

Interview with Bertram Bussell, Ph.D.
Professor Emeritus
March 25, 1994

Interview conducted by Professor Russell O'Neill

O'Neill: Bert, tell us a little bit about yourself.

Bussell: Well, I was born in New York City in 1923 and went to school in both the Bronx and Brooklyn. Did my high school at a prominent technical high school, Peter Stuyvesant High School, and graduated at the age of 16 from high school and at that point didn't quite know what I wanted to do. I started studying at the City College of New York and after a short time felt that things were very hazy. The War was imminent, so I decided to try my hand elsewhere and I went to what, at that time, was called the NYA—New Youth Administration. It was a training school for young people, one of the government schools, and there I trained to be a tool and die maker.

After my training was over, I got a job in an industry that was providing material for the U.S. Navy. This was just prior to the War. After a short time, I became the factory foreman and worked with them until 1942 when I went up to Bridgeport, Connecticut to work for a larger firm. I left there and came back because I missed New York. I went back to my New York job. The government then said, "Well, if they could do without you for the six months you were gone, they can do without you for the rest of the war." So, in early 1943 I was drafted into the Army. Because of my background, I was put into an Army ordnance group and after spending my basic training days, a couple of months with them, they sent me off to Aberdeen, Maryland where I got my first knowledge and background in anti-aircraft fire control computers—that would be the very early days of analog computers. I spent a lot of time there. I came back to my company, at that point it was in Mississippi, and shortly thereafter, we all got on a train and moved to Palm Village. I arrived in California on—I remember it well—the fifth of July, a 120 degrees in the shade.

O'Neill: Where is Palm Village?

Bussell: It's just outside Cathedral City. That was my introduction to California. I had been married while I was in the service to an old girl friend and she came out and got an apartment in Los Angeles. I would go to visit with her on weekends and that was my introduction to Los Angeles. The first time I visited UCLA this was in the summer of 1943. After a while, doing whatever we had to do down in the desert, which was repairing all kinds of Army ordnance telescopes and periscopes and so on—tanks that Patton had left behind after he trained his troops to go off to North Africa. At that point, I was back in the Army ordnance, not doing fire control computer work. While there, in the desert, I was selected to go to the ASTP, the Army Specialized Training Program. Are you familiar with that program, Russ?

O'Neill: No.

Bussell: No, well, the Army felt that there was a shortage of medical people and engineers and selected a few people from the corps to go to college to be trained as either doctors or engineers. And, so, they selected me and for one month, while waiting, I spent this month here in Chaffey Junior College. From there I was sent to Stanford and I studied two quarters in Stanford until mid 1944 or early 1944 when that program collapsed. Then I was assigned to a signal corps organization without any training and no sooner did I join them than I was told we're getting ready to go overseas. There were a number of people who were in my shoes that had just arrived, hadn't had much training and so they needed training and they asked me if I would teach. And so, without much training, I gave courses in electricity and magnetism and electric circuit theory and so on. And, went over to Europe with this group of people and spent from early September of 1944 until August of 1945 at which time the war had been over in Europe for a couple of months. And, on August the fifth, I think it was, or second, we got on board a boat in Marseille and headed off for Japan. Of course there was still a war going on. And somewhere, while I was out in the Atlantic, the bombs burst over Hiroshima and Nagasaki, the war ended and my ship was the first ship that turned into New York Harbor.

I arrived in New York about the tenth or twelfth of August of 1945 and was discharged from the service in November. At that point, I came back to the company I had been working for earlier as a tool and die maker and foreman, and the plant manager told me that they wanted to go into the electronics business. Did I know anything about electricity? And, I told them, yes, I did. I had learned some in the Army and so he made me the chief engineer [laughs] and I designed phonographs and recorders. And this was the market that was opening up for home music entertainment and so on. I worked there for a while and at one point we were going to do some development that was beyond my skills and I told them I needed a consultant. And, so, we hired a consultant who was an outstanding electronics engineer. He had been in charge of the Naval Electronics Lab during the War and I worked with him for a while and at one point he asked me if I would like to come to work for him. I told him that that would be an honor and I left this company and went to work for J. Kelly Johnson. And all the time, in the back of my head, was swimming at Stanford on January first in an outdoor pool. And, the lovely warm weather and the beautiful campus at UCLA and I went home one evening and called my mother and said, "Mom, I think Bea and I are going to move to California. I want to go to school out there."

At that point, and just coincidentally, my father was having some problems with the boss who was his brother-in-law at a place where he was working and he quit. And so my mother and father said, "Well, we'll go there first to find a place," and they came out here in 1947 and found a house in Burbank. In 1948, early in the year, I came out here. Before I came out, I told Kelly Johnson that I was coming out here and he said, "I have a friend who worked for me back in Washington by the name of John Barnes. Why don't you look him up and maybe he will give you a job. He's

working in computers.” And, so I came out here. I, of course, applied to UCLA and was accepted and when I came out, the first thing I did was to look up John Barnes. And, he informed me that he was not in the computer business, but suggested that I talk with people in the research groups, both Harry Huskey, who was running the SWAC program and the engineering research groups and I don’t recall whether Bob Bromberg was running that at that time or not. So, I came here in February and I started work in research in early April.

O’Neill: But, you didn’t know [L.M.K.] Boelter or know of Boelter and the unified curriculum?

Bussell: No, I didn’t know Boelter. No, at that point the only thing I did know was that UCLA was a respected school and I didn’t even know anything about engineering. It was a very short time afterwards that I met Mr. Boelter and I was very impressed. He was a very impressive man, as you know, Russ. I was surprised at the feeling that people had about him. They felt he was a tyrant; he was frightening. They were frightened of him and so on. I had none of this fear. I enjoyed him; I got along extremely well with him and, in fact, I went out of the way to be in touch with him when I could. I took courses from him when I could. He was a driving force for a lot of the research that I was involved in. One thing that was of interest, when I came here, as you got from what I told you before, I was planning to study electrical engineering.

I should have mentioned when I went to CCNY I was studying mathematics. I was studying to be a mathematician. When I came out of the service, while I was working I started school at NYU and NYU had an evening engineering program, which was a full time program, and I went there for the two years that I was out of service in the evening and I was preparing to go into electrical engineering. I took the electrical courses and the labs and all the mathematics background and so on. When I came here it was suddenly a great shock to me that there was no such thing as electrical engineering. There was just general engineering and there weren’t very many electrical courses. Most of the courses had to do with heat transfer and thermodynamics because that was Mr. Boelter’s major interest. And, so, I started to switch over and I became a heat transfer person and did a lot of work in heat transfer and, in fact, all of my early years in research dealt with heat transfer in some of the early Westinghouse projects and the Air Force projects dealing with atomic weapons and so on.

O’Neill: How did you get involved with computer science here?

Bussell: As I told you, I had been interested in computers and when I came here I started working in heat transfer, and the only, outside of the mechanical differential analyzer that was in the Temporary Building II, the only other computer we had was an analog computer, a resistor capacitor computer for heat transfer and that was my baby.

O’Neill: Was this the one [Myron] Tribus was involved with?

Bussell: Tribus and Bromberg and I worked with that doing a lot of research, experiments and so on. As I said, I was trying to become an electrical engineer and I was being pushed into becoming a heat transfer person and anytime there were courses that dealt with any form of electrical engineering I would take them. And, so, when [W. Delmar] Hershberger arrived here in the early '50s I took his course. And then suddenly, I noticed in the evening there were courses being offered by Monty [Montgomery] Phister, Willis Ware, and Lowell Amdahl in computer science. And, these were all people who had distinguished careers in the computer field. And, so, I started to take courses with them. While I was doing all of this I was still working in heat transfer.

O'Neill: Were you taking those as concurrent courses for credit?

Bussell: Yes, that's right. I was taking them for credit. I guess I should mention that through my wife I met someone else on campus—this was my second wife. My first wife and I had parted company, and my second wife was a graduate student here in the music department and also a librarian in the physics department where she knew Dave Saxon and other people—Mike Melkanoff. And, one of the people that she became friendly with is Morrie Neiburger. I became friendly with Morrie and I remember back in 1957—we skipped a number of years there, but, at the moment I don't think that's important—he mentioned that an old friend of his from Princeton was coming out here and he would like me to meet him. And, so, he invited me to dinner to meet Jerry Estrin. Jerry was an electrical engineer on the John von Neumann Computer Project at Princeton. And we became very close and that's how I switched over to computer research. At that point also, all of the atomic energy contracts were fading away and Jerry was starting up this whole research effort in computer science.

O'Neill: Neiburger is kind of identified with the work on smog. Did you do any work on smog?

Bussell: Yes, I did quite a bit. Back in 1955, I guess it was, Goody Knight, if you recall, Goodwin Knight, governor, set aside a large sum of money for research in smog. I had known about the smog research because Morrie Neiburger, as you mentioned, had been involved with it and I was interested in the things he was doing. And, so, I started to do smog research and one of the things I did do was to build a computer model of the basin. This is an analog model of the basin running from about Ventura or Santa Barbara all the way down to the Mexican border.

O'Neill: This is a physical model?

Bussell: A physical model, that's right. And, these trails of potassium coloring would flow through and you could follow and adjust pressure and so on and see different things. That was part of the research I did.

O'Neill: Who was involved with you on that? Buchberg? Al Bush?

Bussell: No. Al was ... I can't recall who was with me. I know that when I was finished Al Bush came to me, but I was no longer interested in that. Al Bush asked me if he could have the model and I gave it to him. And, again, it was a plastic model—it must have been four feet long and a foot and a half wide and perhaps two to three inches deep.

O'Neill: This was at a time when people really didn't understand smog and what smog was.

Bussell: That's right and also the flow.

O'Neill: This was really the very, very beginning of the extensive research. Who was the person at Caltech who was so well known?

Bussell: That was [Arie Jan] Haagen-Smit.

O'Neill: Did he ever see your model?

Bussell: I don't believe so. I don't believe anybody saw the model. I know I wrote a couple of reports, or at least one large report, with photographs. As I said, when I switched over into digital computer research, I gave that model to Al Bush.

O'Neill: What was your title at the time when you were doing these sorts of things?

Bussell: Starting around 1953, when I got my master's degree, I was called an instructor and then a junior research engineer and then an assistant research engineer and associate.

O'Neill: So, you were in the research engineers series?

Bussell: There were a large number of people in that series and I mentioned instructor because most of us also taught in some form or another. I guess I should mention that what I was teaching turned out to be electric circuit theory. I was teaching with another colleague Gerry Paskusz who was doing research.

O'Neill: Were you and Gerry Paskusz teaching the same course, kind of team teaching?

Bussell: At some point we started the team teaching business.

O'Neill: Boelter was very interested in team teaching.

Bussell: And what came out of that was a textbook, which we wrote and was published. Just about the time it was published Gerry Paskusz left for Texas. He had gotten his degree. My degree was pending and I was now really into computer science and no longer involved in teaching this course when the book finally came out. The people who were teaching felt that there were other books that had come out more recently that they preferred using, so we never really used that. Gerry and I were the only ones that ever used the book in its paperback form. The sponsorship for that was part of the Ford Foundation funding that we got back in those days through Myron Tribus.

O'Neill: The Education Development Program. What about the beginnings of computer science, now a department, but what was it before it was designated as a department?

Bussell: We had an engineering college before the engineering school and within the engineering college we had divisions and there was an electrical division and a mechanical division and there was a computer division. The computer division had three pieces to it, it was called, let's see, computers, communication, and control. Those three areas were in this one division. It had in its group people like Corney [Cornelius] Leondes, Masanao Aoki, Balakrishnan, Jerry Estrin, and Mike Melkanoff. At some point, in the early 1960s, I got a Fulbright Fellowship to go to Israel and at that point I guess I had applied for a faculty position and while I was away I was notified that I had gotten the position as an assistant professor and when I came back Jerry was very anxious to get moving on a computer science department, at least separate the divisions.

O'Neill: What was the year?

Bussell: Let's see, this was about 1965, '66. That's when I was away in Israel. He had asked, he had suggested to me that we ought to ask Mike to become chair of a new department or at least of this division. Melkanoff agreed and we, at this time, were already teaching many courses at the graduate level and some at the undergraduate level in computer science and Melkanoff then took the bit and started to prepare the formal documents for getting the CVCC, I guess, and the graduate council approval for a department of computer science, or computer science department. At that point, I think Mr. Boelter had already agreed to having departments but that part is hazy. At that point, Mr. Boelter wasn't around very much

O'Neill: He retired in 1965.

Bussell: Right, and, I'm not sure who it was that was running the operation at that point. Was it you?

O'Neill: Yes, I was running it as acting dean until Chauncey Starr came on in 1967—January of '67.

Bussell: Somewhere in there then the approvals came through for allowing separate departments in the college. And at that point Melkanoff was ready.

O'Neill: But, the computer science department was special at the beginning because it also was linked administratively with the College of Letters and Science.

Bussell: It was linked in the sense that there was controversy about whether there should be a department like that in the College of Engineering when the mathematics department was so involved already in building the SWAC computer and teaching courses for the SWAC computer. So, there was a loose linking. By loose, I mean, we had our own

faculty. We generated almost all the courses, but we did invite some of the mathematicians who were interested in computer science to be involved. One of them, of course, was [Charles] Tommy Tompkins, another was...

O'Neill: Was David Cantor one of the....?

Bussell: David Cantor was one and I can't remember who else. There was a third fellow who came on much stronger later on in the program. But, Cantor was the only one who was really active who would come to departmental meetings and raise his voice and give advice. And, again, the department formed, as I recall, in 1969. At that time, Melkanoff was made chair and I was vice chair. There was a short period where I was acting chair when Melkanoff was out of the country for a year. And, Melkanoff remained chairman until, I'm not sure of the year, but until Walter Karplus took over the chairmanship. I remained as the vice chairman under Karplus. There is always this problem, I'm sure you're aware of this, of people who are so excited about research not wanting to get involved in administration. And, so, it was always a problem to find an administrative head for the department. And, so, Karplus stayed on for many, many years and I stayed on as vice chair for all that time until he finally decided he wanted some respite from it. And then, [Algirdas] Avizienis took over. While Avizienis took over, I was still vice chair and then I took off on a sabbatical and when I came back he had already replaced me with someone else and I never returned to that position. Oh, I'm sorry. Jerry Estrin was there for about a three-year period after Karplus and then Avizienis.

O'Neill: Going back to the early days, you described the campus as kind of a beautiful, tropical place. How about the work environment and the morale and the excitement of what people were doing and that sort of thing?

Bussell: Well, it was a very exciting time, of course, the whole field of nuclear energy was expanding and we had a research contract with Westinghouse for submarine engines. And, we were doing all kinds of research at that point in heat transfer and thermodynamics while the nuclear people were doing their research. That was the beginning of the rocket launchings and so we had a whole bunch of programs going on with the WAC missile and Sergeant missiles—all to be calculated at that point on our mechanical differential analyzer.

Quite by accident, a few of us got involved in other research projects. Our biotechnology people were doing some research. Professor Taylor and John Lyman, were involved in taking surface measurements of the human body because of exposure to radiation and to thermal effects of nuclear weapons. And, so, it was an interesting, humorous time, I might add, where I would lie on a board that would rotate in a pair of bathing trunks and a hat and people would be up on a roof taking pictures of me and moving me around. [laughs] Those reports exist and there were three of us. We were three people who had been selected because of where we fit in the measurements. I think it was the Air Force Academy. I was the normal and one fellow was the slender and the other one was the heavy. And, so, we would make all

these measurements. It was lots of fun. The group was very, very much together. We had a great group.

The research was carried out just in these temporary buildings, but most of the involvement that I had was in what was called TEB II. It was a two-story temporary building. Half of the upstairs floor housed the mechanical differential analyzer and the other half had all the desks and the offices of the people who were in charge. Walt Hurty was in charge at one point and Bob Bromberg was in charge at one point. The people that we worked with, as I said, were all a jovial group, very close together. Many of them had come down from Berkeley with Mr. Boelter, some finishing, I guess. Tribus was one, Bromberg was one, Harry Buchberg was one. I don't know if Heinz Poppendiek was actually working on any program, I mean on any degree. As I said, we had a great group. We had ping pong tables outside and we had volleyball nets where we played volleyball.

O'Neill: What stands out in your memory? What is the event or several events that really stick out in your mind?

Bussell: Well, there are so many things I should mention. Let me jump back to our smog research. There was a smog research program. One of the things we did... this sort of stands out. A bunch of us got up at 4:00, 3:00 in the morning and got in our trucks and cars, and so on, and headed out to Russ O'Neill's place up in the desert. He's thinking about it now...and we dug shallow, circular pits and we got some jet fuel from Edwards Air Force base and we had circular pits of different diameters and we filled them with the jet fuel and we lit them and then we got back with cameras and we took pictures of black plumes. Do you recall this, Russ? Black plumes. The bigger ones would go up higher before they flattened out. These were all measurements that we were taking to see how the smog was being capped off and what the forces were. But that stood out. We had programs in, what we called, boiling research where we were boiling water and trying to learn something about boiling water. And I remember taking high-speed motion pictures—still shots at a millionth of a second showing how bubbles formed at the bottom of glass jars.

O'Neill: Would you discuss these photographs and data and so forth with Boelter? Was he personally interested in them—in the data?

Bussell: Yes, he certainly was. I'm sure that he would be interested. We never had meetings with him where we would discuss this with him. But, I know that he was very much interested in the reports that we generated.

O'Neill: But, you did have staff meetings regularly.

Bussell: We had staff meetings, yes.

O'Neill: But, Boelter did not attend those staff meetings

Bussell: No, Boelter didn't attend those staff meetings.

O'Neill: Did he give you any feedback on your reports that you'd submit?

Bussell: He would make comments every once in a while about the work we were doing and the directions we were going and we also would have meetings with him where he would make suggestions about areas of research that we ought to try and attack. I remember very, very early on, I remember being in a meeting with him where he was suggesting that we should start thinking about ion propulsion. This was, gee, back in the mid-50s—long before people were doing much work in that area. There was an experience that I, unfortunately, didn't have that would have been the highlight. I guess we had a research program that was classified and had to do with the atomic weapons.

We had a classified section, we had a guard and so on and, as a matter of fact, I think you gave Don those cards that I gave you. These were the security cards and we built some measuring devices to make measurements on heat, measurements, and general spectrum measurements from the tail of a B-39. B-39? I guess it was a monster airplane; it could lift two railroad cars into its belly—that's how large it was. And, we had all these instruments in the tail and this was over the Pacific. This was an atomic weapons test where they would drop an atomic weapon and zoom away and our instruments were making measurements and so on. And, a lot of the people in the program went and I declined to go. And, I'm sure it would have been a memorable occasion—it was memorable that everybody was gone and I was there all by myself.

O'Neill: How about the people who kind of stand out in your memory?

Bussell: They all did. They were an exciting group of people. There was a group that I worked with at first. The first job I got in research that I didn't mention at all and they were very, very lovely to work with. That included George Tauxe, [Ray] Stoker, and Ned Taylor. This was a research contract on the effect of various kinds of solvents in putting out fires. I don't know if you recall, but we had a table built and we built little forests with twigs or with dowels and we'd start fires and we'd go across and we had photographs and we, at some point we would, things would get weighed as the fire progressed and we would put the fire out and so on. That was the first group, and, oh, Jerry Gwynn who was a research person was involved in that. Again, lovely people and then I went to work with other people like Harry Buchberg, who was wonderful. Walt Hurty, Alphonso Ambrosio, gee, I can't even think of all these people. There were so many of them and they were so, just, just wonderful, pleasant guys to work with. Dick Sanders ...

O'Neill: You got involved with a lot of different projects. Did you ever work with the traffic people?

Bussell: Yes.

O'Neill: What did you do with them?

Bussell: I stood on the corner of Wilshire and Westwood [laughs] and counted cars. [laughs] I think we counted every car with a five in the last position or something like that and we made these traffic flow charts to see how the flow of traffic went, where turns were made, and so on. I remember at one point towards the end of the work that we were doing Louis Pipes got involved—he and I had been friendly for sometime—and I remember he was likening the flow of traffic to slug flow in a pipe and so he was making a mathematical analog of the flow of traffic. It was very interesting.

O'Neill: Did you work with him on that or just...?

Bussell: No, I didn't work with him. He just discussed it with me. As I said, we had become friendly. I spent a few days with him in Hawaii at a conference where we both had presented papers and learned some of his weaknesses there.

O'Neill: What about the students? Have you seen any great change in the engineering student body over the last 50 years?

Bussell: Well, there's one effect that I have to pull out and that is that everybody seems to be getting younger. [laughs] So, if I can cancel that out, I know that even while I was here, before I retired, there was a big increase in the number of international students and now, as I walk through campus, this is even larger. The people, when I first started here, which was in 1948, so many of the people were in my position. We were military people or people just fresh out of the service. Older, serious, married, you know, a lot more commitments. And things, you know, as far as students are concerned, that has changed. I mean they're getting younger, they're becoming more international and ...

O'Neill: And fresh out of high school.

Bussell: And fresh out of high school. Correct. The people that I graduated with were, again, older people. Neal Richardson was a very close friend of mine—we studied together. A number of people, just a humorous thing, I got a call about, oh, it couldn't have been more than or less than, maybe six, eight months ago from some guy who said, "Hi, Bert, do you remember me? I'm Harry Zeller." And I said, "Yes, I remember you. We went to school together, this was in 1950." He said, "Yes, when we went to school I loaned you a notebook. It had answers to the differential equation problems in Watson. Do still have that? [laughs] "

O'Neill: Did you?

Bussell: No. [laughs]

O'Neill: Well, I think we're at the end of the tape. Thank you very much.

Bussell: You're welcome.