John GASCOIGNE

I'm talking to John Gascoigne on the 6th December 2011 at his home in Canberra. John, I think you were appointed to the Physics Department in Adelaide in 1948. What were you appointed to? What was your job then?

I was a trainee [technician] at that time. That was the last year of Sir Kerr Grant, and I remember the interview with him, or one part of it: He brought out a model of the Earth, the Moon and I think probably the Sun was incorporated – it was all geared, so that the Moon went round the Earth – and he said, 'Gascoigne, you know, if we've got this wrong you'll have to reorganise the gears,' and I've never forgotten that.

You were a young fellow then.

Oh, yes. I'd just left school.

So you were just appointed to the department as a [Trainee Technician].

Yes, in the workshop.

In the workshop. How many other technical people were there then?

The people that I recall was Joe Paul, who was the foreman or manager – I'm not sure what his title was; there was a Les Bruggerman, he was a skilled instrument maker; there was Lionel Maggs, he did electronics; there was Alan Johanssen, he was another trainee, he was virtually finishing his time with a Max Doldee.

Is that Duldig?

[Yes Duldig]. There was also a chap, we called him 'Bluey' Morris, his Christian name I can't recall. (laughter). Also [Bill Austin], [who was a year ahead of me], and myself. There was another trainee who started at the same time as me and they couldn't really separate us, but he resigned later that year, I think and he came to Canberra and ended up in the army at Duntroon. So that, really, was about all the staff of the workshop at that time.

Well, that's quite a team. I rather gather that at that time there was not much research going on in the department. What did you all do?

Well, I guess when Huxley came in '49 the department was reorganised quite considerably.

Yes, but before Huxley came, that team was in place?

Yes – well, making little bits and pieces for the research people, but I can't really recall what one worked on in that first year. Things changed, as I say, when Huxley came.

Yes – and lecture demonstrations, I suppose that planetary model of Kerr Grant's -

Yes, probably. I think there was a little bit of research going on, but I can't recall what. You know, I was the young chap in the place at that time so I had to learn the ropes, really, and that was about the extent. But when Huxley came the workshops were reorganised completely. The workshop was split and quite a bit of it, and its staff, went down to the Engineering [Department] and so became a smaller workshop after '49 and, as I say, the staffing was reorganised. I was offered a [five] year apprenticeship [back dated to] February 1948

So are you saying that prior to this reorganisation that workshop provided a service not only for Physics but for Engineering?

I think there were probably jobs coming in from other departments within the university, but I really can't recall that.

Yes. And where was the workshop, then?

The plan of the main building is virtually a 'U', isn't it?

Well, it's a long thing with two big wings going off.

Yes, that's right. Well, in between those two [wings] was a building there, two storey building. **Yes.**

The top floor was a demonstration area, I think [Mick] Iliffe [had an office there] as well.

Oh, yes. Yes, that building is still there.

Yes. And the bottom area was the workshop and store.

What was the equipment like?

Oh, that was quite good. There was a quite precise Monarch lathe there that was rather unique because the cross-slide was graduated in diameters as distinct from radii. I've never seen another lathe quite like it, but the bed was fully ground and the lead screws were fully ground. Behind that was a Cincinnati – no, excuse me – another lathe, which was used for much of the work – can't think of that name at the moment. There was a radial drill. There were several South Bend lathes and a welding bay. That's probably about it.

I'm not sure if that radial drill isn't still there!

Is it? Yes.

A big thing.

Yes, that's right. I think there was probably some coil-winding gear as well. There was quite reasonable capability.

Did you essentially do an apprenticeship in the workshop?

Yes, I did. Yes, [five] years and – yes, that was quite interesting. Things were, becoming fairly competitive in those days and the trade school was quite good, much better than the original school on Frome Road in the old School of Mines, where one started off blacksmithing and tasks like that. But yes, our projects were much more advanced. For instance, I made during training a zero to four [inch] micrometre which won a bronze medal at the Adelaide Show at one stage. I got interested in gearing and subjects like that. One of the [Departmental] projects I did, probably in the third year of my apprenticeship was to make a three-speed or a four-speed gearbox from scratch – I can't remember whether it was three or four speeds now. The gearbox was used to drive a recording camera which took signals from the meteor drift work. There was a magnetic clutch just above [the gear box], made by others, [which drove] a paper film

[in the camera]. The paper film was probably about 80 millimetres wide. With the magnetic clutch [the paper would] start [to run] in [less than] half a 50 cycle [trace]. So, the take-up was quite good. This enabled the incoming signal from the [reflection of the radar beam] from the meteor [trail, which was shown on an] oscilloscope to be recorded on the paper film.

So you made this for Graham Elford – – –?

I'm not sure who was working on that, but it would have been one of his group.

Yes.

Alan Weiss was in that area as well.

Yes, that's right. It's amazing how quickly that work got going after Huxley arrived.

Yes, that's right.

The whole place must have been a hive of activity there.

Yes. He got things organised pretty well from the research point of view I believe and I think he set up probably three groups; Graham Elford in the ionosphere wind work; Dave Sutton in geophysics – seismology, [as well as the Electron Drift work].

Yes – that was a bit later, though, wasn't it? He worked with Bob Compton for the first few years.

I'm not sure about that. You'd have to find that out from them.

Yes. They first started together and they did their PhDs together in the slow electron work, and it was in the late '50s sometime that David took up the seismology.

That could well have been the case.

While I think of it, yesterday Bob Crompton referred to some work that had probably been done before you came but it was in electron diffraction and used a piece of equipment he called the 'Flint camera'. [Bob refers to a 'Finch electron camera'.]

Yes. I don't know anything – – –.

Did you know about that at all?

No. I don't know anything about that. I think Bob had his hand in a lot of things. He's very energetic and very keen.

So how did you first become involved with his work?

Well, the main work started in 1954. Up until that time the drift tubes were quite small, they were about 30 millimetres in diameter and quite short drift lengths, and were mounted on a spigot in a glass envelope and that was how they worked in the early times. But then – – –.

Well, that's the equipment he used, he and David Sutton used, for their PhD work.

That could have been so.

And I guess it was 1954 they were awarded their PhDs, which were the first Physics PhDs at the university.

Okay.

And then I guess he was building a second generation equipment.

Yes, a lot of credit goes to Bob, because from the rather small, not so precise tube, he devised a means for producing what we now call the 'expandable tube', which is quite a large tube – it's in 150-millimetre diameter Pyrex, and it's quite long.

We had a photograph of it yesterday.

Oh, right. Well, it's in the museum at Physical Sciences at the moment, and I can give you a colour picture of that. I can give you a black-and-white as it was in Adelaide,

and in its present state in colour. But the great advantage of that was twofold: the drift length could be varied from one centimetre to 10 quite precisely at those intervals, one, two, three, up to 10 centimetres, and the receiving electrode consisted of a number of annular rings, and the gap spacing I think from memory was about a quarter of a millimetre. Now, that was fairly unique and that was first assembled in 1955.

Was it?

Yes. The apparatus – most of the apparatus – the electrodes, I mean – were made out of Brightray, which is nickel/chrome [alloy], about 80/20 I think, very hard to machine, and the rings were all produced. The receiving electrode was mounted on back-to-back Housekeeper seals, so the resistance to ground was quite high, you're talking about 10^{12}, 10^{13} Ohms, something like that. And the glass envelope was glass blown by [Dennis] Smith at Weapons Research. He was a master glassblower. He was very, very good. The electrodes were also gold plated out at Weapons, and the problem there was that we couldn't plate directly onto the Nichrome because of the chrome oxide on it, and the technique used was to de-plate and then start the plating process straight away. There was an expert out there in plating who really got us over that sort of problem, so we spent quite a lot of time out there, going through that process.

The first assembly of the tube was probably August 1955. We started in the morning and didn't finish until the early hours [next morning]. We had a problem with the assembly, and I remember the date very well because Bob drove me home to Prospect, where we were living at that time, and we were telling all Prospect how well we'd done during the night, and [Nath, my wife] was lying in bed [and could hear all of the conversation]. At the time she was pregnant with our first daughter, (laughs) so that marks the time of that assembly.

Now, Bob was telling me about that yesterday and he was saying how you'd made a vertical lathe, glass, for sealing –

Yes, that was here at [ANU].

– the final sealing of the [Expandable Tube].

Yes, that was here at ANU.

So how did you do it in Adelaide?

In those days all the joints were [black] wax joints. That's all we had at that time. You know, we're still playing with systems that had grease taps, and in the summers there that was difficult because the taps would tend to leak after a while and you'd have to start the whole process again, out-gassing the tube and so on. So the techniques from the Adelaide days improved grossly, [and] the geometry of the tubes improved grossly.

But that tube, with the variable drift path

– it was used in Adelaide. [Bob] took data in Adelaide.

Yes, .

And then he was describing how it was – oh, I don't know – suspended from springs and put carefully in a car and driven to Canberra.

Yes. That was early in 1961. Huxley came here as Vice-Chancellor. He went to CSIRO and then he became Vice-Chancellor at ANU, and as I understand it he had the option of having a research group. As there was no money in Adelaide at that time the decision was made to move here. That was one of the hardest decisions I think that we had to make because we'd just set up home, as Bob had, and I'd just finished concreting the drive and this opportunity came up. In about February I got the option of coming over to see what the facilities were like here [at ANU].

That was February '61?

'61, that's right. And so, it was organised for me to catch the train to Melbourne and then fly up in a DC3 [aircraft] to Canberra, and in those days it was just a wheat field and I thought, 'Are we here?' And [I was told], 'Yes. This is it.' So we just climbed out of the aircraft [onto the tarmac]. And so I spent probably two days here trying to assess [the situation]. At that time the old laboratory that we were to [use] had been

badly burnt, which was probably good news from [our] point of view, because with the gold surfaces we didn't want any mercury in the laboratory and [as] that area had been used with mercury manometers. So [it was a relief during the rebuilding, that the floor was tarred over and sealed]. So we had a good beginning when the lab was set up.

[It was probably March or April when] Bob and I drove back [to Adelaide] in the department's ute to collect the [experimental equipment that was to come to ANU]. [In Adelaide] the carpenters made a big box [for the equipment] and of course Bob Menzies was the PM then and the guys [painted] 'Bob's Box' on the box – I can show you pictures of this, if you like – so it was a [play] on [words] Bob Crompton and also Menzies. (laughter) So we came over with that. The [box was suspended by springs attached to a] steel frame [which fitted neatly into the tray of the ute, [ensuring] the equipment had a smooth ride. We also loaded the ute up with some sand [to help smooth the ride].

Could we go back to the earlier days when Bob built his first equipment? I rather gather that he was no mean glassblower himself.

Oh, he was good. He could turn his hand to all sorts of things.

How did he learn those skills?

I'm not too sure. He seemed to pick them up very quickly from just observing people. In Adelaide we used to use two glassblowers. One was specialised in tungsten to glass seals – you know, lead-throughs.–

Yes.

– and he was down the South Road down by Daws Road, but I can't remember any more than that and I don't know his name. There was also another chap that we used but I can't remember what for now. [Bob had] lots of contacts and he'd pick things up very easily. [With] glass work he taught me a lot himself, and I [also] picked up things from others.

Bob doesn't seem to recall himself how he learnt, but there are all sorts of tricks to joining two pieces that –

That's right.

[Bob] obviously knew, but how he acquired those skills is still a mystery. Do you remember a person called Perry Miles?

No.

He was a student in the department in those days who did a master's degree in 1950 that involved a vacuum chamber. Now, he talks about getting some assistance from a person called Fred Cook[Crook?].

I don't know him, either.

You don't know ? He was a person who had a workshop in his home and Perry used to go to his home in the evenings and use a lathe there. And then he referred to getting glass diffusion pumps from the Oliphant brothers. Do you remember them?

I remember them – I did some work down there, cutting glass [spaces] and things like that, but that's about it.

So what were the pumps – were they glass pumps that you were using in those days?

Yes. Edwards rotary backing pumps, two stages, and there were small glass diffusion pumps. Pretty crude, when you think back to it. (laughter) Because after we moved, everything went into UHV. and that was very early days for UHV., so things improved vacuum-wise grossly. Eventually we changed to turbo-pumps from very early stage after '61.

So you had turbo-pumps then, did you?

Oh, not too long after that. Excuse me. First of all, we used Varian ion pumps, that's right, when we first came here. But there are problems with those pumps. And I suppose it might have been several years after that that we finally moved to turbo-pumps.

But, really, the first time that you worked with Bob was after he'd finished with his PhD and was building a new piece of equipment.

Yes, that's right. The expandable tube, as we call it.

Yes. What about David Sutton? Do you remember him getting started with his seismological work?

Not a great deal. I think I helped set up a magnetometer in the room opposite 204, – I suppose it's roughly the northern end of the building in the room above, the [ground] floor – or the first floor, I suppose it is. But that's about it. I went up to around Mount Lofty at one stage, where he had the seismic equipment.

Mount Bonython.

Mount Bonython, was it?

I think, if it was – that's where it certainly was later.

Yes, okay, I think you're right.

It's the peak right next to Mount Lofty.

Yes. Yes, you're right.

Yes, the PMG, I suppose it was then, had some facility there, I think –

Oh, did they?

– and he used that site. What about Huxley, what do you remember of Huxley in those days?

He was a very personable person, took an interest in all the staff. I got on with him very well. At that time, as more of a training exercise, I was doing watch repair work and I remember working on his watch. (laughter) But he was a very personable sort of person. One of the things after he came was that, to get onside with all the staff, I think, he put on an evening with strawberries and ice cream, and I'll never forget that. That was superb. I think Molly [his wife] must have gone out and got the best strawberries in the Adelaide Hills. He really turned on a great show.

So when would that have been?

I guess that must have been not long after he first got there, which would have been about '49, towards the middle of '49, I guess.

So what was the department like as a community, then? As a technical staff, did you feel you were part of a community with the academic staff?

I think so, yes. Yes, well, later, I imagine it must have been about '59, about then, there was a department picnic down at Second Valley, and that was fantastic. Someone had made up a large grilling frame you could clamp the meat in, and in our group it was called the 'slow electron trap'. (laughter) But that was a great day out.

I'd never been down that far down the coast and that was good in those days.

Was that a regular event, to have the department picnic?

That was the first one that I recall.

So when was that?

I think that was in about '59. It might have been '60, but I would think '59.

I see. Yes. Yes, because those – I was a first-year student in '59. By the time I got to honours in '62 I remember the departmental picnic; it was a regular thing.

Oh, good. Well, that might have been the forerunner for it.

But back when you were first there was there a departmental tearoom? Did you all?

No. The workshop staff had their own tearoom.

Ah, yes.

That was in the – what I'd call the 'office'. You know, you'd walk into that building; the switch room was on the right, and then straight ahead was the room for the workshop staff and that was really the tearoom.

Yes. That continued for a long time with the workshop staff having a separate – that was a sort of division of the technical staff, I suppose, where there was a departmental tearoom where the academic staff, honours students, higher-degree students would all have morning tea – – –.

I guess in part it was the practical way to go.

Yes. And it would be a tendency that there would be technicians employed in research groups supporting research directly, and they would meet in the department tearoom.

Yes.

But the workshop staff would meet separately.

The first one of those that I recall was one for Stan Tomlin, and that would have been – let me see – that would have been mid to late '50s, I would think. Before that, I don't think anyone had any workshop people in the area, assigned to that area. I joined Bob's group in 1958, officially, even though I'd been working there; but they got to a point where they considered they needed a technical person fulltime up there and I was lucky enough to get that position in '58.

I see.

But prior to that the only other one that I knew of or I can recall was with Stan Tomlin. There was also always someone – there was Clem Appleby, who was perhaps an exception; but I don't know what you would have called him. He usually set up the demonstrations for the main lecture theatre.

Yes. In my time, Clem Appleby was really providing technical support for mainly the first year teaching laboratory.

Yes.

So you remember Huxley as a person you got on well with?

Yes.

What about Stan Tomlin – what are your memories of Stan?

Stan was slightly different. He was just a little bit away, really, I think, when you discussed something.

A little bit aloof?

Perhaps, yes. Yes. I didn't have a great deal to do with Stan. There was one job that I worked on very early in the piece, and that was making components for an X-ray tube. C. Worthington. There's the paper in there by him. So that was, as I recall, one of the first jobs that I did for the research area, and that was under Stan, as I recall.

Was Harry Medlin there then?

Oh, yes. He was a good person to work for.

Was he?

Oh, yes. Very talkative. But, you know, I remember I had to do a modification on a goniometer camera, and that entailed the design and manufacture of a small solenoid

to activate a ratchet so that the camera drum would rotate, and from Harry I learnt the important thing of getting the maximum [amp-] turns in the first few turns of the coil. So yes, he was always good. [I] worked quite closely with him on that project.

Yes. So you interacted with Harry rather than Stan Tomlin.

Yes. Yes. That was better. And what else did I do?

Huxley is remembered by some as a strict disciplinarian.

Oh, you knew – – –.

Forbade whistling in the corridor, that sort of thing. Do you remember him being like that?

Well, I wouldn't have whistled in the passage when he was about. But at the same time he was very approachable and you know, he expected things to run on very reasonable terms.

Who else were the characters in the department that you remember?

Oh, there were quite a few characters in the place. There was Des Liddy. Now, I don't know what he was, what position he held, but he was quite – – –.

Well, he worked with – he was a PhD student, I guess. Would have been working with Graham Elford, I think.

Eric Murray was a very helpful person, very helpful indeed. Privately, I made up a sound recording tape deck which was very new in '53, and Eric was quite helpful [to] me in building up the amplifier for it.

Which group was Eric working in?

I think he was probably in Graham Elford's group. And there was a John Smith there as well, and he was also very helpful.

Yes.

But Eric, you know, some of the jokes were quite funny.

Incidentally, John Smith died just a month ago.

Oh, did he? I haven't seen him for – well, since I left Adelaide, probably. But, some of the tricks that they got up to. There was an Arthur Shepherd who used to keep the accounts and so on –

Yes.

– and he was as stiff as a board, and one of the tricks I recall was that he ate a lot of nuts, and someone – and I don't know who – got into those one day and they cut them open, took the kernels out and glued the [shells] up, put them back in his lunchbox. You can imagine the hullabaloo that occurred after that. (laughter) But, you know, it's all good, clean fun and that's what made the place, really.

Yes. Now, when I was first there Arthur had an office upstairs in the workshop building.

Well, that had changed. It used to be on the ground floor. You'd walk in the main door, [turn left into the corridor, on the left was] the secretary's office, the head of department, Huxley's or Kerr Grant's, was next, and then it was Arthur Shepherd's [office].

Yes. I remember he was very particular about hygiene. If anybody used his telephone he'd wipe it with disinfectant afterwards.

(laughter) Yes.

So they were memorable days.

Yes, they were good.

Anything else you remember from that time that is worth talking about?

That's probably about all, I should think. Yes, it's hard to go back to that period because so much has happened since '61. You know, the pace really got going when we came over here, and you tend to forget the early days.

It was interesting, though, under the old lecture theatre there was a bit of a workshop, and some of the equipment in there must have come out of the 1800s, I think. There were some interesting, lathes and so on. They would have been collectors' items these days.

I wonder what happened to those.

No [I have no] idea.

You know what they did with that lecture theatre?

Yes. It's all cut down.

They took it all down and put a floor and another workshop underneath and a much more gently-inclined lecture theatre above.

We got on well with the people in the museum, who were just [across] the courtyard, and they were helpful on occasions. That used to be the old police barracks, I think. There's an arch there as well.

Yes, that arch is still there.

Is that still there? It is? That must date back a long way.

Yes, that's very early Adelaide days, yes. So the museum people, they had a workshop, did they?

I guess they had a lab. They'd do field trips and come back, and I can't remember what now, but there were a couple of occasions when they were quite helpful with some processes that we needed. There also used to be an old book in the workshop which was quite thick and badly torn [and probably] came out of the 1800s, I think.

Some of the formulas that were in the [book] I wish I still had. It was very useful. It must have come out of the Ark, I think. (laughter)

But, you know, when Huxley reorganised the workshop there was quite a range of people who went through. There was a Stan Sincock, who was the foreman for some time. He'd worked here at ANU and then, being an Adelaide person, went back to Adelaide. There was a Lindsay Hettner, who was the foreman for quite a long time.

Oh, he was there for a long time. He was the foreman when I was a student.

Is he still about, do you know?

I'm not sure what happened to Lindsay. In the early '60s a person called Basil Briggs was appointed by the university and he established new radio probing of the ionosphere, and they built a huge array of antennas just north of Adelaide, a place called Buckland Park. And Lindsay at one stage gave up as foreman of the workshop and went out there to manage that field station. He was there for a very long time.

Yes, I should go back and say that the meteor work I think was done in the old munition huts just south, I think, of WRE. They were fully-enclosed buildings, perhaps of one room, and it was dusty out there. The other people that were around was Arthur Bowers, Eric Middleton, Bill Jamieson – – –.

Yes, Eric Middleton I just remember.

Right – yes, he was a nice chap. He'd come from Rhodesia [in] South Africa, he and his wife. He's deceased now. There's [was also] Bill Jamieson.

Yes, I remember Bill. He was a bit of a character.

Yes, he's a bit of a character, mainly in the motor trade, I think, probably engine building. And Jim Connock [?Connick].

Yes, I remember Jim.

Right. There must have been a couple of others, but I don't recall them at this stage.

Yes. Peter Schebella, was he there – – –.

No, I don't know him.

He became foreman of the workshop later on. Yes, the technical people are very important to the department. Although things have changed. There's much less of designing and building equipment and much more purchasing equipment off the shelf.

Yes. Well, if you can purchase it, sure, you do it.

But there was one period when I think Adelaide students were noted for their technical skills. Was that your experience –

Yes, they would – – –.

– that the students would come into the workshop and do things themselves?

Yes. There was an area set aside for the students. They had a [Hercus Lathe] setup in there and they were encouraged to get their hands dirty and do it, which I think's very important because unless you've done that you haven't got much [of an] idea of design work.

That's right – and what can be done and what can't be done.

Exactly, and how easily it can be done.

Yes. When I talked to Perry Miles that I referred to earlier, he talked in 1950 when he set about doing a project for a master's degree that he designed a piece of equipment and had no guidance about how to design it; but, having designed it, he realised he'd designed something that was essentially impossible to build.

Well, that's a common problem.

It's that knowledge, isn't it, that's very useful.

Yes. But, you know, over at ANU it's become quite a specialised field. In the tubes, the tolerances were greatly reduced, and [in the] Expandable Tube, the gap in the electrode was reduced to 50 micrometres, and in the Tube 7 [to 25 micrometres]– that's the special [diffusion] Tube [with a fixed drift length of 10 cm] you know, you get into techniques of vacuum brazing copper to alumina, and techniques like that, for the insulators. You know, as I say, you're looking at resistances of 10^{13} [ohms] or thereabouts [to reduce] leakage to ground.

How big were the currents you were measuring?

About 10^{-12} amps [or less]. Something like that. You'd have to ask Bob about it.

What would you measure that with?

[During manufacture a resistance bridge which enabled 10 or 15 volts to be applied across the insulator and the leakage measured]. [For the experimental work], Bob had developed electrometers, and an induction balance – we're looking at DC [measurements] – the induction balance would [produce a linear increasing voltage] and the electrometers would measure the differences between [the current] falling on the centre electrode and the chosen annular electrode they wished to use. But, Bob's the expert in that; you'd need to talk to him, or you'll be talking to Malcolm, ask him.

Yes.

But, you know, the tubes these days, they're bakeable to 200C and they operate down to liquid nitrogen temperatures, so it's a fair [temperature] range. And the geometry has got to be maintained throughout that temperature range, and it's all UHV. because – well, it's all old-fashioned work now, so I'm told, but this is all static work. So if you're looking at doing measurements in any of the gases – argon or whatever – it's static, so you've got to look at the out-gassing [rate] of the apparatus over the – you know, it might be several days, and you're looking at one in 10^6 one in 10^7 of impurity

in the gas, so quite often we've get Matheson gas and we had to purify it, so there's various techniques for purifying it. But, looking at the labs these days with the O.H.& S. restrictions, I doubt whether we could do [a lot of the work] now. (laughter) I mean, you know, gas cylinders in the lab and things like that.

Yes. That's another story.

That's another story.

Yes.

So, you know, the days in Adelaide were very good and we did what we could, but we were learning all the way and the problem was to tie down the errors. Another one was pressure measurement, and in Adelaide we developed [one of] Bob's ideas. We used an aneroid capsule and a concave mirror, [having a focal length of about 1½ metres]. [The mirror was mounted on a spindle having jewelled bearings]. [On the capsule was mounted a short spigot with a ball end, on which the concave mirror rested. As the capsule expanded, so the mirror rotated. The length of the light path was probably 1½ metres and to reduce the size of the unit, the light was reflected back, using a plain mirror, onto a scale alongside the pressure capsule. That was quite an advance for those days]. Hysteresis in the capsule had to be taken into account. The original calibrations were done in the room [across] the passage from 204, and used the mercury manometer with a liquid nitrogen-cooled trap to isolate the gas so that the mercury didn't [diffuse] back [into the gauge]. The mercury [in the manometer] was [contained] in a large diameter tube, [probably] 30 millimetres in diameter. [The height of the mercury was measured] using a reading microscope [looking at the] diffraction pattern above the mercury surface [which was illuminated by a light placed some distance away. That's how we did the initial calibrations. After that we started looking at dead-weight testers, and I acquired some cast-iron honed cylinders, from one of the manufacturers making them in Adelaide. We picked the four-inch one and made a piston out of ~14-gauge aluminium and turned that to be a very neat fit, put a spigot on the bottom with a Teflon bearing which went into a tube [to keep the piton perpendicular to the cylinder axis] so [the piston could be floated] in the cylinder. The

problem was determining the effective area of the piston so the pressure differential generated [could be calculated]. The top side was evacuated, of course, and that was, in those days, probably down to a few microns, I guess, even with gas leakage. So we could develop [an absolute] pressure that way.

At ANU [pressure measurement] was tied up using a piston cylinder [combination with weights] which we had bought in from an American firm. [With this setup we calibrated several commercial gauges]. The Texas gauges, had a long quartz [capillary] spiral, with a reflector, which rotated through 100 degrees, and [a null detector to follow it with] a worm gear [which was geared to] a scale [having a] length of 300,000 units. 'Our standard' was compared with [the standard at the] National Management Lab in Sydney and also with NBS in Washington. So that was quite [an] interesting [project].

[With Bob's help in the early days], I developed a number of contacts in National Management Lab in Sydney, where in those days if you had a problem, oh, Charlie here or Fred down the passage had some clues on that, so you'd call on their expertise. That's how we started to solve our problems.

Contact potentials on the electrodes was a major problem, and there was an awful lot of work done on that. At one stage, early in the piece, I would fly down to Sydney with the electrode in an evacuated bell jar [in the cabin with me] and use their big coating unit [to evaporate a gold layer onto the electrode. On return I would] start measuring the contact potentials, using an electrode just above [the surface] looking at the [contact potential variations]. Initially we found that the contact potentials were tapered across the electrode. On one side [they would be] quite high and on the other side low. [This effect would cause field distortion and effect the measurements significantly]. And so that took an enormous amount of work to try and overcome that problem.

Well, it's an interesting story, John.

Yes, there's lots of interesting work. But, as I say, a lot of water's gone under the bridge since then and it's hard to remember back to the Adelaide days, to a large extent.

But you technical people are an important part of a research team, and it's good to Hear that part of the story. Thank you for talking to me this morning.

My pleasure.

END OF INTERVIEW