.

Well, he had applied for the job. So, had Bob Brown, so had the guy that became chief scientist -

Robin?

Robin Batterham. There had been a number of people apply for that job. I did not apply for it. In fact, I didn't want it, because I'd bought a house at Mt Waverley. I'd had my family all settled, boys at Scotch College, etc. Keith Boardman told me that the job was in Canberra and I thought about it for a few days, and- I said, "Well, let me talk to my family about this," and I talked to Elizabeth. I said, "Look, if I can't stay here as chief of this division and I have to basically quit, I think we need to go back to America." And so, I called Keith Boardman up and I said, "Look, Keith, if I have to move, it will be back to America," because I knew my old job in Morristown was available if I wanted it. I'd had a fairly good response there, and in fact it had been made clear to me that should things not work out in Australia, come back.

And anyway Keith said, "Oh, okay, look, settle down. You can stay in Melbourne." So, that was the deal and I was not an applicant for the job. I was stunned to be asked, but what Keith Boardman said is, "The board has been very impressed with what you've been able to do with what really was a problem child, in only six months, and it's clear the way you tackle problems is a way that the organisation should be tackling its future." So, probably - because I'd come in relatively new, I had no real preconceived ideas or no allegiances, no loyalties, no favours. It was a clean-slate appointment and I could, I'd like to think, look at situations objectively.

So, the division - you were the chief of the division until the first of January 1988 when you became the Director of the new Institute of Industrial Technologies and then you suddenly had come - you now were in charge of those divisions, applied physics came into that division

Well, now there were five basket cases to deal with basically, rather than just one. It was daunting, and they all really had the same sort of problem, as far as I could see. There'd been no clear definition of expectations, with the exception of the polymer bank-note work, and there'd been no attempt to set goals which were not impossible, but were probably challenging, nor the resources really, I'd have to say to follow up any of the things that should have been done. So, the organisation was, in many ways, staffed with the wrong sort of people for developmental projects, without any real budget flexibility. So intelligent people basically decided that the sensible thing to do was just keep publishing good science, and hope that somebody decides that it's adequate.

So, the Institute got the nine million dollars from the Reserve Bank, or five million or something.

No, it got less than that. It got four million initially, which I negotiated up to five with Dr Boardman, but it didn't get the whole nine.

No, it didn't get the whole nine.

And so that at least gave us a little bit of breathing space. We could actually think about investing in a few things that were developmentally expensive, but for a while the divisions at least would have something to show in the years ahead that would possibly be of use. Your division got to build a pilot plant that allowed you to scale-up. I think we put a fair bit of money into some manufacturing technology kit too, in order to get them modern equipment that they needed. So yes, the five divisions got about \$1m each, the money was spread around, and at last we could look toward some practical “deliverables”. Finding Australian companies with a contemporary view about co-investment and participation was also challenging.

So, my recollection is that it took a long time for the organisation to appoint a chief of the division of applied physics

And material science.

And material science.

Yes, and biomolecular engineering.

But Bill Blevin eventually became the chief of the division of applied physics.

We tried to hire a Dr Abbas who was an Oxford graduate who'd worked at Bell Labs, and was highly regarded at Bell Labs. He was married to a South Australian woman. He was interested, and came out to visit the Division. He spent a week in the division and eventually I think he had a counteroffer from one of the Fraunhofer Institutes, or to set up a new Fraunhofer Institute in microelectronics, which he subsequently did. It was very difficult. I can remember saying to the board at the time, “You’re seeking a chief of division, somebody with high level scientific insight, somebody with the human resource skills of St John the Baptist, the financial acumen of a Rothschild, and all for a third world salary, so it’s not surprising there is not a great deal of interest,” and I think that probably has continued to be the problem that we face.

So, the institute started off in 1988 and Keith Boardman was the chief executive of the organisation. Sometime in the 1990, John Stocker was appointed the chief executive. So, how did you manage that transition from Boardman to Stocker?

Well, I welcomed John into the organisation. I thought he had overseas experience that was really relevant, but in a very different field. I think very early on that I had to explain to him that the way in which the pharmaceutical industry did their research and development was very, very different from the way that the engineering evolution occurred. He agreed that that was the case, and I got very full support from John, unlike some of my colleagues; I don't think I ever had an argument with John. I never had a cross word. I think John saw intuitively the sort of things that I was talking about were actually correct, but probably more importantly, he trusted my judgement. So, I can't recall ever finding John either difficult to deal with or opposed to any of the sorts of things that I did.

So, Colin, earlier you mentioned the CSIRO Board.

Yes.

That was back in the days, I think, when institute directors regularly attended board meetings.

Perhaps, but I didn't attend many board meetings. I think I got called in for an introductory session to the Board in - it must have been toward the end of 1987, I guess. It might've even been in response to that earlier piece I wrote about the way forward. Adrienne Clarke said something to me about what a wonderfully glowing reference I had from Morris Cohen, and of course, I still don't know what Morris said, but I suspect that Morris might have gilded the lily to some extent, but the Board was certainly supportive. I remember Ralph Ward-Ambler was on the board, as well as Laurie Carmichael, and at the time and they were great supporters of collaboration with companies, and what they assessed as my capacity for making a difference to the organisation, so -

So, Neville Wran was still the Chairman when you were appointed?

Neville was the Chairman, yes.

Yes.

I was surprised to be asked to run the Institute, but I could see that the sorts of things that I was talking about were really practical approaches to what was a pretty complex problem, but in all of that, you can't actually afford to get the people that you're working with off side, so I always tried to get people to take on roles of project managers, because they were respected by their colleagues, and they could actually influence the behaviour of most of the organisation that way.

So, when you took over the Institute, you inherited some staff. John Yates was the secretary of the old one, so you kept some of the staff that Dave had had, Dave and before him, Hill Warner, had as the Secretary of the institute and you hired me as the corporate planning person.

Well, you needed people around who basically understood the organisation and I was new to the organisation. I had no real network of influence, particularly in Canberra, in fact I found many of the people in Canberra were really very inwardly facing and very public service responsive, rather than thinking about the external world from an objective point of view, and thus making decisions that were based the requirements of the world outside.

So

Sorry, did that include finance and HR? Is that the sort of people you're talking about?

Well, people were making decisions about appointments in Canberra, where they had no insight into essentially what was required for that job to be done within a Division. I remember one of the staff in Canberra telling me they were going to close down all of the workshops in Clayton, and they were going to have everything subcontracted out, and I basically erupted. I can remember calling up Keith Boardman and saying, "Hey, over my dead body," and those sorts of unilateral decisions that could get taken and imposed upon divisions, seemed to me to be part of the culture that was wrong. Finance, with appropriation decisions being made unilaterally, just seemed to me to be crazy.

And, so pretty soon - in May of 1989 or in the early 1989, Keith appointed you as the acting chief executive when he was overseas.

No, he was injured in a car accident in WA in about May 1988, and he broke his leg, from my recollection.

*Okay, and you were the acting chief executive and you wrote this quite detailed reflections on your period as the acting chief executive*¹

Yes, I remember writing it. I don't remember much detail of what I wrote.

Well, it's quite insightful because it tells you - you talk about the role of the board and recommending that the board should actually be more externally focused than internally focused. You say that there should be much better delegation. You point out your view on the corporate centre as being administratively isolated from the Divisions, and there- should be a more developed pragmatic and forward looking managerial style. That the organisation has either not enough money or too many staff, and that there needed to be a better devolvement of authority, and a better line management philosophy, and that we needed to have a better improvement in the management skills within the divisions.

I think that's probably all accurate. I always preferred active line management over staff/committee decision-making at corporate centres. I was particularly concerned that Divisional money was allocated on an historic / head-count basis, rather than on funding for specific projects with pre-agreed objectives and outcomes. John Stocker managed to finally implement that process, in part, but it took a lot of persuasion and some years to introduce.

So, when you were the acting chief executive, did you actually - you spent that time in Canberra, at the corporate centre?

Yes, for something like several weeks. One of my enduring recollections is a conversation I had with Neville Wran about essentially budgets, and what had happened historically. Bob Frater and I discovered early on in 1989 that the organisation had actually exceeded its past annual allocation, and so it was forward-borrowing into the next year's appropriation. So in a sense, you started out the new financial year of the order of one month down the hole. And anyway, it wasn't all that clear and - I don't think it was apparent to Keith that this was going on, but Bob Frater and I worked that out that was "managing" within Corporate Finance.

I said to Neville Wran that basically one twelfth of our budget was being consumed, or has been consumed in the past year, before we even get a chance to actually think about the next year's expenditure, and he said, "Oh, yeah, well, what's new?" and I said, "Apart from that, though, we also need some expansion money." "Well, how much do you need?" I said, "Well, it works out it's about 90 million dollars." So, he says, "Okay," so he picked up the phone, and called Bob Hawke.

Anyway, something was said by Neville Wran outlining the nature of our problem. I don't know what was said at the other end of the line but Neville Wran responded by saying, "Well," he said, "I've got guys here writing on placards, putting on white coats, and they're

¹ Adam, Colin (1989) *Reflections on six weeks as Acting Chief Executive of CSIRO* (See Appendix A)

about to go out and march in the street.” Something else occurs on the other end, I don’t know what, so Neville Wran hangs up and he said, “Well, I got you \$90 million.” And what that 90 million did, is to basically allow us to put a forward budget together that contained 12 months expenditure, and some increase in appropriation to the divisions. And so, that was one of the things that happened when I was acting CEO, fortuitously after Keith Boardman was injured. As one of my colleagues wryly commented, - “This brings whole new meaning to the phrase – break a leg!”

Acting CEO in 1989?

Yes. Mid 1988.

SiroTECH

Okay, so then John Stocker came on as the chief executive and then the Sirotech business came, so you went off for a while to be the chief executive of Sirotech. How did that happen, Colin?

Well, I think that happened because Keith had decided some years earlier, - I suspect on the recommendation of the previous board, that there should be some sort of CSIRO commercialisation arm. There needed to be some group that took good ideas out of divisions, went around and found somebody who could commercialise it, and found some capital, so that group was put together and had operated in Melbourne for a few years.

In the early '80s, that started.

Well, I don’t really know too much about its genesis, but it was pretty clear, I think, that it was becoming a problem. I wasn’t sure, again, what the problem was, so Keith suggested to me “How about going in there for a while to either fix it up, or recommend some changes?”

By Keith or John?

No, it was Keith Boardman initially. Keith suggested it, but it was in the period of John Stocker’s appointment that John agreed that I should undertake a review. So, John, I think, in the early stages, saw me as some sort of competitor, but after having a couple of meetings, it was very clear to him that I wasn’t. I had already told Professor Clarke that I was not at all interested in the CEO position, and had already turned down one Canberra-based appointment. I had my hands full with material science, and the new Divisions within the Institute, so now I’ve got six hands full, with the divisions that didn’t want to support Sirotech.

Anyway, to be asked then to clean up Sirotech Ltd was just another manifestation, I suppose, of the organisation needing a fairly capable set of hands to solve problems, when I hadn’t actually solved any of the problems that I already had on my plate within five Divisions. But nonetheless, I went into Church Street in Richmond and into the building there and tried to figure out what on earth they were all doing. The really interesting thing I found was that most of the divisions were apathetic and reluctant to have anything to do with Sirotech as an intermediary, in any sort of negotiation that they were having with outside parties.

So, there was open hostility between the Chiefs of Divisions and whilst the Institute Directors were in a more powerful position, most of them didn't really know whether Sirotech was going to be able to help, or on their side in commercial assessments, or essentially going to countermand some of the things that they wanted to do inside their own institute offices.

Now, Alan Reid, for instance, was a case in point. Julian Land struggled to reconcile his mandate within, and for Sirotech, with essentially keeping Alan and the minerals divisions happy with whatever it was that was negotiated on their behalf. I could see that the creation of the new Institutes really put Sirotech at a real conflicted disadvantage, because the institute directors were being asked to do things that essentially counteracted the commercial mandate that Sirotech Ltd had traditionally enjoyed. Also, Sirotech Ltd had virtually no corporate governance protocols, and had suffered under at least two poor CEO appointments.

And the new structure of the Institutes had a business development person on the staff of the Institute Director, so you had Trevor Thacker.

Yes, but I think really what happened was that Sirotech was a good idea when it was proposed, but it was neglected in the McKinsey Review, and it was never really thought about in any real detail in the creation of the new Institutes, and so the aspirations of the Institute Directors and the requirements that people had inside Sirotech was difficult to reconcile. So, I can remember having a meeting with John Stocker and saying, "Look, John, I think the only way out of this, is to take the good people from Sirotech back into the Institute structure," and some of them did. Alan already with Julian Land, for instance, however some staff didn't appear to be wanted anywhere, neither Institutes nor Divisions.

The agricultural divisions really didn't want to have much to do with the people that were employed there, and in fact one, of our unfortunate court cases, was a direct result of a Sirotech staff-member decision. So, when Neville Wran then asked me at a board meeting, "What do you propose to do?" and I said, "I think the only thing to do is to wind up Sirotech Ltd, find somebody in the organisation who's interested in doing that, and you have to transfer the good commercial people back into the Institute offices, and I'm going to go back and run my Institute. Neville said, 'Yeah, sounds like a good plan, yeah, let's do it.'" Now, that was probably the only time that I felt that I had bypassed John Stocker, but John didn't know what to do with Sirotech either. He had no detailed view about it, or the quality of the people there.

He did get a fair amount of useful insight from John Grace, whom he'd work with at AMRAD, but the Institute Directors did not really have any clear idea about how to handle that break up or wind up of Sirotech, and the pros/cons of putting some staff back in the Divisions. It was John Grace who basically nicknamed the organisation 'Psychrotic.' You'd probably remember John Grace, do you? At the time, it did seem to describe certain behaviours.

I remember John Grace, and I remember the time. It was Peter Francis that first said that word to me, but it seemed to be pretty popular. So this might be a good time to have a break.

[music]

Interaction with Chairman and Chief Executive

So we're now back after lunch and we go back a couple of steps. So Colin, one of the things that the troops in the organisation often wonder is what instructions do their bosses get from their boss's boss, so when you joined the Division of Material Science and Technology, the discussion you had with Neville Wran, did he give you some clear expectation of what he wanted?

No. I felt his role was to calm the organisation down politically.

When you became the Institute Director, did Boardman give you a clear understanding and for example, when you went to Sirotech, did John Stocker tell you, clearly, what he wanted, or was it all left to your judgement?

No, to both questions. Well, let's start at the beginning. Neville Fletcher, I think, had pretty much decided he was going back to New England. I think he had intellectually departed, and so I don't think he was really in a position where he could give me any encouragement, or any idea about what to do because had he had those ideas, he would have done it himself. So, I think Neville had already resigned, intellectually. I think he was back in New England as a professor of physics. Most of my initial Institute dealings were with Ian Elsum and Andrew Pik, both of whom were keen to keep going on "business as usual". The model for that Institute was a university without students; excellent publications counted most. I had a feeling that working on practical applications was considered demeaning.

In relation to what to do about the Institute, I think Keith's only comment to me was that the board had been very impressed with the progress I'd made with Material Science, and there were a few other divisions that needed that sort of insight, so it came across to me that most of the people in the senior positions in the organisation really didn't have a clue about how to define the organisation's objectives, or how to determine "deliverables" that could justify the tax-payer's investment in CSIRO, at least in quasi-economic / political terms.

They were men of a different era essentially, used to the credits that came with excellent scientific work and publications, but unaware of how to develop industrial linkages that would improve Australia's competitive position. I think Keith Boardman was being pushed pretty hard by the Board, probably also as a result of the McKinsey Review, to do something, but nobody quite understood what that "something" was. My year or so in Sirotech Ltd was to try to convince myself that it was redeemable, but would I be able to change it into something that would serve the organisation, and what do you do with it managerially? So, it was more "that it's a problem child. We don't actually understand too much about what needs to be done, but you probably do".

Well, of course I didn't, but like many things in life, you go in and ask a few questions and see how things are happening and then slowly, but surely, the light dawns and you can essentially see a path forward. But I couldn't see Sirotech Ltd surviving with the evolutionary model that was required for the Institutes. They were incompatible.

Yes, and I think we, the chiefs at the time, thought that, that the two - the direction that you were taking, shaping the institute, meant that those capabilities that we needed to do, what

your vision of how your institute was going to go, meant that we need to build up those capabilities within the division.

Well, of course. The segments of the economy that each of those Institutes served were very different, so, what worked for our Industrial research divisions and the companies we faced, was very different from agriculture. It was different for Roy Green's environmental divisions, and it was difficult to explain to our Board, not necessarily John Stocker, that the response from each Institute had to be attuned to the external world that they serve, or purport to serve. It was difficult to have some sort of harmonised internal model where everything's done the same, when the sectors of the economy were so different.

So, just keeping with Sirotech Ltd for a minute, before we go back to the organisation, after you left Sirotech and came back to the institute, Don Gibson became responsible for the transfer and wind-up process.

Yes.

How did you get on with Don Gibson and how did you see the evolution of that?

Well, Don's instruction from John Stocker was to basically close it down. I think once we'd made that decision, and that the good people from Sirotech need to be brought back into the organisation under the Institute structure, it was just then a question of doing it. John talked to a number of chiefs or people who might be interested in doing that, and Don was the one who essentially said he would do that job.

I spent some time with Don before he died, so we went back over those years, and we talked about that. He said he thought that he was being handed a poisoned chalice, because his job was to do himself out of a job, and I suppose initially he had some confidence that John Stocker and the organisation would subsequently look after him, but that didn't transpire, so I felt personally pretty bad about that.

No, I think that if you I think that there's some truth in that, that - and it comes, I think, from what your answer to my previous question, that when the organisation puts you in a position, it doesn't tell you what they expect from you very much and so the corollary to that is that when you come back from doing something else, they think you're going to look after yourself. Can I just go back briefly to Neville Fletcher, because one of the things that's not in your PH file is the result of a performance review that Neville Fletcher gave you. So, there's a letter too saying, "Dear Colin. I've done this performance review. You may or may not."

I didn't see it.

So, you didn't - you never saw -

I don't believe I ever saw it.

No, well it's not in the PH file. It says that there's some notes on it that you might find valuable, but you never saw it?

I don't recall ever seeing that. I was surprised to get that phone call from Keith Boardman saying, "We basically want you to run the institute." It was really quite it was out of the blue, but it may well have been based on that sort of insight from Neville Fletcher. I think I only ever had a couple of meetings with Neville. - My recollection of that six-month period was that he was mentally on his way back to New England. The fellows that had a lot of influence within the Institute were Ian Elsum and Andrew Pik, and I think in many ways they were the ones that were basically doing most of the work that Neville required. Neville may have talked to them about it, but I felt that they had overall strategic responsibility within the Institute without any commensurate experience.

They were running the institute, were they?

That's my view - I think it was Ian Elsum who wrote to me early in 1987 and said that I'd be limited to 10 cubic metres of household goods in shipping to Melbourne. I called up Keith Boardman and said, "I'll be bringing back a standard shipping container full of my household goods. If that's not satisfactory, let me know and I'll stay in Morrismtown." Problem solved.

So, Colin, getting back to CSIRO, you became the Institute Director, and about a year later you went off to Sirotech Ltd. You came back as Institute director. I think during part of that time the Board had made the decision to shift the headquarters from Canberra to Melbourne. Were you involved in any of that?

No.

And what did you think of that?

My recollection was that John was getting mightily sick of travelling, and I think he made a fairly strong case for being closer to Melbourne. I think that decision was basically driven by John, not the board. I felt that the board had to acquiesce to what was a very reasonable request.

The Board had to make the decision, but it wasn't the Board's idea, so what did you think of the decision?

Well, three Institute Directors were in Canberra, and there'd been an attempt to get all of them together in Canberra. Alan Reid probably would've done it if I hadn't revolted. Ted Henzell, Alan Donald and Roy Green were all in Canberra. Bob Frater didn't want to leave Sydney, and then Alan Reid basically then drifted back to Sydney. I had stayed in Melbourne so I think really the decision to come to Melbourne was driven more by John's desire to be here. It probably would've made more sense to essentially have John in Sydney. It was geographically closer to the centre of mass of the organisation, but I don't recall having any participation in that decision. It was just John's decision, I think, to be closer to his vineyard. His girl's schooling may have also have been an important consideration.

Do you think it worked?

Well, I don't know. I could see that there were some real advantages in having it in Melbourne, and for me personally, it was fine. It was closer to where I was. It meant that John and I, for the first time, worked a lot more closely on almost a day to day basis in

Parkville, and then subsequently when we moved into the Reserve Bank building, I was able to run my part of the operation from there quite successfully. So, I don't really know how important it was for the CEO to be in Canberra. Politically and financially it was a serious consideration, and getting the political will bent to complex technological considerations has never been an Australian strength.

But if the organisation was dealing with external companies, then it was the relationship with those companies that ultimately would determine whether the technology was ever implemented and picked up. So, it really depended, I think, on whether the Board wanted the organisation to be externally focused or internally focused. But I do remember with some degree of disappointment a number of times the Board said to me, "Colin, we really shouldn't be too commercially, because if we are the government's going to give us less money."

Did you say the Board?

Yes, that was a Board view, well Adrienne Clarke in particular had that view. I mean, when you think about the composition of the Board, there weren't really many captains of industry, ever on that Board. Some very committed, well-meaning people, but few had global technological experience.

Commercial Practice Manual

There were some, but it wasn't dominantly a commercial board, was it? So, Colin my recollection as a chief was that the systematic notions of commercialisation, the commercialisation manual, the work that you did in trying to get the Institute and the organisation to follow good processes and procedures was a big contribution to my understanding or to my work as a chief of a division. So, did you initiate that? I mean, how did that all come about?

The main reason the Manual was initiated was our clear failure to head off two very troublesome law-suits, both of which could have been avoided for entirely different reasons, and both of which started with some naïve "deals" being agreed to by relatively junior staff. Terry Healy could write succinct summaries of where we were at risk. The Manual was subsequently put together by a very experienced team of commercial and legal staff from across the organization. We had about 20 capable people distilling their various experiences, and putting it together in a logical approach. It was basically my experience that I kept seeing documented in "The Commercial Practice Manual". I remember giving a talk many times to say that we are now in the "Commercial CSIRO" operating across two distinct cultures. There is a culture associated with scientific inquiry and research, and that culture has to be seen with all its strengths and weaknesses, just as an external market focus involves a different culture. Commercial culture, just like scientific culture, accumulates from experience, and often failures teach one what to do differently in future. It is not a question of one approach or culture being better or worse than the other, but like being bilingual, you've got to be able to translate from one to the other. It always seemed to me that it was an either/ or, and that the organisation was having a hard time seeing how you could do good science, in an environment where you actually wanted some results and outcomes on which you could essentially develop a company, or change the way in which an industry worked.

Ted Henzell probably understood that better than most of our colleagues at that time. Ted Henzell's book is one of the very good source documents that people ought to read. He has contributed most of his Institute research papers, and experience over his lifetime in CSIRO, into the Fryer Library at the University of Queensland. I have read a couple of chapters that Ted wrote, and reviewed it for him, particularly over the Sirotech days. But Ted, I think, saw the process of delivery into the agricultural industries, into farms and into the state agricultural organisations, pretty clearly. It was very much of the Rivett model.

He was more inclined to my way of thinking, although he didn't have that same commercial aerospace industry experience that I'd had in the United States, was philosophically attuned to that idea that you've actually got to do something useful and deliverable to the external world. So, the whole of the commercial practices debate was to try to get people in the organisation to be "culturally bilingual". I did have somebody from the North Ryde Commercial group fairly recently - well, a few years ago, say to me that she'd found in the archives this thing called a Commercial Practice Manual and, "Wow, why wasn't that made available for everybody? It is a brilliant document". And I said, "Well, I don't know. I can't answer a question about corporate memory".

Why, do you know the answer?

Probably, it was an NIH issue.

So, we now come up to the period in the end of John Stocker's term as chief executive, so he made it clear, I think, from the beginning that he was only going to be there for five years and he was going to move on. What's your recollection of that period in the organisation from 1994, '95, '96, the end of John Stocker's time as the chief executive and the transition to the new time?

My personal view is that John just got very, very tired of travelling, and dealing with politicians. The most insightful example of that was a meeting John had with Chris Schacht and with all of the Institute Directors, when Chris Schacht was Minister for Science. I remember that only Alan Reid and I had some inkling of how to deal with that sort of personality. And really, to give John his credit, I think he just decided he'd basically move on. This was not a problem that any of us could solve.

Working with Malcolm McIntosh

And you didn't want to be the chief executive after John, so you said all along you didn't want to be the chief executive, so did you?

No, I had a very nice letter from Nick Minchin offering me the CEO position after Malcolm McIntosh became terminally ill, which I turned down, largely because I felt that I was not going to make any real progress with the politicians. I felt that my own particular personal style, and the way in which I operated, was pretty much antithetical to the whole political process and in a way, we hadn't made the sort of gains that I wanted commercially. Perhaps if the royalty stream had come in from WiFi patents earlier, and there was some money to devote to basically different types of projects, and funding for more developmental prototype work, I might've been inclined to do that. I just came to the conclusion that I'd

probably offered the organisation pretty much all I that had to offer, at that time, and I didn't want to live in Canberra.

I didn't really look forward to engaging with the sort of Canberra politics that would have been needed, and I wasn't sure that I was ever going to succeed in getting more money for the organisation, nor did I want to be the guy that closed down the shop, and reduced the staff from 7,400 to 5,000 or whatever it was later on.

You said in your reflections of 1989 of what we needed to do.

Yes. Staying in business during alterations is always going to be a challenge.

So, but we're back in 1994, '95, and it was then that the Board decided that the current - the institute structure at the time, it probably needed to be reviewed, and Bob Frater had the internal committee to look at that, and the result of that was the formation of the renaming of directors in a sense to deputy chief executives and you - in that restructure, you became now the deputy chief executive in charge of the minerals.

And energy.

Minerals and energy

Well, that was really Malcolm McIntosh's decision. It had already been realized that Government Departments, and most companies, needed a unified approach to many contemporary technological challenges, and the reorganization was in part a response to providing organizational-wide advice based often on multi-disciplinary science. Institutes, and Divisions, frequently held different views, and the reorganization would encourage a broader co-ordination with multi-disciplinary analyses. It would also allow CSIRO to undertake projects with companies that transcended the skill-sets of just one Division.

An earlier exercise proved challenging for CSIRO in providing unified scientific advice to Government for the proposed Wesley-Vale pulp mill during 1989-90. Some 20 years later the Murray-Darling Basin water analysis was handled far better, and CSIRO proved quite capable of providing coordinated multi-disciplinary scientific advice.

Malcolm McIntosh implemented the recommendations of that Frater committee.

In part. I think what Malcolm decided, in considering his health, and how little time he had to travel, what he would do is to split the organisation into four "executive" quadrants, and essentially give the deputy chief executives pretty much full responsibility, as the chief executive would have, for those four quadrants of the organisation involving finance, corporate (HR etc), government interaction, and commercial. So, in a way, I inherited that commercial quadrant, which was a fairly obvious fit. Some Institute Directors were retiring anyway; Ted Henzell and Alan Donald, so there were really only four Institute Directors left. Malcolm just split it into four and said, "Well, who wants to do what?" As part of that, Alan Reid retired a little later.

The choices were relatively clear. Paul Wellings handled the Environmental parts of the organization and governmental relationships, Chris Mallett handled the Agricultural Divisions

and Finance, Bob Frater managed IT and the Industrial Divisions and Corporate, and I managed the commercial areas and the Mining and Energy Divisions.

I thought basically, the Chiefs in the IMEC divisions needed the sort of encouragement that I'd given to the other chiefs in my old Institute, so I talked to all of the IMEC chiefs and they all said, "Look, that'd be great. There are things that we want to do, but we've never been able to convince Alan." So, in a way, it was the Chiefs that supported me in that role, rather than my basically saying, "This is something that I want to do." It was a job that needed to be done and my original degree was mining and metallurgical engineering. I'd studied almost three years geology, and I had a pretty good insight into a lot of the science that was important to those divisions. So that was resolved, and Bruce Hobbs was good to work with. The IMEC chiefs were all very good.

I remember Rod Hill. I said, "I'm happy to give you this job as Chief, Rod, but I'm going to require you to do the Harvard MBA short course," to pick up some of what I thought were necessary finance and management skills. He was there for two or three months, anyway. And he later told me, "When I got there, I realised I was absolutely - I was just terrified." He said, "I thought I'm absolutely incapable of dealing with this material at this sort of level. Colin's expectations of me are just completely wrong." And he said, "After a couple of weeks I realised everybody else there felt the same thing. And then so for the first month I went from feeling very insecure to thinking, 'Yeah, this is probably okay.' And the last period I was there, I enjoyed it. I got a lot out of it and I thought, 'Yep, Colin was right. This is something that benefited me enormously.'" But it's a bit like throwing a kid into a swimming pool and getting him to teach himself to swim. You basically probably don't want to do it at the outset, but anyway, Rod was a very good chief. So that was a fairly pleasant experience in retrospect.

So, you - that was the deputy chief executive in charge of minerals and energy and that was the time that Malcolm became the chief executive, and Malcolm's health started to deteriorate and you took up - you became in some ways the acting chief executive at some time when Malcolm still alive. Did you work closely with Malcolm in helping to run the organisation? What was the relationship between Malcolm at that time and the other deputy chief executive.

Yes, I worked very closely with Malcolm for most of 1999 and 2000. What Malcolm told me is that toward the end of 2000 he said to Nick Minchin, "Look, there are two people that you can appoint as chief of the organisation." He said, "There's one who's a Fellow of the Royal Society, very good scientific skills, will be accepted throughout the world as being an eminent expert in his field. There's another guy who's got very good scientific credentials, but hasn't pursued publication, and wouldn't be seen in that light, but has very astute commercial judgement, a safe set of hands.

You have to decide what sort of person you want." He said, "I'll take the latter." And so, I got a nice letter from Nick Minchin offering me the job as chief executive. I was being pressured pretty much by the board to take the job. Vicki Sara came and had a long, impassioned session with me one day in Canberra, and basically tried to convince me that I ought to do it, "But the fate of the organisation and science in Australia requires you to do that, Colin," but I

wasn't particularly inclined to do that. Malcolm and I worked pretty closely together, I think fundamentally because he trusted me.

Acting Chief Executive

And what were the issues that you faced in that period of acting - towards the end of Malcolm's life and then your time as acting chief executive? I was in Jakarta a lot of this time, so my recollection from abroad was that there was some - there was a whole range of issues to do with property and with budgets and with dealing with the chief scientist, that the whole - the innovation review of the incoming Howard government and so on, the CSIRO not getting its fair share of resources.

One of the particularly tricky issues was when it had been decided that government needed to find money to finance the East Timor military excursion. Finance had decided that by selling CSIRO's real estate, and forcing us to do a lease back arrangement, substantial revenues could be generated. Malcolm McIntosh had been advising Defence, about basically how to deploy troops quickly, how to supply and resource them into Timor. There were a number of meetings, some of which I attended. Malcolm was really acting as an adviser to the Secretary of the Department of Defence during that time. Defence was the job that he had wanted, and had been in the UK preparing for, and that was the job that he was going to post-CSIRO when the incumbent retired.

So, the Minister had consulted with Malcolm and essentially figured out that Timor was going to be very expensive. They had no tropical warfare kit, defence didn't know how to quickly get procurement organised because the main supplies were held somewhere in Sydney and Melbourne. I can remember Malcolm saying, "Well, what the British did in the Falklands was they basically issued every officer with a credit card and said, "You're responsible for equipping your platoon, or your company, or your brigade. There are plenty of commercial outlets there. Just go buy what you need." And so, that's what was done for the Falklands.

The officers went and bought their kit and their cold weather gear and whatever else they needed, and that was assumed to cost about a billion. Finance had decided that they could get the necessary (unbudgeted) amount by essentially selling all of CSIRO's real estate. We would then operate our laboratories using some sort of leveraged lease-back deal from a bank. I can remember we had many meetings with Finance. Charles Allen asked me, "Well, what do you recommend," and then Terry Healy and I had a conversation about obtaining independent QC advice.

Charles Allen agreed to obtain appropriate QC's advice, to see whether the Minister of Finance actually had any mandate in this area. So, we found an impressive QC in Melbourne who wrote us a one-page document that essentially said that the Minister for Finance must take direction from the Minister for Science and Industry under the Act, and he has no unilateral right to force the organisation to do anything that the Minister for Science and Industry does not approve, nor his CSIRO Board endorse. So, that insight that gave me a fair amount of confidence to basically go along temporarily with the Finance objective, without actually ever agreeing to sell our land assets.

And we had many meetings with them about those issues, and Finance developed a plan to present to Cabinet for approval. They had it all carefully laid out, and in the penultimate meeting I reminded the Secretary of the Department of Finance, -“Do you realise that our title deeds do not say “Commonwealth of Australia”. The title deeds say the “Commonwealth Scientific and Industrial Research Organisation”, therefore Finance has no authority over the real estate, and my Board has instructed me to oppose your proposition.” His face went pale. Terry I understand wasn’t at that meeting by Ted Cain may have been with me.

I wasn’t at the meeting but I was part of the team preparing the QC brief.

Ted Cain may have been with me.

I was part of the process of getting there.

Anyway, the Prime Minister was out of the country. Peter Costello was to chair the Cabinet meeting which would decide on whether CSIRO had to dispose of our real estate assets. I’d called up Ted Evans (Secretary of Treasury) and said “Ted, I really think you need to advise your Minister, the Treasurer, Peter Costello, that this is going to be a pretty contentious issue. We have obtained independent QC advice, and the CSIRO Board does not agree with the position that Finance is taking about selling all our real estate. I’d like you to alert the Treasurer to the fact that this is not going to be a happy ending for somebody, and I don’t know whether it’s going to be unhappy for CSIRO, or unhappy for Finance, but nonetheless, I’d really appreciate it, Ted, if you’d advise your minister accordingly.” And so, that’s what happened.

Cabinet made a decision not to force CSIRO to dispose of our real-estate.

Would you prefer not to say anything about the meeting you had with Minister Fahey with and his advisor?

I probably shouldn’t say anything. It was not a good meeting, but I think the minister was badly let down by his staff. For Finance not to realise that the title deeds were not in the name of the Commonwealth of Australia, really, was gross mismanagement, and it’s a great pity that Finance went so far down that track, thinking all the time that the real estate belonged to the Commonwealth.

So, getting back to the other issues when you were the acting chief executive, what were the other things that occupied your mind, apart from this issue to do with land? I mean, Robin was the chief scientist at the time, wasn’t he?

Robin was disappointed earlier that he hadn’t been promoted inside CSIRO. He came to see me after the announcement about my appointment as Institute Director, seeking some insight about that decision. I was unable to enlighten him, saying that it was Dr Boardman and the CSIRO Board who made that decision. I suspect that he and I differed philosophically on CSIRO’s mission. I was very much of David Rivett’s view that there are some national problems that probably only Australian science can solve, and we ought to be devoting our scientific resources within CSIRO to those in the national interest, rather than only trying to publish high level science.

So do you think that attitude of Batterham's, do you think laid behind the report that he did as chief scientist?

Oh, for sure.

About abolishing the requirement on CSIRO to get 30 per cent external earnings?

Yes it's a great pity that subsequent generations of CSIRO chief executives hadn't actually thought a lot more about David Rivett's philosophy. After the Second World War organisations all around the world were impressed with the obvious success of basic science, and the technology that flowed from that during the war, because it contributed so substantially to both sides, both for the Germans and for the Allies. Belief that continued investment in basic science must axiomatically somehow or other confer national prosperity and corporate wealth proved to be misplaced, and it took some 20 years for politicians to start asking the obvious questions about practical outcomes. CSIRO was just unprepared.

No, you have to work on it. So, you dealt with a whole lot of ministers in your time in CSIRO from John Button, Simon Crean, Barry Jones, Chris Schott, Peter Cook, and then the ministers in the Howard Government, Peter McGauran, Nick Minchin.

Yes. Well the outstanding ones from both of sides of politics were John Button and Nick Minchin. They were both trained as lawyers. They had that logical fundamental understanding of process and they were both highly intelligent people. They were both, I felt somewhat frustrated to some extent in that they couldn't always bring their cabinet colleagues along with them and John Button expressed that. Nick Minchin less so, but I thought they were both very, very competent people and in their own way, but unable to influence cabinet to do the things that really were long range, strategic and in the national interest.

I had a long session with Nick Minchin over energy policy, and I said, "After thinking about David Rivett's approach to national technology policy, the one thing that we really had going for us as a nation is that we had cheap energy based on coal, but that wasn't going to last, and whether we talk about nuclear power, or we talk about the use of natural gas, we somehow or other as a nation have to figure out what's in our long-term national interest," We were discussing moving most of our Energy R&D to Newcastle, and we needed more \$ to initiate new development projects there. He said, "Well, first of all, I can't convince my colleagues that there is a problem, or that energy is going to be important, and we won't ever get to debate that or discuss it because there doesn't seem to be any real need right now. There's no short-term imperative, there's no real gain short term, and besides which we've got pretty competent energy companies working in this area."

During that whole period of the time when you were the deputy chief executive and the acting chief executive, a lot of that time was the Howard government and John Howard had the Prime Minister Science Council and particularly with, first of all with John Stocker as the chief scientist and then Jim Peacock, were you involved in the Prime Minister Science Council and what's your reflections now on the way that the government gets advice, scientific and technical advice when you've indicated a bit of that with the discussion with Nick Minchin. How did you find those processes?

Well, I think the process itself was really very worthwhile, but my reading of John Howard is that he basically didn't see science as something that was overwhelmingly important to the nation. Science policy may just have been a little too far removed from his daily preoccupation with the body politic.

So, I missed - there's John Stocker, Robin Batterham and then Jim Peacock, so Robin was in charge of the - that process that for a lot of the time that you were the acting chief executive.

I probably shouldn't say too much about Robin, but I think there were wasted opportunities. I don't think the PM Science Council approach was to define important national technology objectives that had significant economic outcomes, and I felt that CSIRO was being side-lined during that process. The Prime Minister's Science Council could have been identifying things like the energy crisis that was coming, differing views on climate change, the need for integrated Murray-Darling Basin socio-economic research, and essentially addressing them at a high policy level. They are all in the national interest and they do require the collection of a lot of people with different points of view. I didn't see any evidence that was actually done. So, it became "science showbiz" at times.

And so, were you part of the debate about climate change?

No, it was just starting about the time I left. I can remember giving a talk in 2001 at the Melbourne Club about significant science and technological issues facing the country. I can remember saying that I thought the debate about climate was going to be very interesting, and very divisive. I said I thought that we're going to have to make some real progress on considering nuclear energy as an option, as a nation, sometime soon. And I think that the general feeling in the scientific community is that these are areas that will be quite divisive, but all of that action happened after I left, so - I may have been better equipped to deal with it than some of my successors, I don't know. - I could foresee that these issues were going to become pretty contestable.

Achievements at CSIRO

So, now looking back at your nearly 15 years, was it in CSIRO, what do you reflect on your major achievements in that time?

Well I think we actually delivered a lot of good practical outcomes, across the board, in those Institutes and those Divisions that I was working with. We managed to have our Institute and Divisions supported, and respected, by national and international companies, by engaging constructively with them. Major investments by companies like BHP, some \$10 million over 5 years, and Boeing, were important achievements. I encouraged people to have the courage to go after some big goals. We did that. We had a number of commercial successes. We had a number of things that worked pretty well and people's careers, I think, took on a different dimension, because they suddenly felt they were important, and not neglected. I encouraged Bob Brown, Chief of Manufacturing Technology, to allow four of his staff to leave CSIRO and set up a new company, The Preston Group, to supply critical-path scheduling software technology to the aviation industry. With venture capital from Advent, we grew the company over several years. I ended up being Chairman of the Preston Group, and we sold the company to Boeing Aviation Solutions for some \$15m around 1999, of

which our equity was worth some \$5m and went to the original Division of Manufacturing Technology. It was reinvested in the Division.

Some of the people whose careers I influenced are no longer with us; Steve Wilkins, for example. I can remember saying to Steve, “We’ve got optical microscopes, and we have electron microscopes. Steve, why don’t you go build an x-ray microscope, based on phase contrast?” and he replied, “Well, yeah, but that would cost a lot of money.” “How much?” “Well, probably 100,000 dollars.” I said, “Okay, you’ve got it. Go do it,” and he did. A decade later, his high-resolution x-ray phase contrast images were on the front cover of “Nature”, and a spin-off company, X Ray Technologies, was formed. It was a matter of giving people the opportunity to do things that they would not normally have had the opportunity to do otherwise, had they just continued to publish in learned journals. There are numerous examples of our technology moving into companies.

We managed to give people the courage and the confidence to grow their capabilities. I encouraged them to leave the organisation, go pursue some opportunities in a company or university, which is probably where some had never left, and where they always wanted to be. So, we gave a lot of people post-doctoral and post retirement fellowships to go and do all sorts of things. And the organisation was better off, they were happier. I think my view about life is that most people want be doing things that are useful and, by and large, most of them did.

Yes, my - what I think that I learnt a lot from you was this approach to research planning and commercialisation which I don't think - I think that you added that to the organisation, so you, yourself don't reflect on that as being a major contribution, but I - that was my impression.

It was introducing a different and perhaps difficult culture. It was making people in the organisation feel comfortable with dealing with Boeing, for example, whereas once upon a time, industry would've been seen almost as the enemy, because they were antithetical to supporting long term strategic science. It wasn't so much they were antithetical; they were ignorant about successful companies being very hard-headed about what they could afford to invest in. It's a great pity that we don't have the brand names in Australia that exist in other parts of the world, developed from home grown companies. We haven't matured to that sort of level yet, although I would have to say companies like ResMed Ltd, -their market capitalisation is now about four billion dollars – have succeeded. Peter Farrell has done a very fine job with that company, coming out of a bit of science that evolved from Professor Colin Sullivan at the University of Sydney, Medical School. There are more good examples, but most CSIRO staff were generally unaware of the genesis of these companies.

So we might have a break there Colin.

[music]

The Boeing alliance

So, I think I'd like to go back a bit to the Boeing story, so, that was - you had, in the manifesto that you wrote in 1987, you mentioned that there are opportunities in the aerospace

industry, so, could you just talk a bit about how the Boeing relationship, which is still going, I mean, how that started and your contribution to it and your reflection on the benefit of that to Australia?

Well, it really started with an invitation from John Button, and this must have been late '87 or early '88, to talk to him about the offsets industry program, or the offsets arrangement. He said he had a feeling that it wasn't working. I didn't know very much about it in detail. I knew the concept, which was that in return for purchasing Boeing aeroplanes, Boeing would agree to spend a certain amount having parts manufactured or having some developed here.

This is a civil offset project?

Well, and military too.

And military too?

Yes, it worked for both acquisitions, and so I didn't say very much. I listened to his departmental advisors, but I knew from my experience at Pratt and Whitney Aircraft, because the F111 had PWA TF30 engines, that there were some problems, and I'd talked to one of the Pratt senior managers who had, coincidentally, been in Melbourne at about that time. They basically added whatever the percentage was onto the cost of the contract, so if Boeing or Pratt and Whitney were required to spend three per cent, in Australia, on manufacture for some part of that aircraft or engine, they'd just add three per cent onto the procurement cost. And when I pointed that out to John Button he was astounded. I said that these are commercial people. You're going to buy their aeroplanes anyway because they're the best. They will be very objective about the cost-benefit of building anything in Australia. However, if we have some unique technological advantage there will inevitably be a different type of arrangement. So, we talked about that and he said, "Well, I've been invited over to Seattle." I think this must have been about - February or March of 1988, "Would you come with me?" I said I'd be happy to. So, I dreamed up the idea that maybe what Boeing ought to be doing, rather than basically paying lip service to this civil offset program, was to think about developing some relationship between Boeing and CSIRO that would actually develop something unique in Australia that Boeing could actually use in their production line. And so, during John Button's visit, we had that conversation with Bert Welliver, who was a Boeing senior vice president responsible for new aircraft development at that time. Bert had been the chief engineer of the 737 programs. In fact, he still had FAA sign off for the 737.

So, did you know him when you were at Allied?

No.

So, you met him on this trip?

For the first time.

Trip with John Button?

I knew a lot of other Boeing staff in their materials lab that I'd worked with at both Pratt and Whitney, and at Allied, but I hadn't met Burt Welliver before. He said "I've got to come down in - I think it October of November of 1988 for the air show, the centenary at Richmond Airforce Base." He said, "Why don't we meet then? I'll bring some stuff down," he said. "I can talk to you about it then," he said, "But- we're thinking about making plastic aeroplanes. I've got 600 metallurgists working for me and one guy with a PhD in organic chemistry." I could see that Boeing may have a problem, so we've got a few things we can talk about. Now, what he did subsequently was contact a new Boeing Senior Vice President, Larry Clarkson, who had worked at Pratt and Whitney in Florida, and he said, "I met this young guy from Australia. He said he worked for Pratt. You worked for Pratt. Do you know him?" Larry said, "Yes, I know him. We went to the same church. He and Elizabeth sang in the choir together". Now, I'd probably met Larry three or four times socially, but I was not in the choir--

In Florida?

Yes, at the Tequesta Presbyterian Church. I had no contact with him professionally when we both worked for Pratt and Whitney Aircraft. He was an erudite, well-educated engineer, and had been in the aerospace industry all his life. So, when Bert Welliver asked Larry Clarkson, "Do you know Colin Adam?" and Larry said, "Yes, I know him. He's a good guy," - that's all Burt really needed. We met at the Air show at Richmond Air Force base. He then came down to Melbourne to Manufacturing Technology at Preston, carrying a 10 cm (4 in) thick stack of overheads. He went through all of his material and said, "These are the challenges we've got. This is what Boeing needs." Out of that came the first three projects, and it really was an opportunity for Boeing to get some people whom they wouldn't be normally talking to, to think about some of their problems, and a real opportunity for us to show what we could do.

In the early stages we agreed to fund these projects jointly, and split the costs 50-50, which meant net cash flow into CSIRO, because we were paying those staff anyway. I'd have to give credit to the staff involved in all of those projects, because they were extraordinarily successful, and Boeing were able to, in most areas, get insights into applications of our science that they had not been able to find anywhere in the USA. Boeing had made a corporate decision 40 years ago, not to have a corporate R&D lab. They were going to use the best technology from around the world, from wherever it came, and so they didn't have gatekeepers inside the organisation, who were protecting the corporate technology empire. They basically went wherever they could, to get whatever they needed. I wrote a three-page paper on the Boeing projects for CSIRO, that I've got somewhere or other that I can give you.

It'd be good if we could get hold of that

I think I sent you a copy of the Boeing paper. It has been one of our most successful industry collaborations, generating over some 30 years about \$100 Million to CSIRO. It is an example of my view that if someone senior enough in a world-class company can say, "These are our problems," a subset of people from CSIRO can look at those challenges, and then honestly decide what they can contribute as a solution, you can make real progress.

I think the scheduling software from manufacturing technology was one of the original projects, wasn't it?

I think the first project was to look at toughening epoxies. That was the one that was done in your division. The second one was the purported atmospheric / stratospheric emission contamination. Boeing had been attacked by the environmentalists that somehow or other, when they flew an aircraft in the stratosphere, which you do between about 65 degrees north and south latitude, over the poles, even though you're flying at 35,000 feet, you're in the lower level of stratosphere. Somehow turbine engine emissions, carbon dioxide, nitrous oxides and water vapour, were thought to be contributing to exacerbating the ozone-hole problem. Keith Ryan and his team in Sydney had a mass spectrometer chamber where they were looking at catalytic reactions on surfaces. So, they were able to simulate stratospheric chemistry reactions on the surfaces of ice crystals. Over a period of about three years, CSIRO and Cambridge University, who had a similar sort of stratospheric chemistry group, were able to publish papers that essentially showed that if anything, gas turbine engine emissions were contributing to the generation of ozone. At worst the effect was benign, and at best, the effect was actually positive in counteracting the ozone problem. So, that independent scientific view from CSIRO and Cambridge provided hard evidence, and satisfied the environmentalists. That research was a big contribution to Boeing's environmental credentials.

The funny story about the cellular manufacturing work was that Bob Brown had a young engineer who worked with him on the implementation of that technology at Holden, in Adelaide. Bob encouraged him to go over to have a look at the Wichita fuselage manufacturing plant which was still based on the old, WW2 model. Boeing had all the turret lathes together; they had the die stamping equipment isolated, so it was all the old-fashioned machine-shop segregation into similar pieces of equipment. Within some six months, he had redesigned part of their factory to make several parts in discrete manufacturing cells, which saved Boeing something like 10 million dollars, and the payback period for cost of the equipment reorganisation, and down time, was something like several weeks.

This was a significant development; Boeing thought he was an employee. They gave him an Employee of the Year Award, without actually recognising he was still paid by CSIRO under our contract with Boeing. He still worked for the division in Adelaide, but he was over there as a secondment on the Boeing-CSIRO contract. There were a lot of funny stories like that.

So, one of the notions that you introduced in the Institute was the notion of the key account manager, and Trevor Thacker was the key account manager for Boeing. Looking back on Trevor's contribution, what would you - how would you think about that now?

Well, I think the people in Boeing saw Trevor really as one of them. He had been Managing Director of Toshiba Australia, before joining CSIRO, and was used to working with senior commercial executives. They didn't see him as a scientist or somebody who was essentially from a laboratory working on detailed projects. So, in a way, it was a matter of having somebody inside the organisation to act as a "commercial" interpreter, and so Trevor's great value, was that when the Boeing people came out to Sydney, he'd meet them in Sydney and take them up to the vineyards if they were interested in wine, and show them around the vineyards. If they were interested in golf, you'd have a game of golf with him, but it was really more about making those Boeing executives feel comfortable, and that the Aussies

actually understood them and their challenges, which is often not the case. Often it's about communication of ideas and establishing trust.

He did the same with ICI and Orica, didn't he?

Yes, he understood that role of having somebody to identify their "wish list", and then finding people in CSIRO that could address those requirements. Bill Blevin, Chief of Applied Physics at Lindfield, was just appalled that I would recruit somebody like Trevor. I mean, "He doesn't have a PhD, Colin. How could you?" but that was the whole point. Trevor understood market requirements, and professional technology marketing.

Yes, no, I thought Trevor made an enormous contribution to that whole Boeing enterprise - the success of the Boeing relationship.

Yes, my experience in America was that when people at very senior levels, in Allied in particular, failed to get appointed as chief executive, the company was smart enough to send them to Washington to sit on a lot of the Senate Select committees that were dealing with basic legislation for either chemicals industry or aerospace. It's often a matter of having interpreters, which Trevor was. I mean, it wasn't just a one-way street, Tom, and you educated Trevor about chemistry and the periodic table, for instance. Trevor had to leave school at fourteen when his father died, in order to support his family. Although denied further education, he was highly intelligent.

So, I'd just like to go back briefly to something that you said about the Boeing relationship, which I think is an important point about the way that CSIRO operates with companies. So, you said that your agreement with Boeing was that they'd pay 50 per cent of the costs - CSIRO would pay 50 per cent of the cost, and that was a net inflow of cash into the organisation. And that - and the role of Boeing was to - it was twofold, one was to have the net inflow of cash, but the other was to guide some of the research that the organisation was doing, that meant that it had dual benefits.

The organisation could do very good research, like Jonathon Hodgkin did in part of the polymer work, but also have an assured commercial outcome to it, because it was part of a long term strategic plan between the organisation and the company. So that notion of the long-term research of the organisation fitting into the goals of the company and people sharing 50-50 worked well, works very well. It's something that is not really done anymore as much as it was when you were them, so the organisation's policy changed as a result of various things. My view is that that was what the Boeing was quite good. How did you see, in your period as the acting chief executive and the pressure from treasury and finance, did that have any effect on the way that the organisation dealt with companies?

A: Well, the long-term contribution to the nation needs to be spelled out a little bit differently from just a cash-flow term, but it is a good measure of commitment and industry sincerity. As a consequence of the work we did with Boeing, Boeing now have 4,000 employees in Australia. They ended up buying both the old Government Aircraft Factory and the Hawker plant in Sydney. They also developed, I think, quite a respect for Australian science and technology. Senior Boeing people often said, "You Aussies are clever people."

The big investment in the Wedgetail Project, which initially was partly within Bob Frater's Institute, relied on clever local technology derived from our radio-telescope work. It shows the importance of long-term strategic science, investment in demonstration hardware (the Australia Telescope) and industry contacts. Just as importantly, the University of Queensland supported that project, which went ahead at Amberley Air Force base. There was a huge investment by Boeing in a particular bit of communications technology for essentially the so-called C cubed, (command, control, communication) interface, where they've got 747s and 737s now with big dishes on top, to talk to satellites. Almost all of that developmental work was initiated here in Australia, and so Boeing Australia as an organisation really grew out of a view of Australia being not only a reliable ally, but also having very sophisticated IT technology. I think the growth of Boeing Australia as a company really rests on a lot of the earlier work that we did together, where there was a sense of trust established, and mutual respect.

Now, that's what I really meant by strategic development. We tried to do that in other industries. Bob Frater visited Bell Labs, knowing that Dr Abbas had almost come to work as Chief of Applied Physics, and almost all of the work that Bob's Divisions were doing was related to advanced signal processing and communications, but they just didn't respond. They didn't make the connection, and I think it's because Bob wasn't able to attract somebody like Trevor Thacker into his Institute, who was able to market our technological capabilities, and deliver a process of engagement. It appeared that he was not able to really get the people in his divisions interested in the sorts of things that might be future communication projects within AT&T, nor did we make any progress with Telstra. Now you could argue that the Wi-Fi came out of that, but my view of Wi-Fi was a very happy accident. It wasn't a consequence of a deliberate strategy, but rather inadvertent patent infringement, by several US companies; nonetheless we'll take it.

We'll take the money anyway.

We'll bank it, yes.

Alright Colin we might have a brief break here.

[music]

Post CSIRO activities

So we're back again Colin and I think in this last session we'd just like talk to you about some of your post-CSIRO activities. So what did you do to start with?

Well we started a small group in 2002 called Principals Funds around Denis Hanley and Andrew Denver, (both of whom I had worked with for about a decade as a member of the Memtec Ltd Board,) and also a banker, Charles Kiefel, and me – The Principals Group. We started the Principals Cornerstone Fund about 2004 by raising \$40 million capital, and subsequently invested in four companies, with the idea of replicating our earlier success in commercialising Australian micro-filtration technology with Memtec Ltd.

These four companies were Universal Biosensors Inc (glucose measurement for diabetics), Cath RX (new catheter technology for treating cardiac arrhythmia), Sunday Silicon Technologies (new methods of purifying silica for low-cost silicon solar-cell production) and SpeedX (new molecular diagnostic RNA – DNA analysis)

SST - We ended up being successful in purifying silica, of which there's a fair amount in Australia, as a precursor for making solar-grade silicon. We got to the point with that company where the technology was proven after about four years. Dennis and I decided that we actually didn't have the appetite to raise another 40 million dollars, which had become increasingly difficult after the GFC. This amount was what it would have taken to build a substantial pilot plant in order to get companies like Samsung interested in co-investing. So we shelved that development, and we wound-up that particular company. We only had 12 employees, and we were able to find jobs for all of them.

Another company called SpeedX was really a spin off out of Gene Shears, where a group of about 12 people who had worked for Johnson and Johnson in Sydney,- remember J&J were the people who decided to commercialise the biological application of the CSIRO-developed Gene Shears, from Plant Industries. In one of the rounds of corporate brilliance that happens in large companies, J&J decided they would divest themselves of any ventures that didn't have commercial prospects inside two years. And so, we took over that team, basically, without having to spend very much money.

Q1: Is that a company, and do you have a name?

A: Yes, that company's called SpeedX.

Q1: SpeedX?

A: S-P-E-E-D, capital D, small x. So SpeedX now looks like it's able to do molecular-level analyses based on RNA and DNA strands. I don't know too much about it because I've been off the Principals board now for nearly three years, but my guess is that it's being fitted up to work off some technology resembling the UBI platform. It's generally considered to be a fairly advanced form of molecular diagnostics, and it has reasonably good licence revenue from some larger diagnostics companies. It could be a commercial product that a company like UBI acquires at some point.

Q1: And UBI and Principals -

A: Universal Biosensors Inc.

Q1: Oh, okay.

A: Universal Biosensors was the first of the four companies that we established with funding from the Principal's Group.

Q1: Does Principals still exist?

A: Well, it exists in the sense that Principals Funds is now run solely by Charles Kiefel. We returned most of our Principals Cornerstone Fund shareholdings, of shares in our investee

companies - the original shareholders; to the people who put in the original \$40 million. We distributed that out, and our residual interest is really only in SpeedX, where Dennis Handley and I are the two directors on the holding company for the residual SpeedX investment, but not on the SpeedX Board. So, Principals Group, in a sense, has run its course, and has been wound up, but we are holding the investments in SpeedX, essentially in specie for the original investors in the Principals' Cornerstone Fund.

About 2014 we decided that we should wind the fund up. We're all getting older, we weren't prepared to raise more capital, and we believed the original investors have their own capacity to make decisions about their investments.- For example, Universal Biosensor shares - whether they want to hang onto them or sell them-, but it's inappropriate to have a public company shareholding held within the Principals' group. We believed it was better to distribute the shareholding to the original individual investors, and to let them make their own decision about the fate of their share. So, we've done that with pretty much all the Cornerstone investments.

So, I'd say in summary, about those four companies, UBI has been very successful. We wound up SST- the silicon technologies company, because we basically didn't think that it was likely that we would see out the next phase of investment, which will probably be ten years to commercialisation of that technology. CathRx is still in play. It's still being looked at by major biomedical companies. I think it's a prospect for a trade sale at some point. And I think it's highly likely that SpeedX, somehow or other, may get folded into some diagnostics company not unlike Universal Biosensors. So, all in all -

And Andy Denver is the acting chief executive of Universal Biosensors?

No, Andy has resigned as chairman.

Has he? Okay.

The Chairman is Craig Coleman, who's the Executive Chairman of Viburnum Funds in WA, and has a substantial shareholding in the company. The main revenue stream is still glucose testing, and that's about 20 million dollars a year. The new chief executive has come from Siemens Healthcare, who are using UBI warfarin testing technology. Warfarin is the second analytical stream for Universal Biosensors, marketed through Siemens Healthcare in US, and last year that returned some two million dollars. This warfarin revenue should increase for the next few years. There is a possibility that molecular diagnostic testing could eventuate, but I don't know how far off that is. All analyses are very much market driven, and all very much marketed through large technology companies. Siemens Healthcare is a 14-billion-dollar enterprise in the United States and it's to be spun out of Siemens fairly soon as a stand-alone company. The fact that one of their senior executives has taken over as CEO of Universal Biosensors, might lead one to conclude that Siemens Healthcare have an interest UBI as an acquisition, but who knows?

So Colin, you told me years ago that what distinguished Principals as a vehicle for investment was that you guys were not passive, you were actually hands on managers of the investee companies.

Yes, that's true.

Do you want to just reflect on that as an approach by venture capitalists?

Well, the two things that were really critical in our success were that we'd all had a pretty diverse background in business, and in commercialising technology, of one form or another. The second thing is that the successful companies all had a couple of internal champions that were really red hot to get the technology developed, so they, in a sense, were not so much employees, but true believers; Alastair Hodges would be a classic example of that.

Alastair believed passionately that he and Gary Chambers, between them, could essentially build a modern manufacturing line that could make these new electrochemical sensors at the rate of about a billion a year, and to be the most accurate, the cheapest and essentially the most reliable of any technology for analysing for blood glucose. And so I think, apart from the fact that you've got to get some capital together, having people inside the company that believed passionately in what they're doing and actually want to do it, and want to see it succeed, is the first pre-requisite. But, what is equally important is having a Board that actually has practical experience who can guide those people into ways in which you might introduce new technology to the market.

It is important to be able to think through all of the chess moves that essentially get you to the market; that is, risk evaluation is also extremely important, but you need both. I don't think either one of those things is enough by itself. And I'd have to say in the case of SST, we failed to make headway as quickly as we should have, because we had no Alastair Hodges in that company. We actually employed a very capable research engineer and said, "This is your job," and he looked on it as a job, but I don't think he had the same fire and enthusiasm to succeed at all costs, and over all obstacles, that Alastair had.

So, in Speedx, there are a group of highly motivated of young people in particular, and a mature brilliant woman who's managing director of the company. They have that same sort of passion to succeed. The right capable people are critically important. They actually want to get the RNA and strand DNA as a molecular diagnostic tool done, commercialised and used, and so those people are really what the company gets built around, and that's what the venture capitalists all around the world are looking for and doing.

This Principals Funds activity has been a major part of your post-CSIRO activities.

For about for twelve years.

And you've been on other government boards or CRCs and you're on the board of -

VCAMM Ltd

VCAMM, for a while.

Yes, the growth of VCAMM was somewhat disappointing in the sense that we just about got to the stage where the company could self-fund its future, and the Victorian government decided they weren't going to continue to fund it anymore. Another year's funding, that company could have been a standalone company, but anyway, that's another story. VCAMM built the prototype carbon fibre production line at Deakin University, and that has allowed Deakin to make prototype parts. It spun off a company down there called Carbon

Revolution, that is making high quality carbon fibre reinforced automotive wheels and they've got a decent business exporting wheels all around the world. So, reducing the weight of a wheel, in essence, gives you faster acceleration, so the payoff in the high-performance vehicle industry is pretty high. But that came directly out of VCAMM, and I was chairman of that since its inception. We succeeded in breathing some life into local manufacturing that was based on local carbon fibre, and modern epoxy technology, some of which was derived from CSIRO-Boeing work, too. It was a great disappointment that we had to wind up VCAMM on the eve of its commercial independence.

So, are you a chairman of Carbon Revolution?

No.

You were a chairman of VCAMM?

Just VCAMM Ltd.

Right, but were you on other CRCs or other boards?

I was Chairman of the ARC-funded Light Metals Centre at Monash for the duration of its ARC funding, and enjoyed being part of a metals research community again. However, I mainly stuck to the commercial stuff, Tom. I decided I'd forgo the opportunity to get involved in CRCs because in many ways, most of the CRC agenda is still run by the research community, rather than by company commercial representatives aiming to enter new markets. I'd decided that I'd rather try to devote my interest to things that looked like they were going to be commercially successful.

So, if we now just say to you looking back on, from the time you left CSIRO to now, what do you think are the - what's your reflection on the performance of the organisation, post Colin Adam?

Well, I still think of the organisation very positively. Probably you'd have to say the last couple of chief executives have been somewhat unknown quantities in relation to new business development. Reducing staff numbers was never going to be a long-term solution, and the ability to generate new levels of income is probably a reasonable metric about their performance. John Stocker was actually quite wise, and quite savvy, in managing to invest the WiFi income stream when he was Chairman, and I think his personality was amenable to the Canberra bureaucracy where he could make friends easily, and influence government positively. He was successful in the sense that he fairly quickly earned the respect of Ministers and bureaucrats in Canberra which is essential.

And the ministry.

And the ministry. Malcolm McIntosh of course had a phenomenal reputation coming back to Australia, and the organisation was really fortunate, but also unfortunate that Malcolm's health was so poor. He was a very steady hand, and of all of the people I've worked with, I think I've probably enjoyed being around Malcolm most. I felt that he had great insight into both what the organisation could do and what it couldn't, or shouldn't, do.

Mm, and he had good insight into the abilities of people.

He was very good, a very well-rounded person, Malcolm. I think the way he dealt with his illness too was just admirable. I don't know many people who would've held down those sorts of responsibilities when they were so ill. So, yes, I mean, what would I do differently? I think I probably would've been a bit more impatient to get the Board to essentially get onto the sorts of commercial directions I have outlined more quickly. In many ways, the Ministerial selection process didn't give the organisation the leadership it really needed. I felt that many of the people that were on the Board didn't really understand what an organisation like CSIRO could, or should, do.

Or couldn't do?

Well, change takes time, and organizations have to have the capacity to learn from their mistakes. It is really a question of risk management or risk avoidance. Over the years, they hadn't had much international experience or exposure, so the Board chose the latter. The sorts of processes that people went through to build large corporations in America were pretty much unknown to the Board members. John Gandal was perhaps the exception. There is an amusing story that I could tell you about his appointment, but won't. Baxter Healthcare was built out of a small company that supplied basically dialysis or pure water into hospitals. Mr Graham, who ran that US company, encouraged a number of his enterprising staff to actually leave, and he'd say to them, "Well, if you think this is such a great opportunity, I think you ought to leave Baxter. I'll give you the technology that we have in the company for you to make that a success. I'd just like to retain 20 per cent of the new business. And if you are overwhelmingly successful, I'd be happy to pay you a billion dollars in 10 years' time to buy it back."

So, there's a way of thinking about creating opportunity, and managing risk, that I don't think many of our board members actually had, so it would be very hard to help an organisation change, when you actually don't have that sort of confidence that comes from experience. So, we don't have a nation that's had a very clear track record of creating wealth, and jobs, and opportunity out of technology. Most of that confidence in the western democracies came out of the Second World War, and maybe the success of First World War to some extent.

So, if you were advising the government today, what would you say to them about CSIRO?

Equip the organization with the people and resources to develop our strategic businesses. The "I" in CSIRO has been long neglected; sadly, David Rivett's legacy was somehow lost or forgotten. I think CSIRO is in a difficult position regarding original research now, because our universities are so much more powerful than they were, in say, 1960. I mean, if you think about how many universities had the capacity to train PhDs then - there were only a handful.

Yeah, the main eight, the eight...

We've invested a lot in our universities but, as a consequence, our universities now employ more administrative staff than they do teaching or research staff, and that has to tell you something about university budgets and management. So, the capacity to do really top-level original research has really been very much diluted, as far as CSIRO's concerned, because it's

no longer the only game in town. It then begs the question, well what game should it play, and it's perhaps the current chief executive who's the right person for the current times, because he's trying to position CSIRO to become some sort of technology commercialisation vehicle, without sacrificing high-scientific development based on our long-range research capabilities, which has to underpin our future. Whether it can do so only time will tell, but if you don't have those two prerequisites that I talked about earlier, with our own experience of people with a real passion to overcome all sorts of odds to get their developments into the market, and a board that's experienced enough to take them on that journey, you will fail. We can have as many seminars on Innovation as we like, but really only time and experience of managing the market-entry risk will prevail.-

So, that's really the lesson of Universal Biosensors, Resmed, and the like that probably needs to be more generally understood by people.

Well, it's a bit like athletics, Tom, where you say, "I'll give you a pot of money and I want you to win a gold medal." The money's irrelevant unless the individual has the passion to go out in the hard, cold weather and train, and then compete at the highest level. Now, where are the people that have got that sort of guts inside CSIRO? If you haven't got them, I think the organisation is going to struggle, because you can't force that attitude on people. And so, I suppose my view is that the big hiring boom that CSIRO must have gone through post-World War II and into the 1960s, didn't really equip the organisation with the leadership and experience that would take it into that growth environment in the '70s and '80s.

I can remember Irene Irvine saying to me, "Colin, I can't imagine why somebody with your background and experience would want to get tied up with an outfit like this." I replied, "Well, I still feel that I had been very fortunate to have been funded by the taxpayer for an undergraduate education, a doctorate, and a post-doctoral position that led me to acquire great experience in US. This was essentially several years of Commonwealth funding, so I felt a bit of a responsibility to try and pay something back." So that was, to some extent, my answer to, "Why would you want to do this to yourself, Colin?" And I don't doubt the organisation learnt something along the way about some of these commercial issues, dealing with companies and behaving honestly and with integrity, and all the rest of the "commercial" culture. I don't know that I'd do anything much different, Tom. I don't think it's ever been clear to me that we have a political leadership that is at all insightful in this era of technological complexity; - maybe a handful of people, but they were a minority.

Handful of ministers over the years you say, Button and Minchin were your two, the two people that -

Yes, well Minister Cook was good too. I think he was a very decent man, but in many ways, I felt that a number of the ministers were given a portfolio, but didn't really quite understand what was expected of them. Nor could they convince their colleagues that what "science and technology" could deliver was really important to our national well-being. I mean, in many ways, the Minister for Science was third prize.

Yes, it was probably the case although when the super-ministry was formed and Button became the minister in charge, that elevated it up into cabinet and Peter Cook was a cabinet minister as Minister for Science.

Well, that Hawke cabinet was probably the best collection of political talent Australia's seen for a long time, on either side of politics, I guess.

Yeah, the early Hawke cabinet. Yes, all right. So, you'd keep the organisation?

Absolutely. Why, - where else is Australia going to make progress in a technological world without that sort of talent. I tried to do something different with a number of people at 40 years of age, and ask that fundamental question, "What do you want to do when you grow up?" and people then were forced to say, "Well, I just want to keep doing research."- "Well, that's okay," or, "I think I can basically step up to manage a slightly different process of development." That was progress, and many people grew professionally as a consequence of that.

Ken Hews-Taylor was a good example. I mean, Ken was very influential in getting Cathy Foley to develop the SQUID technology so that we've now got a world class airborne magnetometer, based on SQUID which came out of our early super-conducting work. It was Ken Hews-Taylor who really convinced Cathy that it was okay to keep playing around with SQUIDS, and "you'll make a few mistakes", but when BHP flew that early prototype of hers and found a small mineral deposit that wasn't necessarily commercial, but they didn't know it was there. So, there were lots of examples like that, where people have decided mid-career that maybe it was worthwhile learning to play a new game.

Good, well, thank very much Colin. I think that was good. Thank you very much for spending all of this time with us. Thank you.

[music]

[End of interview with Colin Adam]

Appendix A

Colin Adam

Reflections on six weeks as Acting Chief Executive of CSIRO (1989)