An Interview with

WILLIAM W. BUTLER

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Conducted by Arthur L. Norberg

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William W. Butler Interview
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Abstract

Butler begins with a brief description of his early life and education. He discusses his work on radar and sonar with RCA during World War II. He describes his decision to obtain a graduate degree in electrical engineering after the war and his subsequent employment with Douglas Aircraft. The focus of the interview then shifts to Butler's work with Engineering Research Associates (ERA). He recounts his start with ERA in sales under William C. Norris and his contribution to *High Speed Computing Devices*, and his work with John L. Hill and Arnold A. Cohen. Butler recalls the difficulty of selling the idea of the magnetic drum and his later engineering work on several ERA projects. He discusses product planning at ERA, including the 1103 computer, and later at Remington Rand. Butler describes the competition and cooperation between Eckert-Mauchly and ERA when both were divisions of Remington Rand and Remington Rand's corporate structure. He concludes the interview with a brief mention of Engineering Products Associates, Technical Systems, Inc., and Commbase, three firms he founded after leaving Sperry Rand.

DATE: 8 November 1984   INTERVIEWER: Arthur Norberg

LOCATION: St. Paul, MN

NORBERG: This is November 8, 1984. We're in the offices of Mr. William W. Butler, for an interview on his activities

principally connected with ERA, but also with other activities in the state of Minnesota, some of the predecessor

activities in the aerospace industry, and during World War II. Mr Butler I'd like to begin at the beginning, if you

don't mind. Would you tell me something about your early background? I'm interested in where you were born, your

early education, your parents, and so on.

BUTLER: I was born in Mason City, Iowa, where my father was an attorney and later county attorney. Went to the

public schools there. I think in about junior high school I found a book in the library on radio and became very

interested in radio. Subsequently I built a few small radios for my own personal use. That I guess led me into interest

in electronics and science. From high school I went to Iowa State University.

NORBERG: Let's go back to your father for a minute, as an attorney. What sort of practice was he in?

BUTLER: Mason City was a town of about 25,000 and he had a rather general practice. He did some criminal work;

did some courtroom work; and also deeds and wills, and all those things that lawyers do in small towns.

NORBERG: What was your mother doing at this time?

BUTLER: She was a housewife and somewhat active in our church and in women's organizations.

NORBERG: What church? Not by name but by denomination?

BUTLER: Methodist.

NORBERG: Was your father interested in any of these things as well? Radio, science, baseball?

BUTLER: Dad had grown up on a farm and he told me that as a boy he enjoyed putting together machines and so forth. Horse drawn machines. When I was young, he always had a wood working shop and some tools and he got me some wood working tools when I was quite young so that we did some projects together. As far as electronics was concerned a friend of his started building radios from kits when radio first came in. So Dad engaged his friend to build a radio and then he got the high school industrial arts class to build a very nice walnut cabinet. So we had a radio in our home. I don't recall that he took any special interest in that, but I always found it intriguing.

NORBERG: I don't remember if you said what year you were born?

BUTLER: 1919.

NORBERG: All right so this would be around 1930 that you're talking about now. So when radio was a substantial market product. Do you have any idea what encouraged your father to run for county attorney? I assume it was an elective office.

BUTLER: Yes, it was. Well I think his long term ambition was to become a judge and I think that was considered a stepping stone. And in fact, after I left home, he did go on the bench for many years.

NORBERG: Do you remember anything about the high school years in terms of any particular aspects of your training?

BUTLER: I enjoyed math and science in high school, but I also enjoyed history and other subjects. I was a lousy athlete. However, I always aspired to be athletic, so I went out for a number of teams, including football, and got banged around a lot.

NORBERG: So there was an involvement in extra-curricular activities?

BUTLER: Yes.

NORBERG: Did you have any jobs during this period? In high school?

BUTLER: Yes. I don't think I started working until my senior year, but I got a job in a filling station in the evenings. I had worked summertime on farms and one year in construction.

NORBERG: In the extra curricular activities was there anything involved with things like radio or some other science or engineering?

BUTLER: For a year or two there was a radio club at the local YMCA. And I was very enthusiastic about that and got a lot of help from the adults that were running that operation.

NORBERG: Do you remember them at all?

BUTLER: Yes. One was a young man named Jay Decker. I'm not sure how he got into radio. Actually, he inherited a lot of money from his father who had a meat packing plant and he eventually ran a sporting goods store. I'm not sure how radio got him. But he was quite knowledgeable and he was quite willing to share his information with the young people.

NORBERG: Are there any high school instructors who stand out in your mind?

BUTLER: Yes. I had a very good math teacher in high school, who also taught in the junior college. I did stay for a year of junior college. So he stands out. He was very meticulous and very demanding, but a good teacher. Also the

physics teacher, who was a bit of a comedian. Had made physics enjoyable and so it was interesting.

NORBERG: Was there a laboratory connected with the physics course?

BUTLER: Yes, both chemistry and physics had labs, which I enjoyed.

NORBERG: So there was a consistent activity, then, over several years?

BUTLER: Right.

NORBERG: In these areas. What about in the humanities?

BUTLER: I enjoyed the humanities. I recall being completely turned off by sociology. For some reason, I switched from sociology to typing. I've forgotten what the problem was.

NORBERG: When it came time to consider college, what led to the decision to go to Iowa State?

BUTLER: Well, it had an excellent engineering school and I did want engineering. It was near by and in-state tuition was attractive. Also I knew some older fellows at Iowa State, which was another attraction.

NORBERG: Older fellows meaning people who'd gone to the high school you'd gone to and you knew them?

BUTLER: Yes, that and also through scouting. One of the camp directors who actually lived in Ames was in college, and he encouraged me quite a bit to come down there.

NORBERG: What did your parents think of this?

BUTLER: Well they backed it pretty much. They'd both gone to college and wanted us to.

NORBERG: But was there any discussion about going elsewhere?

BUTLER: I don't recall any no. I think it was during the Depression, and funds were limited, so the least expensive place was the in-state school.

NORBERG: That makes sense. All right you wanted to study engineering. Do you have any idea why?

BUTLER: I suppose because of my interest in radio and building things. I'd always enjoyed making things with my hands.

NORBERG: There was no consideration then of perhaps pre-law, which at that time would have been History or English or something of that kind?

BUTLER: No, it didn't turn me on at all.

NORBERG: What did you find when you got to Iowa State in terms of the instructors and the programs?

BUTLER: Well, I was generally pleased with the program. However, in those days, electrical engineering was highly oriented toward power engineering and we spent a lot of time learning how to wind electric, AC and DC, motor armatures, which didn't really interest me that much. I think subsequently they changed the curriculum, but I felt as I was going through that it was rather unbalanced. However, in my senior year, we got an excellent professor who came back to the campus with an excellent background in electronics and taught a very good course in radio design.

NORBERG: Who was that?

BUTLER: Let's see, what was his name? I can see a tall guy we called "Tiny." I think it'll come to me in a little while.

NORBERG: Do you recall the text?

BUTLER: Yes, we used Terman.

NORBERG: Figures. That must be about the second edition by that point?

BUTLER: I think so the second or third. Probably still have it somewhere.

NORBERG: My mind is on Terman at the moment. I interviewed Terman several years ago. That's why I was thinking about that.

BUTLER: We'd also used Everett for circuits. Terman for radio.

NORBERG: In the engineering program if the emphasis was on power I would assume that the labs showed that emphasis as well. When it came to the radio and circuits courses was there a lab connected with them?

BUTLER: Yes, not very elaborate, but I remember it had some general radio test equipment and some bridges. I think we had an oscilloscope, but I don't remember it very well. Perhaps only one.

NORBERG: Any other people in the class that you remember well?

BUTLER: Oh yes, I made some good friends in college. One chap was Fred Hargesheimer. He went to work in the New York City area with Armstrong the radio inventor. And Fred worked on FM for a number of years. Eventually he and I came to Minnesota at the same time to work for ERA.

NORBERG: Did you take any courses in physics there?

BUTLER: Yes, I had one year of physics.

NORBERG: Did you bump into Atanasoff?

BUTLER: No, not personally, but I remember the name and his reputation, but I didn't know him personally.

NORBERG: Did you engage in any research while you were there as an undergraduate?

BUTLER: No.

NORBERG: Jobs?

BUTLER: Yes, I worked both in the fraternity house where I lived part time, and also took some odd jobs around the campus and around the community.

NORBERG: But nothing within the program itself?

BUTLER: No, I did not work in the department.

NORBERG: What was it like living in Ames at the time? This would be pre-World War II?

BUTLER: Yes. It was very pleasant. Nobody had any money but most everything was within walking distance and entertainment was quite inexpensive. And I did join a fraternity and did a lot socially.

NORBERG: Which fraternity?

BUTLER: SAE, Sigma Alpha Epsilon.

NORBERG: Let's go back to that radio and circuits course and the Terman book. Can you think about the possible value of that to the work that you did over the next five or six years, say from 1940 to 1946 or so?

BUTLER: Yes, my first job was at RCA in New Jersey. I went into a two year training course, which involved night classes. One was a class in radio receiver design and built almost directly on the course work they'd had at Iowa State.

NORBERG: How did you get the job at RCA?

BUTLER: I was interviewed and then I wrote some letters to the interviewer. And then I was invited to come to Camden and interview about six people there.

NORBERG: Were they at that time gearing up for war? Or did you know?

BUTLER: In retrospect, yes. I didn't fully appreciate it at the time. I think the training course started out with twenty recent graduates in it. Then within six months, they brought in another twenty or thirty. And I think the year before it had been ten.

NORBERG: Can you describe the training course for me?

BUTLER: I think we were divided into four or five groups. There was a group headed for research and development. A group headed for engineering design. A group headed for manufacturing. A group headed for accounting and administration and another group headed for sales. So with that in mind, we were given assignments. Appropriate assignments. For example, I was headed for manufacturing. So some of my assignments were in manufacturing.

Both assembly of radios and tests. But some were in the design departments. And I also had a very interesting design, sign done of development. Product development group.

NORBERG: You seem to recall these rather well. Can you describe any of the assignments?

BUTLER: My first assignment was on an assembly line, where they were assembling radios for the Christmas season. And I recall this line was started up about the time I arrived and they hired about a hundred women, pretty much off the street, many of whom had never seen a soldering iron before. Part of my job as sort of a rookie and the department administrator help teach these ladies to solder properly. One of the inspectors would find something wrong at the end of the inspection line and I'd run back in and try to deal with source of the problem. An earlier manufacturing assignment was in a department that assembled ordinary record players. It was a mechanical assembly, and we had lots of quality problems there. Which I think in retrospect probably went way back to the design, because parts didn't fit too well. At the end of the line people had to bend things to make them work properly. And so again I was sort of running around trying to find out who was goofing up. Never did quite fathom that one. That's very subtle. Let's see, I think I have a short stint in time study, around, oh, stop watch measuring time. It was in a group that designed test equipment for use in the factory and had to help come up with a low frequency oscillator, which I then built and tested. In the development group was a group doing work on television. That was an extremely interesting group because I was interested in television. And I recall that my particular group was building a portable television transmitter for use at the Republican Convention in Philadelphia, which must have been in late '41. This was a box about two feet cubed crammed with miniature tubes and batteries. I got involved in more than just what I did. But in some way perhaps.

NORBERG: The dating there seems a little bit odd to me given that the campaign would have been in 1940.

BUTLER: No, it doesn't seem right.

NORBERG: Anyway, that's not all that important I guess. Even though you were headed for manufacturing, did you

participate in the assignments for other groups as well? Sales and development and so on.

BUTLER: Development and design. I didn't get into sales at all or accounting but had a fairly broad exposure to technical areas.

NORBERG: My indication is that you were in that program for about a year. 1940-to-'41.

BUTLER: I left in December of '41.

NORBERG: And went where?

BUTLER: A year and a half. At that time the draft board was breathing heavily. It was a choice of volunteering or being drafted or getting into something at RCA that was service related. Another of my friends had transferred into what was called the RCA Service Company. And the Service Company had contracts with the Army and Navy to install and maintain RCA equipment in military vehicles or ships and submarines and so forth. So I did transfer into the Service Company. I was trained in radar and the first assignment was to install a radar, a new radar, in submarines. After fairly brief training, I was sent up to New Hampshire to make an installation at Portsmouth Navy Yard. Just before Christmas 1941. And then, right after early January of '42 I was put on a freighter and sent out to the South Pacific to meet the Pacific Submarine Fleet. I finally met them in Western Australia. I spent a year there installing radar and subsequently servicing it. And something like that.

NORBERG: What sort of radar?

BUTLER: Well, this was a very primitive radar, had a vertical antenna mounted on a periscope mast. So it was non-directional. The idea was that we were losing submarines, particularly to the Germans, because as a submarine was just about to surface it's very vulnerable. It's within sight of enemy aircraft and it's unable to defend itself. So the idea was: before surfacing to shoot this periscope antenna up above the waves, and take a quick look to see if

any aircraft were in the vicinity. You really didn't care whether they were north or south or east or west. If they were up there you want to get back under water again, not complete the surfacing. This was electronic equipment. The job of installing the radar required pulling out the periscope and installing the antenna in the periscope mast. We used the outside of the mast as the outer conductor of a co-ax and we put porcelain insulators and copper pipe inside to act as the inner conductor of the co-ax.

NORBERG: Who had developed the radar?

BUTLER: RCA.

NORBERG: RCA. So this would be one of the early ones that had still not involved use of the magnetron and other such devices?

BUTLER: Very early triads of a hundred and twenty-five megacycles.

NORBERG: Do you have any idea of the effectiveness of these?

BUTLER: Yes, they were effective. One friend of mine subsequently wrote and said he thought that his submarine had probably been saved because they were surfacing and got a strong blip and were able to get back down in time, with no detection. Also it was used, it was kind of interesting sidelight, it was used 'til people came back from patrol and told me that they had been able to navigate because when they got close to Japan they could pick up Mount Fuji. Though they didn't know the direction, they knew the range. And..they were doing some triangulation and so forth, they could confirm their navigation. It was an unexpected, I think they were having some trouble with navigation equipment and they actually used their radar to establish where they were.

NORBERG: Now, did you do this sort of thing all during the war? For the four years?

BUTLER: Yes. Different kinds of radar and different locations, but always working for RCA on radar. Well, actually on sonar.

NORBERG: How did you learn about the radar and sonar systems?

BUTLER: Well, they had kind of a crash course in which they put us right in the engineering department where the radar was being designed and the production department was right next to it. So we talked to the designers about the design. We, as I recall, observed the stuff being put together, so we knew how it went together. Then we got involved in the testing so we knew how to test it. Also at that time the Navy did not have proper test equipment, so I put together quite a large box of special test equipment which I learned how to use and took with me. I set that up in Australia and was able to do appropriate testing.

NORBERG: Can you give some details about the test equipment?

BUTLER: One of the most handy things was a neon bulb, which would tell whether the transmitter was transmitting or not. To test a receiver we had a little sweep oscillator on which we could view the intermediate frequency stages to see if they were properly aligned. We could actually realign intermediate frequency coils in the field. I think there was an RF generator to check the RF end. Must be an audio generator. Some little oscilloscope meters.

NORBERG: Now when you say that you put this together, was this something that had not been thought of or would you need the typical sorts of things that were being used to test them in the laboratory?

BUTLER: I was sort of there when it was put together and was aware of it, but other people sort of knew what was needed.

NORBERG: Did you get to Cambridge at all, to the Radiation Laboratory?

BUTLER: Never did. I had some friends there.

NORBERG: Did any of those people come to RCA and instruct you or your group in anyway, about the operation of the new design?

BUTLER: Possibly so. You see it was very highly secret at that time and although I'd been working at RCA I had only the faintest inkling that radar must have been going on within a hundred yards of where I was. I had only the slightest inkling about it until I came into the service department and was sworn to secrecy. But even then, you know I was only taught what I needed to know. One of the chaps in our training group went up to Harvard and worked on radar there. Fellow named Newman, who eventually helped, teamed up with Bolt and Beranek to form Bolt, Beranek & Newman. There was some reverse. I don't recall. But I'm sure that the top technical people were working with MIT, but I wasn't aware then.

NORBERG: What about the working conditions during the war? Now we think of an eight or a ten hour day, but what was it like then?

BUTLER: Well, it was very erratic. When we first arrived everybody wanted the equipment installed right away so I worked very long hours. I think I had twenty, fifteen or twenty, sets with me, which matched the size of the fleet. But after those were installed - that took about six months to get those installed - then the last six months, I was working half days.

NORBERG: Now when you say six months what period are we talking about?

BUTLER: Well I arrived there late January, early, about mid February 1942. I left in early '43.

NORBERG: So about two months or so to install these sets and then roughly a year working on installation and maybe maintenance or whatever needs to be done the second six months. So now we're up about to '43 or so?

BUTLER: Yes.

NORBERG: What did you do for the remaining war year?

BUTLER: Well, I came back to RCA and by that time they had developed a high frequency radar. Higher frequency radar. And they sold that to the Navy for use on destroyer escorts. Small destroyers. And so I studied that. And by that time the Service Company had hired instructors and had formal classes. We sat in a class with fifteen or twenty other engineers. We studied that much more formally. On the other hand, it was quite a bit more sophisticated, so there was a lot more to learn. The early, first radar we learned really only had a couple of transmitters and then the receiver was clearly conventional so there wasn't that much to learn about it. But the higher frequency equipment was much more sophisticated. It had a directional antenna and the servomechanism to drive the antenna was new to me. I'd never, well, just barely, heard of negative feedback. Servomechanisms were new at that time. So, after I'd taken that course for six weeks or so, I was sent to Bermuda and spent about six months working on the destroyer escort fleet in Bermuda.

NORBERG: Now, when you would be installing such a system, whether it be in a submarine or on an escort, who was involved? Were you supervising a group of Navy personnel...

BUTLER: Yes.

NORBERG: In the installation as opposed to your actually installing the device?

BUTLER: Right. I would train the Navy Chiefs, Warrant Officers and enlisted men to do it. I would usually get in on the testing once it was installed. I would help them test it and sort of give it a blessing, and frequently go to sea then with it. And then, anywhere from one to six months later, it would come, they'd come, back after being out at sea. And easily things were out of whack a bit, and some of the maintenance people on board were able to do quite a

complete job of maintaining and so forth. Others were not as competent or didn't have as good luck. Then I'd come aboard and help them get it tuned up again.

NORBERG: How long did you stay in Bermuda?

BUTLER: Six months. Following that I came back to New Jersey for some more training and was sent to North Africa. In the second or third training course I spent quite a bit of time learning about sonar, because RCA was building sonar at that time. So I was responsible. And also they had a thing called a radio beacon. It was used on aircraft carriers. It involved a directional antenna which rotated and at each azimuth angle it put out a pulse signal. I've forgotten the code, but it was fairly simple, like maybe one beep at zero degrees and two beeps at ten degrees and so forth. When they were out of sight of the carrier they could count the beeps and find out whether they were at ninety degrees or a hundred and eighty degrees from the carrier, and know how to get back to the carrier. So I learned about that.

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NORBERG: Did you have any contact with the people in this program after the war? We're speaking now of the people who went through these various training programs and helped to install such equipment and so on.

BUTLER: After the war I left RCA.

NORBERG: Yes. Please just answer my question and I'll get to that in a different way.

BUTLER: I'm sorry. What was the question?

NORBERG: The question was: any of the other people in the program, did you become associated with them after the war?

BUTLER: On a social basis. I didn't work with them.

NORBERG: In connection with social basis, what was your social life like during the war? Did you get married anytime in this period?

BUTLER: No.

NORBERG: Or after the war?

BUTLER: No, I was enjoying bachelorhood all through the war. And generally work was periodic. I'd work very hard for a while and then I'd have a lot of time off and I was able to enjoy my work.

NORBERG: Do you recall at anytime during this period, particularly toward the end of it, '44, '45, beginning to think about the post-war period? To what you might do.

BUTLER: I recognized that I was getting rusty technically and did make the decision near the end of the war that I should go back to school and go for a masters degree.

NORBERG: How could you have made that assumption about being rusty technically when you were working in an area that was considered to be the fore-front of electronic development?

BUTLER: As I say, I was working at it from a maintenance point of view. That didn't give me a lot of insight into how things were designed. Only how to fix them when they went wrong. And I didn't think I wanted to spend the rest of my life fixing other people's mistakes. I like to make my own.

NORBERG: Well put. Then how did you decide what to do?

BUTLER: After college?

NORBERG: After the war.

BUTLER: I decided to go to college.

NORBERG: How did you come to choose CalTech?

BUTLER: I was on the West Coast at the end of the war and liked it and wanted to stay on the West Coast, so I checked out the University of Seattle, the University of Oregon, Stanford, and Cal Tech, which were the four engineering schools. And as I recall CalTech accepted me first. It sounded like a good school. I didn't know a lot about it. I was kind of torn between Stanford and CalTech. I'm not sure just what the final decision was based on.

NORBERG: That's a fairly sophisticated decision though, to know that there were four principal engineering schools on the West Coast. How did you come to learn this?

BUTLER: Well, when I was aware, I started thinking about this, I wrote to the Dean, the head of our Electrical Engineering Department at Iowa State. He was a friend of mine, and he wrote a nice letter telling me what the good schools were. He recommended some schools in the Mid-west as well but I more or less eliminated those for social reasons.

NORBERG: Now CalTech at that time was beginning to change its program.

BUTLER: I think so, yes.

NORBERG: What sort of program did you encounter when you got there? I think the best way to answer that

question might be to contrast it with what it was like at Iowa State in the 1940s.

BUTLER: I found that the laboratories were fairly well equipped with things like magnetrons and clystrons and so forth, which I'd been exposed to during the war but hadn't really known much about. It was either the filament was burning or wasn't and it was either putting out or it wasn't, but I didn't know a lot about the theory, so that was a real plus. What was the question again?

NORBERG: What was the program like and contrast it with what the program was in 1940, thinking about Terman's book, for example. What sort of materials were used in 1946?

BUTLER: A new course at CalTech, a topic which I hadn't even heard of out of State, was in servomechanisms. I'd been exposed to servos during the war so I was interested to learn the theory. Mathematical theory. They have some excellent math-physics courses. In fact, I'd never heard of math-physics before, because at Iowa State the math department was here and the physics department was there.

BUTLER: The electrical engineers and the mathematicians coordinated teaching of differential equations, which I appreciated very much. I like math, but I like to know how it's going to be used. There was a course a very good course at CalTech called Math-Physics which kind of built on differential equations, but in which the math and the physics were introduced in the same classroom at the same time, very unified and useful.

NORBERG: The reason I asked the question in the way I did, Bill, was because the time that you were at CalTech was a transition period. The knowledge gained during the war in things like radar, circuitry and servomechanisms and so on, had not been encapsulated into textbooks.

BUTLER: Right.

NORBERG: Until about '47.

BUTLER: That's right.

NORBERG: If you think of the Radiation Laboratory Series, for example, it didn't come out until late '46, so these things are not available yet for use in the classroom. So I'm curious what sorts of things were being used at CalTech in that period, if new topics were being taught, and I believe they were.

BUTLER: Well, you know MIT did put out some books during the war. In fact, I bought one during the war and carried it around with me. They had a pretty good book on high frequency circuits. I've forgotten the name of it, but it got mildewed and fell apart on me. As I recall, it wasn't even typeset; it was typewritten onto paper and then printed. Very common now, but it was the first book I ever saw that wasn't typeset. But it was rushed out during the war. This Math-Physics course was taught by Willie Fowler who's since become a Noble laureate. He had his own notes, mimeograph notes, that he handed out each day. So he more or less developed a text as we went along.

NORBERG: Who else did you take courses from besides Fowler?

BUTLER: The chap who taught servomechanisms eventually became head of the Jet Propulsion Lab.

NORBERG: Pickering?

BUTLER: Pickering, yes. He was an interesting guy, an Australian. Two of the non-engineering courses that I enjoyed were one on labor relations with a chap named Gray, who stayed on for many years, and then there was an economics course for engineers by [Gilbert]. This chap had gone to Germany after World War II on a commission to assess the effects of strategic bombing and made a report and worked that into the lectures once in a while.

BUTLER: He was from Washington State, up near Yakama. Gilbert. Remember him? I never kept track of him. I think he left.

NORBERG: Now as you were coming to the end of this program, I assume it was just a one year program.

BUTLER: Yes, by design.

NORBERG: And it was fully coursework. Was there any research connected with it?

BUTLER: No.

NORBERG: As you were coming to the end of the program, what ideas did you have in mind?

BUTLER: I was quite interested in Hewlett-Packard as an employer and did write to them. Also Hughes Aircraft was hiring and a number of my classmates went to Hughes. However, I was approached by a chap who had been in one of my classes who was director of a small research group at Douglas Aircraft in El Segundo. He and I hit it off and he invited to join his department and so I did that.

NORBERG: What was his department doing?

BUTLER: They called it research. It was really kind of an odd job instrumentation department. So he was doing a number of things. For example, one of the things I recall was putting strain gauges on different places on airplanes for static and dynamic load testing. They put the gauges on and actually carried out the test. They also developed some hydraulic actuators I believe. I didn't get involved in that, but I remember observing that. Douglas Aircraft also got a study program from the Navy to do, to propose what was called a pilotless aircraft. This was an airplane that had an auto- pilot and some kind of inertial guidance or radio or something. And had a load of bombs. It was supposed to fly from one airfield to someplace several miles away and crash. This was kind of a fore runner of guided missiles, but it was more or less a conventional aircraft. So several of us did a kind of study of what was available in the way of guidance equipment and radio control and wrote a report to the Navy and on the state of the

art.

NORBERG: Now was this the total of the work that you did there for that two years, that contract?

BUTLER: I got involved in a number of things. Some flight tests. We did some instrumentation for flight testing. One of the most interesting things, well a couple of the most interesting things, Douglas had built some carrier-based aircraft and delivered some to the Navy. They were experiencing heavy damage after landings, kind of tearing apart around the front wheels. So finally, they did a lot of in-plant testing. They'd haul these things up to the ceiling and drop them to the floor. And they couldn't find any trouble. Everything seemed to work according to design. So finally they decided the only thing to do was to go out on a carrier with instruments and plan to have these pilots land them on the carrier to see what was happening. I helped get the instrumentation set up and went on the carrier and observed these things. And to everyone's amazement the young pilots were hitting the deck about twice as hard as anyone there imagined they could. And so it was really an operational problem not a structural problem. Well, they eventually beefed up the airplanes, but it turned out Douglas was within the design. Another one was a combination of engine and propeller test where they were getting excessive vibration. So they went out in the woods and tested this big engine for vibration. Instrumented it and tried to discover what caused the vibrations.

NORBERG: So essentially this, if you'll pardon the phrase, is problem solving?

BUTLER: Yes, exactly.

NORBERG: It's considerably different than what was going on at RCA, certainly, which was, as you say, maintenance.

BUTLER: Right.

NORBERG: But here you've got a problem solving group which can take on any task it seems.

BUTLER: Yes.

NORBERG: Now did you find this more comfortable than what you had been doing with RCA? Toward the end anyway.

BUTLER: Well, yes and no. It was very enjoyable. On the other hand, I did leave after two years because I didn't see a heck of a lot of future for myself in the aircraft industry.

Probably a little bit short sighted. I thought it was probably going to be done in by aeronautical engineers and electronics was going to be kind of a peripheral activity. And that was on the negative side. On the positive side, somebody from Philadelphia came to Los Angeles and gave a talk on digital computers. And I was, well I also worked on this analog computer.

Douglas took a contract with the Air Force, I guess, to develop the airframe for the Nike missile. Bell Labs had the prime contract to develop the guidance and control equipment. The airframe people wanted a set of trajectories laid out so they could complete their design. Bell Labs could not provide these for about a year. So our department was approached and we were asked if we could come up with a trajectory computer to develop these trajectories in a few months. So three of us were assigned this task, two mechanical engineers and myself. First, we checked out a book by Vannevar Bush on the differential analyzer, which he had developed and built at MIT. We were quite astounded to know that there was such a thing and quite impressed with his ingenuity. It was an electro-mechanical analog computer. One of the crew realized that there were airborne analog computers during World War II. And a lot of that equipment was in surplus. So we found a surplus place and bought about six airborne computers for about fifty bucks apiece. We took them all apart and spread the pieces out on the table. Then we divided up the work. One chap agreed to study the equations and do the layout of the system. Another chap agreed to do the mechanical design and get it built. And I agreed to come up with a servomechanism which was needed to take the output of an integrator and use that to drive the input of another integrator. To build the torque. So we did complete this project

within a few months and it worked successfully for many years.

NORBERG: How would you contrast the device that you people designed with Bush's?

BUTLER: His machine was built back in the '30s and they didn't have electronic servomechanisms. He'd come up with a very ingenious mechanical servomechanism called the "wrap spring break". Which was subsequently used by Eckert and Mauchly, by the way. The "wrap spring break" takes advantage of the fact that if you have a rotating shaft and you encircle it with a piece of wire that's a solenoid that looks like a door spring. If you want to control the speed of rotation of the shaft you can do it by breaking action. The problem with the "wrap spring break" that a few ounces of force on the end of the spring will result in several pounds of torque on the rotating shaft. It's a little like the Chinese finger trap. When you wrap that thing around there [notes his finger] with a few ounces of force it suddenly starts to grip with it over a wide area and really loads it up. So he'd worked out a servomechanism using these "wrap spring breaks". It was very complicated. We were able to substitute the electronic, electrical motor servo using vacuum tubes.

NORBERG: What about size? Was the size of the device the same as Bush's?

BUTLER: Well his device had I think thirty or forty integrators. We had perhaps five or six. So the scope of ours was quite a bit smaller because of the special purpose. His was general purpose. I suspect that his parts were bigger and fairly less precise. His had to be larger to get the same overall precision. I'm a little hazy on that. As I recall our baldest integrators were only about an inch and a half or two inches in diameter. It meant that to get any precision you had to be working at a few thousands of an inch precision.

NORBERG: What sort of problems were solved on this?

BUTLER: Well, you assumed this Nike missile was at some elevation angle and was fired with a certain amount of thrust and had certain drag characteristics and from that would go up through the atmosphere and break out into the

stratosphere or whatever. And based on these drag equations and so forth, you'd calculate what the trajectory was. From that, you could tell how far it would go. Given thrust and given an angle, so you knew how to aim it. Somewhat like you do in artillery. You have to calculate the trajectory so you know how high to lift the gun in order to hit some target twenty miles away.

NORBERG: So what was the overall size of this computer?

BUTLER: It was on a table about the size of this desk as I recall. Since we were in a hurry we didn't spend a lot of time being careful. There were a lot of shafts kind of running back and forth. It was a kind of Rube Goldberg monstrosity. But it did manage to work.

NORBERG: And was one of these supplied to each of the Nike missile sights?

BUTLER: I think only one. No this was really not used for the guides itself, this was used for the designers. In other words we ended up with a piece of paper with some trajectories on it.

NORBERG: There was only one of these used for design?

BUTLER: Yes. Only one was made and that was used by the designers.

NORBERG: How is this related then, to the visit by the fellow from Philadelphia talking about digital machines?

BUTLER: Well, I immediately was impressed with the idea of a more versatile computer. I appreciated the power of the analog computer, but I realized that it was pretty limited in what it could do. So I think I sensed early on that the digital computer was a real breakthrough in computing and as I try to analyze myself I think I've always been intrigued by something that was new. I was interested in television when it was new; I was interested in radar when it was new; I was interested in computers when they were new. So I guess I'm hooked on new things.

NORBERG: Do you recall the circumstances of the talk by the man, the person from Philadelphia?

BUTLER: Well it was given at UCLA, the University of California at Los Angeles. I think it may have been sponsored by the Institute of Electrical Engineers, though I'm not sure exactly who sponsored it. [I] remember there was a good turn out. Maybe a hundred people showed up. At that time I think they were building a computer called the BINAC, which as I recall was two identical computers side by side and did voting.

NORBERG: You mean the people from Philadelphia were building the BINAC?

BUTLER: Yes.

NORBERG: So that suggests that the person came from Eckert and Mauchly.

BUTLER: Or the Moore School. The Moore School continued to make computers, I think they made the BINAC and the EDVAC.

NORBERG: They had the EDVAC but not the BINAC.

BUTLER: Not the BINAC? Did Eckert and Mauchly make the BINAC? I'm not sure whether it was Eckert and Mauchly. It was at a time when I think the two were just splitting anyhow, so I'm not clear who, which computer it was but I think it was the BINAC so it may have been someone from Eckert and Mauchly.

NORBERG: This, then, got you thinking about the digital field?

BUTLER: Right.

NORBERG: What did you do to learn more about the digital field at the time?

BUTLER: Very little. There wasn't much. There wasn't much available I was aware of. But the next event, my wife got a letter from a friend of her's saying that her husband and some others were starting a digital computer company in St. Paul, Minnesota. We were thinking about leaving Douglas and about leaving California and so it all worked together.

[INTERRUPTION]

NORBERG: You've just introduced a new topic into this. A letter sent to your wife?

BUTLER: Yes.

NORBERG: No mention of when the wife enters this picture, however.

BUTLER: Oh, let's see. After I left CalTech and went to Douglas, I was invited to a Christmas party and met a young lady who I had known slightly in college who had dated a fraternity brother. We started dating and subsequently got married in June of 1947.

NORBERG: Now was she from Mason City, Iowa?

BUTLER: She was from Council Bluffs, Iowa.

NORBERG: And she knew William Norris's wife?

BUTLER: Yes. They'd been in the Navy together.

NORBERG: Meaning the two women?

BUTLER: Yes.

NORBERG: So she received a letter from Mrs. Norris about the new company starting up?

BUTLER: Yes.

NORBERG: What transpired then?

BUTLER: I wrote to Bill applying - well I sent a résumé to Bill - and got a prompt reply. He invited me out. He offered me a job.

NORBERG: Just like that, sight unseen?

BUTLER: Right. As I recall his comment was that any friend of Ellie's couldn't be all that bad. And also they were hiring quite a few men. Now I guess he liked my resume. As a matter of fact, I was really making two changes. I wanted to get into a different industry. Also I wanted to try my hand at sales and marketing. He was the vice president of marketing at the time that he hired me. So I applied for a job as a sort of a sales trainee and was accepted as a sales trainee.

NORBERG: How did you become interested in sales?

BUTLER: I had taken a course in sales engineering at Iowa State and then subsequently observed that salesman seemed to be having more fun and making more money. Which was somewhat inaccurate, but I guess the grass on the other side of the fence always looks greener. I guess I'd also decided that I was not really a longed haired scientist. I enjoyed engineering but I really competed with the top people I'd worked with.

NORBERG: So making one's own mistakes didn't seem quite as attractive anymore?

BUTLER: Right. So I thought.

NORBERG: So you received and accepted a job with ERA. And that was in the Washington office?

BUTLER: Yes.

NORBERG: So you moved from El Segundo to Arlington, Virginia?

BUTLER: Yes, that's correct. Yes.

NORBERG: What did you find when you arrived in Washington?

BUTLER: I found that ERA had a small group in Arlington. I think perhaps twenty people. I thought it was a very diverse group. Howard Engstrom I guess was the senior person there. He was living in the area and he was acting as a go-between, liaison, between ERA and St. Paul and the Navy department, our principal customer. Bill Norris was head of marketing. He had some continuing contact with the Navy, but he was more concerned with finding other customers, including other military customers, other government customers. But he also wanted to get commercial customers for ERA.

Let's see, the patent office was there in Arlington. There were several people came, and maybe dropped in once a week, who were really working at the Navy maintaining ERA equipment. In other words, they were maintaining ERA equipment and spent most of their time at the Navy, but they got their paycheck from the Arlington office.

Let's see, we also had some research; we had a small research laboratory. There were a variety of contracts and

things going on. Bob Gutterman, a physicist, was very active in research. He had some contracts for some mechanical type devices. Another small group had a contract for some, I think it was with the CIA, for some snooping devices.

TAPE 2/SIDE 1

NORBERG: You were commenting on the people involved and the type of contract.

BUTLER: Yes. That's about the extent of it. Well, also, Tommy Tompkins was there. He was helping Norris develop proposals for new work, but he was also working on the Navy report which resulted in the book called *High Speed Computing Devices.*

NORBERG: So what was your first assignment with this group?

BUTLER: My first was to work on the book, on the report, the Navy report. And in order to work on it, I had to do a lot of reading, because I had a very skimpy background. As I recall, the reading was mostly from mimeographed reports which the Navy had collected from its own contractors and other government contractors. It included reports from the University of Pennsylvania, Eckert/Mauchly, MIT. I think there were some reports from England; work going on over at some of the universities in England. I was able to find a little bit of material in the popular press, not a lot. And then of course, I did some researching for background reference material, the source of some of the basic circuitry and some of the basic ideas that carried over from earlier art into the computer field.

NORBERG: One of the characteristics of ERA and its work at this time was the highly classified nature of it.

BUTLER: Yes.

NORBERG: Had you already been cleared?

BUTLER: Yes, I'd been cleared at Douglas and I think was immediately cleared at ERA. I don't recall making much use of my clearance, but I think I was.

NORBERG: But the fact was that you could then begin work almost immediately if you had the clearance?

BUTLER: That's true. As I recall, the report was not a classified project. Maybe the report was unclassified.

NORBERG: Who else worked closely with you on assessing the information in the documents you just mentioned?

BUTLER: My immediate supervisor was Bill Stifler, W. W. Stifler, who later did a lot of the editing. I worked off and on with Charlie Tompkins, who was doing the mathematical parts of the book. I worked with Dr. Wakelin who, I believe, was involved toward the end of the period. As I recall, he and I worked a lot on the references. I tried to do a thorough job of supplying a list of reference material.

NORBERG: What was the nature of the interaction of these people? Did you discuss the things that you were reading, or did everyone just assume that each of you knew what was going on?

BUTLER: It was more of an author-editor relationship I'd say. I had two sources of material. A lot of material had already been written when I arrived, and had been written by different authors. Each had a different style. So I did what you might call a rough editing to try to homogenize the style of a bunch of different authors. So that was kind of a re-write without changing the technical content very much. But that resulted in material which could go Bill Stifler for more final editing. Then we took this in areas where nothing had been written. I took the material I could find and developed my own text and sent that to Stifler for editing. As I recall, I worked quite a bit with Tompkins in the early days.

[INTERRUPTION]

NORBERG: Let me see if I can pick that up in a slightly different way. I'm a little puzzled now at the timing of some of these things you're talking about, because it seems to me that some of the things you're mentioning occurred later. The suggestion was made that it was essentially in operation at the time that you arrived.

BUTLER: Yes. Could I pull down the book, it'll help me look?

NORBERG: Sure.

BUTLER: Repeat the question?

NORBERG: Yes, but first let me ask you the question in a different way. When did you arrive in Washington?

BUTLER: I arrived in August 1948.

NORBERG: What was the status of the project to produce *High Speed Computing Devices* when you arrived?

BUTLER: A great deal of source material had been collected from many sources. I would say perhaps two-thirds of the book had been written, but in a rather preliminary and uncoordinated fashion. Maybe three-fourths, I'm not sure. More than half the book had been written at that point, by different authors without much editing.

NORBERG: Right, so you did two things. First of all, you assessed some of this collected material so to as understand what information was in it. And secondly, you did the first stage of editing to try and homogenize the book?

BUTLER: I think that when I arrived Tompkins was still, was just finalizing his outline. What should come first or the order in which the chapters, he pretty well knew what he wanted to include, but he was finalizing the exact order and how it should be divided. And I recall having some discussion with Tompkins about that. He made the decisions,

but I think he asked my opinion about things.

NORBERG: So that essentially around the end of 1948 the table of contents was as we see it now?

BUTLER: Yes.

NORBERG: Did you contribute anything specific beyond the editing?

BUTLER: Yes. I remember writing, I think I wrote chapter fifteen, which had analog to digital computers; digital analog computers. I think some of that had been written, but I think I wrote the bulk of that. It seems to me I wrote one other chapter, too. I think I wrote the chapter on analog computers. Not much had been written on that and I happened to know something about that.

NORBERG: Was there an intent to include analog computers?

BUTLER: I'm not sure. I may have put that idea in Tommy's head, but I don't recall any hesitation on his part to accept. But, as I recall, very little had been written about analog computers when I arrived. I think it wasn't so much that they didn't want to do it, it was just that nobody had volunteered.

NORBERG: Now did you make any visits yourself to other places to collect further information?

BUTLER: No, I worked almost entirely from printed material. So it was a little bit sterile that way.

NORBERG: Were most of the people in the office working on this book at the time?

BUTLER: No, I'd say that I was working full time. Tompkins was perhaps working never more than half time I don't think and sometimes very little. Stifler, who was editing, was also doing other things. By the time I arrived I was the

only person working full time. Other people were working part time.

NORBERG: When did you begin working less than full time hours?

BUTLER: That's a good question. I was in training for sales work and I remember doing other things during those two years and eventually was completely through with it. When was this thing published?

NORBERG: The report was submitted in something like '49.

BUTLER: '49, ok. So after '49 I was no longer involved in that. I was full time selling. But I think there was at least, perhaps, a few months some of each. But I'm real hazy on that. Very blurred.

NORBERG: What is it you wanted to sell and to whom?

BUTLER: We had several products in mind. For one thing, ERA had pioneered in the development of magnetic drum storage and had a very good patent structure. ERA got a contract with Automatic Electric Company in Chicago for a little memory to be used in cross office communications. Where a bunch of messages might come in at eight o'clock but because of the speed you wanted to send them out for the next couple of hours. You'd store them temporarily on the drum and then shoot them out over the perforated tape communications. That was then redesigned into a kind of demonstration package which we had at shows. Our intent, our hope, was to sell large companies on large magnetic drum storage systems. And we did sell a few.

NORBERG: What sort of arguments were used to try to convince these companies?

BUTLER: See, we were competing with the mercury delay storage which was being promoted by Eckert-Mauchly. And of course, there wasn't a heck of a lot of storage. The problem was nobody had used storage before, so they didn't know what it was. So it was more convincing people that it was a good idea to store information rather than

competing with some existing storage medium. Punch cards, of course, were used to store information; also punched tape. And in a way, I suppose, those were the two media we were competing with.

NORBERG: That suggests you were trying to educate companies or personnel into a new form of doing business?

BUTLER: Right.

NORBERG: How did the new form of business idea develop in places like ERA?

BUTLER: Well I guess from the background experience of the engineers and the officers. Some of the people that had experience at least in communications. In fact, they'd come out of a communications background in the Navy. So some of the targets were AT&T, Automatic Electric, ITT, the big communications companies. Another target was the companies making calculators and punch card equipment - National Cash Register, Burroughs, IBM, Remington Rand, and so forth. Another target was the universities who were getting contracts from the government to develop computers. Some work at Michigan, some work at MIT, some work at Pennsylvania. And then there were government agencies doing the computer work. The Bureau of Standards, the Navy, Naval Research Labs. *Nuclear Army*, maybe, the Air Force may have been putzing around. I don't recall we did much of that on drum storage. Although the company eventually did large contracts for computers with the Army and particularly Air Force.

NORBERG: It seems to me you've cleverly shifted the discussion now from sales to development.

BUTLER: No, these are the targets for sales. We were trying to sell to these folks. The concept of magnetic drum storage as opposed to punch cards or punch tape or in the case of a calculator the gears and things.

NORBERG: I do understand that they are the targets all right, but they are also the developers in many instances.

BUTLER: Well, we had the patents, so in a way they had to deal with us either as *licensees* or as customers. And we

preferred them as customers.

NORBERG: This is a very difficult period to deal with from say '48 through about '52. When it's not clear how effective the devices will be, at least not clear to me how effective they were. It's not clear what the future of the industry is. Therefore, what sorts of arguments would be presented in a sales presentation? That would be different from the time you were trying to put radar in or convince people how to use radar? Were there handbooks, for example, were there strategy documents developed in ERA?

BUTLER: No.

NORBERG: It was all done by word of mouth then I take it?

BUTLER: Very informal.

NORBERG: Let me ask the question differently. How important was your engineering knowledge to the sales program?

BUTLER: I would say in many cases it was reasonably important, particularly if I was talking to a group who were developing a computer. They'd want to know how this thing would fit in to their designs and so it was necessary to talk in technical as well as in general terms.

NORBERG: Is it possible to describe for me your attendance at trade shows for example?

BUTLER: Sure.

NORBERG: Because that may help me to phrase the question that I'm trying to get at.

BUTLER: The big trade show in those days was the Institute of Electrical Engineers, which met once a year in New York City at a big building, I can't remember the name of it. It was like an armory, but it wasn't then. The ERA booth contained - this must have been around '50 or so - a demonstration with an electomatic electric typewriter and a magnetic drum. It's really a predecessor of the word processor, because we could enter information on it through the typewriter, store it on the drum and then play it back and type it out at a later time. And rather rapidly, so that we were recording and playing back digital for this drum. And this was a very good demonstration. Got a lot of interest and got people thinking about storing digital information. It was really outside the digital domain so the digital computer people could readily understand how this could help them. But communications people and non-computing people could also sometimes see some of the possibilities.

NORBERG: What I sense then is that you were dealing only with technical people when trying to sell, and therefore wanted to sell them on the basis of a technical argument?

BUTLER: Right.

NORBERG: Was there any thought given to non-technical people and machines for sale?

BUTLER: Are you speaking about the drum storage?

NORBERG: Yes still that same period, '49, '50.

BUTLER: First of all, we didn't sell a heck of a lot of them, so I'm kind of scratching my memory here. I do remember the sale to Remington Rand, which you might like to hear about.

NORBERG: Go ahead.

BUTLER: It must have been around 1949, a half a dozen or so engineers left ERA and took jobs at Remington Rand

in Norwalk, Connecticut. And of course, they were well aware of our work in magnetic drums. But I don't think they considered it particularly relevant. Then Remington Rand bought Eckert-Mauchly. I think Eckert himself was rather interested in magnetic storage. I think Norwalk got a little project then to develop a magnetic storage system. They knew from what they had observed that the key to the whole thing was the magnetic head, which wrote and read the information. So they answered an ad and wanted to buy four or five magnetic heads. Bill Norris said he'd like to go with me, or I could go with him, up to Norwalk to discuss this. So when we arrived some of the former employees showed up and also the head of the patent department and maybe some administrative types, I've forgotten. There were four or five of them. And I remember the engineers that had left ERA were a little ill at ease, a little embarrassed I think by the situation.

But anyhow the morning was spent sort of telling them about the advantages of our system and what it could do. But with every pause they would say, "All we want to do is buy these heads. Now how much are your heads?" Norris would always avoid the question and go on talking about the beauties of the magnetic drum storage and all the money that had been poured into it by the Navy and how difficult it would be for them to reproduce all that. So finally at lunch time they said "Well let's go to lunch," so we had lunch and after lunch they started in on this thing again, "Well, how much is a head?" And finally the patent attorney who was a little more human I guess, finally said to Bill Norris "Well, Mr. Norris if we did buy a system how much would that cost?" I can remember it very well. Bill turned to me and said "Well Bill, how much would a system cost?" So neither of us were very well prepared for this. And I said "Well, we sold this very nice system to Automatic Electric Company recently for five-thousand dollars." So Bill said "Well, we could give you a good demonstration system for about five-thousand dollars." So I think before the day ended they decided they should drop five-thousand dollars into the pot and buy a complete system which we subsequently built and delivered to them.

NORBERG: I'm a little astounded. Were there not enough preparations in advance for pricing the devices to be sold?

BUTLER: Not really. As I think back on it, I'm really amazed myself. It was sort of a fishing trip I guess to see what

we could do. And we actually got a strike. We didn't quite know what to do next.

NORBERG: What was the ad that you mentioned that the Norwalk people responded to?

BUTLER: I'm a little hazy on that, but I think we were running some small ads in technical magazines, probably the proceedings of the IEEE or something like that.

NORBERG: But the ad would be for the system not the magnetic heads I assume?

BUTLER: Right. We were not trying to sell heads.

NORBERG: What was the aftermath of this meeting in which neither one of you knew very well what the price was? Was there some discussion of this as you came out?

BUTLER: Well, I guess that we both knew that the system that we'd done for Automatic Electric was working properly. That five-thousand was a fair price. I don't recall there was any big trauma about that.

NORBERG: How had the price been decided on for Automatic Electric?

BUTLER: I'm not sure.

NORBERG: You were not involved in the sale?

BUTLER: No, that happened before. It'd been sold out of the St. Paul office. Norris was vice president of marketing. Then we had a sales manager named Bill Winget in the St. Paul office. And although technically I reported to Bill Winget, since he was in St. Paul and I was in Washington, I worked fairly closely with Norris. But I was really number three on the totem pole.

NORBERG: How were sales done with the military? Did you have anything to do with that?

BUTLER: No, I didn't get involved. I did not get involved with the Navy because that was highly confidential and it was highly specialized and it was going very well. And so Dr. Engstrom and Bill Norris did most of that. I think Bill Winget and I were charged with getting non-Navy business, to diversify into other fields.

NORBERG: Was the device that you were trying to sell to places like the Norwalk Labs of Remington Rand the same device that the Navy was purchasing for other purposes?

BUTLER: Not exactly, no. It had many of the same elements, but the drums we sold to the Navy were generally bigger and more expensive than the ones we sold to industry, they were smaller, less expensive. But they used the same technology.

NORBERG: Not only used the same technology but did they work in the same way?

BUTLER: Yes.

NORBERG: Did you continue in sales for the time you were in Washington?

BUTLER: Yes. Two years.

NORBERG: What brought you to St. Paul?

BUTLER: About three things I guess. The Korean War broke out and suddenly ERA was flooded with orders, so selling wasn't quite as big a challenge as it had been. Secondly, Norris was moving back to St. Paul and, as I recall, he invited me to come along if I wanted to. I did kind of a flip-flop. I decided that, while I had some superficial

engineering knowledge from working on the book and so forth, I didn't really know as much as I should. So, I'd like to go back into engineering for a while and got on to a design project.

NORBERG: Which one?

BUTLER: It was a classified Navy computer, which used a lot of vacuum tubes. Bill Keye was the supervisor. I think, as I recall, it had a task number, like task 23. I don't know that it even had a name, but it had a task number.

NORBERG: When exactly did you move back to St. Paul?

BUTLER: I guess it was the end of 1950.

NORBERG: The professional staff directory of 1953 says that from 48-51 you were in the sales department and did market surveys on electromechanical counters, self-recording instruments, and magnetic storage systems, contributed to the section of the *High Speed Computing Devices* that we talked about. And then, from 1951 to this date '53, listed as an electrical engineer for ERA, project supervisor and project engineer on magnetic drum storage systems.

BUTLER: After I did my apprenticeship on this task 23 project - which isn't listed there - I was given a small group to develop, we had several magnetic drum storage projects going on simultaneously for the first time, so they decided to make a little group. We had one project for the University of Michigan, and that was a fairly small project, and we had a fairly large project for MIT, which included the drum and quite a bit of electronics. So I put together a group of about 6 or 8 people, I guess, and we designed that stuff and built it and tested it.

NORBERG: Can you give some details about the project?

BUTLER: Give me a clue and then I will.

NORBERG: What I meant [is,] start at the beginning, who's involved in the project, who are these people that you put together in the small group?

BUTLER: Before that I was reporting to Jack Hill, who was a quite experienced engineer. As I recall, he was a supervisor and I was the project engineer. The company was quite busy at that time and it was a little hard to find experienced people, so I ended up with people who were fairly new to the field. One was a chap named Bob Edward, or Edbyrd. He had a background in physics and was a fast learner. He was very helpful in the project. Another fellow named Larry Reed, a mechanical engineer did most of the mechanical design and lay-out, and was kind of a general handyman on the project. I had a draftsman named Pitstrom - I get these Swedes mixed up. Anyhow, these names will come to me. Then, I took a recent graduate from the University who had a background in math and I thought maybe we could do some analysis of some problems, but that didn't work out very well. I think we had a couple of technicians who were fairly experienced, who kind of carried the project.

NORBERG: Can you identify the project the type of tasks that you parceled out to the people that joined the group?

BUTLER: As I say, Larry Reed did the mechanical design and at that time we had a dozen or so projects going at ERA and each was somewhat free to design chassis and so forth, cabinets, as they saw fit. So, there were several competing designs available, and, as I recall, Larry spent some time studying mechanical designs and finally chose one which he thought was cost effective. Some of the designs for the Navy were very good, but also very expensive.

TAPE 2/SIDE 2

NORBERG: We were talking about the parceling out of the tasks to the group and you mentioned the things that went to Larry [Reed] in connection with circuit designs and choosing cost effective techniques for doing this. What about some of the other tasks for other people?

BUTLER: We didn't do a lot of basic design work, because designs were already available in other parts of the company. So our engineers tended to visit other projects and find out what they were doing. Also, our supervisor, Jack Hill, gave us a lot of good advice. So we tended to take established electronic circuitry and put it together logically to do the task at hand. Incidentally, one of the fairly new circuits we were able to use was one developed by Seymour Cray, who was just starting at ERA in those days and developed a very nice little circuit for use in reading the small signals off the magnetic drum. This circuit had a much better signal-to-noise ratio than any of the previous amplifying circuits.

NORBERG: Please assume that I don't know anything about these circuit designs and about the machinery and instruct me a little bit if you will about what these deigns were. And let me add another question to this before you answer. And that is if this was under a task order, it was a military contract I assume?

BUTLER: No, these were two commercial.

NORBERG: They were? Well, it was my understanding that the task orders were under the Navy contract as opposed to any work that was done for the commercial side of the world.

BUTLER: Yes.

NORBERG: But you indicated before that you thought this was under task order maybe 23.

BUTLER: I guess I didn't differentiate. My first assignment when I came to St. Paul was on the Navy task 23 and I think that lasted maybe 6 months. At that point, I was working for other people, in fact, I was low man in the group, at least in experience. Following that, I was asked to form a little group to do these two commercial tasks both involved magnetic drum storage.

NORBERG: Were these speculative possibilities or were they actual contracts?

BUTLER: They were actual contracts.

NORBERG: Do you remember who the companies were that you were doing this work for?

BUTLER: One system was for the University of Michigan and a computer project there. The next one was actually two projects for MIT, for the Whirlwind project.

NORBERG: Can you be more specific about those?

BUTLER: As I recall, each one used a drum which was 8| inches in diameter and about 2 feet long and had about 100 tracks, which meant that there were about 100 heads mounted in a case around this drum. This drum had been developed for the Navy, but ERA had full commercial rights to it. Of course, the electrical circuitry was all vacuum tube. The vacuum tubes were mounted in chassis, which contained anywhere from 10 to 16 tubes. These chassis plugged into a vertical panel, which was inside a cabinet. The electrical wiring consisted of first wiring the chassis themselves, and then, very extensive back panel wiring to connect from one chassis to another and to the power supply and to the outside world and so forth. We used large connectors, used insulated wire, which was color coded not with just one color, but with two colors to differentiate among the wires. Some of the signals were run through twisted pairs, two wires twisted together to cut down the radiation effects. As I say, we did not do a lot of original circuit design, but we pieced together circuits that had been proven on other earlier projects.

NORBERG: Did you, during this period when you were working on the drums, have any contact with companies like 3M, in connection with magnetic materials or whatever?

BUTLER: Well, I did not personally, but Sid Rubens, who was heading up the physics department did have a lot of contact with 3M and I knew about it through him, but more or less second hand.

NORBERG: As your involvement with these projects as an electrical engineer, as project engineer in 1951 proceeded, did your interaction with Norris decrease as a result?

BUTLER: Yes.

NORBERG: So you were not as close to the source of information about the directions in the company as you might have been earlier, in Washington, say?

BUTLER: Perhaps not quite.

NORBERG: Who did you have contacts with? You mentioned Arnold Cohen once. Were you in close contact with Arnold?

BUTLER: When we finished these two drum projects, I was promoted to a next higher level called Project Supervisor and at that time I started reporting to Arnold Cohen, who had several project supervisors reporting to him. The task I recall during that period of time was to develop a device to read magnetic tapes from the Eckert-Mauchly Division and produce punch cards, IBM style punch cards. This again was a project of piecing together some existing designs. We bought the magnetic tape decks from Eckert-Mauchly. We bought the card punch from the Bull Company in France, and we pretty much used standard circuitry that had been developed on Navy projects to tie this all together.

NORBERG: You mentioned the Eckert-Mauchly Division. Did this project occur after the sale of ERA to Remington Rand?

BUTLER: Yes, it did.

NORBERG: Do you recall that period when the sale was occurred?

BUTLER: Yes, I do.

NORBERG: Would you like to describe it for me then?

BUTLER: It came as quite a surprise to most of us, because, although the field was not developed enough so that there was a lot of competition going on, we did feel that eventually Eckert-Mauchly would be a competitor of ours. At that time, they were concentrating quite a bit on so-called business computers, which have a lot of input and a lot of output and very little internal processing. ERA was concentrating more on the scientific computers with limited input and output and a lot of internal processing. So, our paths did not meet head-on as much as we might have. However, we did consider them competitors. We were all kind of curious. It was a curious situation to be reunited with six or eight people who had been fairly high up in the organization and then had left to go to Remington-Rand and were now being reunited through this merger. I remember that caused some interest.

I was not a share-holder at the time, so I didn't participate in that. On the other hand, many of the founding engineers did hold stock and I think they were quite pleased to find their stock was worth something. Early on, there were quite a few visits from people from both Eckert-Mauchly and Remington-Rand Norwalk to St. Paul to look around and get acquainted, and see what was going on. I don't remember just why, but I seem to recall that I was somewhat involved in that. I remember meeting most of those folks and showing them my own project. I'm just a little bit hazy on that.

NORBERG: We'll come back to that in a slightly different way. I'd like to go back to your statement about the competition. You did mention that Eckert and Mauchly were seen as one of the principal competitors of ERA because of the market being close. Who were the other companies seen as principal competitors now, not just the list of who was in the business of developing digital computers, but what companies did you think about, as an ERA employee, as producing products that were in the same market you were in?

BUTLER: Really we didn't think of anyone, because we thought we were far enough ahead that we didn't have any

competition. In a class by ourselves.

NORBERG: What did you think the prospects would be, then, if this was thought about in any conscious way? What would you think the prospects were for the company at the time? How many machines could be sold? To whom would they be sold and so on?

BUTLER: I'm not sure I ever did much quantifying. As I look back, and I think still some of my attitude is to kind of chip away at things and do a little bit each day, but not look too far ahead. In specific terms, that is, although I do tend to look ahead in sort of general terms, general broad terms, but I was convinced at that time that there was a big future for digital computers. On the other hand, I guess I didn't spend much time wondering whether it would be 10 a year, 100 a year, 1000 a year.

NORBERG: Can I rephrase that and say, were you aware of how to exploit the field then?

BUTLER: No, not really. I'd say we were all, I particularly, but most of us were very naive about where we were going and how we were going to get there.

NORBERG: How did your position change after the sale to Remington-Rand?

BUTLER: Well, I think it was somewhat after that that I was given this project to do the tape-to-card convertor, which never could have occurred if we hadn't had access to Eckert-Mauchly magnetic tape. So, it changed the technical content, as it were. ERA had done almost nothing with magnetic tapes. We had worked a lot with magnetic drums; they had worked on magnetic tapes, and when we put the two companies together we had the two technologies to work with, which changed the technical content of what we were doing.

NORBERG: Can you be more specific about those changes?

BUTLER: Well, the work for the Navy almost always involved machines like teletypewriters or electromagnetic typewriters for input and output. Because the input and output was rather limited, they were adequate. Since Eckert and Mauchly had addressed the Census Bureau and General Electric and companies or groups which had extensive input output, they had done a lot of thinking about keyboards, recording input data on tape, high speed printers, things like that. So, although now they seem like two sides of the same coin, at that time it was two separate worlds coming together.

NORBERG: Did you have considerable interaction with the people in Philadelphia then, on a technical level?

BUTLER: Yes.

NORBERG: Who?

BUTLER: Well, Pres Eckert was sort of the general director and a guy named Jim Wiener was Chief Engineer and another fellow named Bob Stoval was eventually set up as head of project planning in Philadelphia, so I interfaced with those three extensively.

NORBERG: Was product planning done only in Philadelphia or was it also done in St. Paul?

BUTLER: Actually, I think we started it in St. Paul. As I was winding up this project with the tape-to-card convertor, I read an article about this new field of product planning, which was planning here at General Electric, I believe. I suggested to Norris that it might be strategic for ERA to have a product planning department. In a few weeks, he agreed that it was a good idea and appointed me leader of the one man department. Since there wasn't much precedent, I had to figure out how to do things as well as what to do. Didn't get a lot of general direction. I think that the whole idea was a bit of a threat to many engineers; they were used to doing product planning in the lunch room and giving it a title sounded threatening. So, we started it and then after the merger or when Norris became General Manager of the whole UNIVAC Division, he asked that Product Planning be established in Norwalk and in

Philadelphia. So, Stoval was appointed to the head of product planning in Philadelphia.

NORBERG: How did you implement a product planning office, then, in the early years, even before the sale?

BUTLER: I spent a fair amount of time just walking around the plant talking to people and looking at what was going on, tried to get acquainted with, you know, the technology we had available. I did a lot of reading, to see if I could find out what was going on in the field. At that time, IBM had started to move a little bit and I tried to track them a little bit. Also, National Cash Register had started to do some things; Burroughs was starting to do some things. So, that was information gathering.

Also, I'd say before the merger we had a kind of amateur sales department. We had Norris, who had sold x-ray machines. We had Bill Winger, who sold something kind of unrelated, and me who hadn't sold anything beyond newspapers. So, I'd say that we weren't stupid, but we were rather unsophisticated marketeers. When we merged with Remington-Rand, we were thrown in contact with people who sold typewriters, with people who sold punched card machinery, people who sold calculators, and they had some fairly extensive statistics on, first of all, extensive knowledge of what was wanted and needed in a typical office and then statistics on how many printers you sell for how many key punchers, and a lot of things. So, again, it opened another door on to the world which just hadn't been open before.

NORBERG: Was product planning in this case largely responsive to the market or was it also responsive to some sort of technology forecast that might have been made, either by you or by others within the company?

BUTLER: I'd say that it was a combination. We in product planning were not ambitious, I don't recall we every initiated research in this area because this is going to be needed five years from now. I would say it was more product planning for next year, which would be based pretty much on technology that was not only in hand, but somewhat proven. As a matter of fact, there was a bit of tension, I think, between St. Paul and Philadelphia, with Norwalk siding more with St. Paul. But the engineers in St. Paul and Philadelphia were fairly conservative and did not

like to design with techniques or components that weren't pretty well proven, whereas Eckert-Mauchly had been reasonably successful, at least spectacular if not successful, in introducing some fairly radical new technology. As a result of that, the reliability of their products suffered and their products required a lot more maintenance. But on the other hand, they always looked attractive to some people, because they were faster and shinier and so forth.

NORBERG: I would see things like *High Speed Computing Devices* as a respectable technology forecast when it was made in 1949 as to what the state of the art was at the time. How effective was that to you in product planning operations in say '50-'51 whenever they began?

BUTLER: Well, I think it was very helpful and being closely acquainted with the background of it.

NORBERG: That I would agree to, but can you cite any way in which it was effective in specific instances, in being able to say, yes, this is a good direction to go perhaps for next year, but this is not?

BUTLER: Again, our emphasis was not so much on technology as it was on general specifications. In other words, what market should we address next. And for that we relied heavily on the Remington-Rand sales department. What existing techniques shall we should bring together to do this. What specifications, broad specifications, for the company. About the same time, I was set up in product planning, a chap named Jim Miles was set up with a marketing half. Jim, who was very active, got out in the field and talked with a lot of companies and came back with a lot of ideas about what was needed out there. So, I operated product planning on kind of a committee basis, or task force basis. If Jim came back convinced - as I recall one area we were quite interested in was the wholesale, we had some jobs with catalog houses, who had a lot of small orders coming in, a lot of activity in the warehouse where they were pulling stuff off and shipping it off and replacing it and all that. They were working with Cardex and punched cards, which were very unwieldy. So Jim decided that that was a good area to look at. So we set up some task forces with some of the marketing people and some of the engineering people to look at it in more detail, come up with some general specs, and recommend to management that we spend some money developing a product to meet this need. As I say, we tended, St. Paul at least, to look at things fairly short-range, you know, who's a customer we can land in

the next six months, what's the technology we can pull right off the shelf without a lot of messing around. There was

new product development going on, but some of the things, like the Williams tube for example, were very short-lived.

Other things like use of magnetic logic were around for about a year and then were completely replaced by

transistors. So it was a time of rapid technological change and we in product planning really were somewhat neutral

on the technology. We were more talking about customer needs and general specifications.

NORBERG: So, in that sense you were interested in the performance of the machine and not necessarily its

components, so that if a new design would give you the same thing, the same results, then you could go to the

customer and say, we're going to serve this sort of need. Was there a tension then between Product Planning, Sales,

whatever we want to call it, and Engineering, which would want to include, I assume anyway, new designs, new

ideas, and maybe even change the resulting specifications of the product.

BUTLER: There was a fair amount of tension. One of the things we needed to do from time to time was to get

accurate cost estimates. You know, the talking of generalities had to come to a halt and people had to sit down and

really figure out what it was really going to cost to automata this plant with the technology they were promoting.

People didn't really like to do this, but they had to try to force it. Another thing, the new technology like magnetic

cores became available, magnetic cores and also magnetic logic, we had to get estimates of how well they do the

speed of doing certain operations, calculations. Again, people hated to go through the work of programming a

hypothetical problem and calculating how long each step is going to take to come up with an overall speed

calculation. Although some people were very good at this, there was always a little bit of suspicion that maybe they

were taking some short-cuts coming up with optimist answers, so that was a challenge to really predict what kind of

speed we could get with the new technology.

NORBERG: You mentioned that there was a product planning operation instituted in both Norwalk and Philadelphia.

Were these run on essentially the same basis as you were running it in St. Paul?

BUTLER: I think so, yes. We would meet I think about once a month to do overall planning. I was in charge of

coordinating all of that.

NORBERG: Did you note any tension between Philadelphia and St. Paul when it came to product planning?

BUTLER: A lot of tension. I think there was always a question of who should be in charge, who should call the shots at the very top, and then it sort of filtered down through the ranks, variations of that theme. But I think if Pres Eckert had had his way, all projects would have been controlled out of Philadelphia and the other two places would sort of be model shops, you know, shops to do things. And since the senior people in St. Paul did not want that to happen, there was a lot of tension. Eventually it was more or less resolved by allocation of funds. Norris would say, O.K., this is your budget and this is your budget and this is your budget; generally, these are your responsibilities. It never resulted in open warfare, I guess, but there was always a lot of politicking and tension.

NORBERG: Can you provide me with some more details about product planning in the period say '53-'55 in St. Paul? The time when one was shifting from 1101 to 1103 and thinking in terms of some major sales with a device like the 1103.

BUTLER: I should probably indicate that not everything that we did went through product planning. I'd say the 1103 would be a pretty good example. 1103 was really developed to Navy specifications for the Navy. However, by that time the engineers on the project had some inside feeling for what commercial customers wanted, so they tended to skew the design a little bit toward commercial customers, even though the Navy was paying for it. As a result, when that design was completed, it was just accepted by management as a commercial product without ever being blessed or considered by Product Planning. So I'd say if it was a Navy project then we were pretty much peripheral to the whole thing. On the other hand, there were several products, the biggest project was probably the File Computer, that were funded almost entirely by the company, also the Univac series, the Univac I, II, and eventually III were funded by the company. We had a little more input on those.

NORBERG: So product planning was not as overarching in the company as one might think of it today, for example,

where there's a good deal more done.

BUTLER: Right.

NORBERG: I think we're approaching a good place to stop for today, because there are two things I'd like to assess.

DATE: 11 December 1984

TAPE 3/SIDE 1

NORBERG: This morning is December 11, 1984. We're in the office of Mr. William Butler for a second session of our interview on ERA, Remington-Rand and Sperry Corporation. The last time we discussed the process of product planning in St. Paul and I'd like to pick up there. You mentioned that it was planning for next year primarily. What specific products were designed through this process?

BUTLER: That's a good question. As I recall, one of the first things we looked at was the area of peripheral equipment. At that time, computers designed and built in St. Paul were based almost entirely on punched tape equipment. The historical precedent is that the U.S. Navy used punched tape equipment at the security lab, and so that was prescribed by them. At the same time, the folks in Univac at Philadelphia had developed a stainless steel magnetic tape and two devices, one called the Unityper and one the Uniprinter, which were a combination of a magnetic tape drive and a Remington-Rand electric typewriter, to some extent. I'm a little vague on the details. The people at Norwalk, of course, were working with punched cards and were kind of vacillating between sticking with the 90 column card, which I think the older people in management favored, and switching over to the IBM 80 column card, which the younger engineers favored. So anyhow, the assignment was to come up with some standards for punched tape equipment, which could be added to the 1101 and later, the 1103 computer as standard ERA/Remington-Rand products rather than products purchased from other people.

That project pretty much floundered, for a number of reasons. One of them was we weren't set up to manufacture the equipment ourselves; another was that none of the people who did manufacture it were willing to deal with us on terms that seemed satisfactory, and third, it was obvious that punched tape did not have a very bright future. After studying that, we more or less dropped it. These may have been some intermediate things, but the biggest project I recall working on was a computer called the File Computer. This was a business oriented computer conceived and designed in St. Paul. The basis was the availability of large magnetic drum storage systems which gave random access to data as opposed to sequential access, which had been available hitherto on the Univac magnetic tape systems. Those are the two projects I recall undertaking in St. Paul.

NORBERG: Can we be a little specific about the File Computer. But let me ask two other questions first, and I'll come back to that. In identifying the specific products which were designed through the planning process, or at least that the planning process influenced, what examples developed out of Miles' field work?

BUTLER: I think Miles was a big champion out of the File Computer, which grew out of a sale he had made in Chicago to a mail order house. A special computer was developed for that application. I think the feeling grew that a general purpose enhancement of that computer would be desirable.

NORBERG: Were there many of these custom developments that you recall in, say, that first five years of 1950?

BUTLER: There were a few. I wouldn't say there were a lot. There were a few custom magnetic drum storage systems sold and delivered. I recall only one or two custom computer systems.

NORBERG: Now this custom magnetic drum storage systems were to be used with other equipment?

BUTLER: Yes, the customer presumably designed other equipment to use with it.

NORBERG: Do you remember any examples of that?

BUTLER: Well, one went to a telephone company in Chicago. Let's see, not AT&T - I'm not sure; it will come to me.

NORBERG: You mentioned Automatic Electric last time.

BUTLER: Yes, maybe it was Automatic Electric. Another one went to Remington-Rand. We discussed that. Let's see. One went to the University of Michigan for use on a computer being developed there. One went to Los Alamos for use on a computer being developed there. Two or three large systems went to MIT for use on the initial Whirlwind project.

NORBERG: Right, you talked about that the last time. One last question on the products out of the planning process. I understood you to say punched tape versus drums, is that correct?

BUTLER: I was talking about punched tape for peripheral equipment and magnetic tape for intermediate storage.

NORBERG: So both kinds of tape were involved?

BUTLER: Right.

NORBERG: Who worked on these projects such as the File project? And I'm interested specifically in the people you worked with.

BUTLER: As I told you, I did not have a staff, however, we put together - I forgot what we called them - but anyhow they were essentially committees. The File Computer committee included Jim Miles, from marketing, Bill Keye, for engineering. I misspoke, I eventually did get a staff person named Joe McMarrow and he took some part in that. As I recall, Bob Erickson was a member of the committee and George Hanson, and I think Miles frequently brought Dick Daley, who was one of his employees. Possibly, Bill Drake, who was heading up advertising at that time. I'm a little

bit hazy. One reason I'm hazy is we had a kind of a core committee and then frequently there would be meetings where the core committee would bring staff and so it would be enlarged to maybe a dozen people.

NORBERG: How did you interact with Arnold Cohen?

BUTLER: Well, by that time I'd been transferred out of Arnold's domain and was reporting directly to Norris and so we were colleagues, but not working directly.

NORBERG: By that time is fine, but how about the earlier period when you were working under Cohen?

BUTLER: I really had four phases at ERA. First, I was working on someone else's project, then I was made a Project Engineer reporting to Jack Hill, who was called a Project Supervisor, and then I was promoted to Project Supervisor reporting to Arnold Cohen, who was the Department Head I believe. I've forgotten the exact titles. And then I was promoted to Head of Product Planning, which was a staff job reporting to Miles.

NORBERG: What sorts of things did you and Cohen interact about?

BUTLER: Our main project was a cooperative project between St. Paul and Philadelphia called a magnetic tape to punched-card convertor. I think I mentioned that last time. We used the Univac steel tape, big box of electronics, and a French Bull 80 column card punch, so that tapes generated on the Univac could be converted to IBM cards. Use on a card primarily for printing but also for any other uses a customer may have.

NORBERG: I see by a chart of the organization in October of 1951 that the technical supervisory staff included Cohen, Hill, Kalb, and Keye, as the four supervisors.

BUTLER: I think when I was working on my first assignment, I was under a project engineer who reported to Keye. On my second assignment I was reporting to Hill, and the third assignment I was reporting to Cohen.

NORBERG: By January 1954, you're still not on the organization chart.

BUTLER: Possibly because I was staff in 1954.

NORBERG: I'm sorry, you were still reporting to Cohen. Cohen had become Director of Systems Development at that time, and you and J.A. Engstrom, Kalb, and Mullaney were technical supervisory staff. In that group. And then there was another supervisory staff reporting to the Director of General Engineering, Swanson. What was the difference between these two: systems development on the one hand, general engineering on the other?

BUTLER: Well, essentially it was a difference between computer centered. Cohen had all the stuff that had a computer content and Swanson must have had the other stuff.

NORBERG: What do you mean by "the other stuff?"

BUTLER: I think reporting to Swanson, you perhaps see Howard Daniels?

NORBERG: Yes.

BUTLER: And then who else?

NORBERG: Bergen, Daniels, Jack Hill, Keye, and Rubens.

BUTLER: Well, that's a little harder to explain. Rubens had physical research, which was aimed toward computers, but it was more or less earlier research. Bergen had a communications group and he and his colleagues developed a product for the Air Force called an Antenna Coupler. This was a device which automatically tuned the radio transmitter to its antenna at any time when the band was switched or the transmitter was retuned. That had been

quite a successful product, made a lot of money for ERA. Now, let's see, who was the next one?

NORBERG: Daniels you mentioned.

BUTLER: And Daniels' was kind of an instrumentation group. In fact, Daniels was a brilliant engineer and any oddball request that came along that nobody else could handle, usually went to Daniels. One of his inventions - he had quite a few patents - one of his inventions was a new kind of tape-recording, which was called variable boundary recording. In this one recording if you can visualize a one inch wide tape with North Poles heading upstream on one edge of the tape and the South Poles heading downstream on the other side of the tape, the boundary between the North Poles and the South Poles was varied with the modulation to create a rather high fidelity recording. Also, it was possible to make recordings directly with a permanent magnet head placed over the tape and by moving sideways you could record mechanically.

NORBERG: Was this used do you know?

BUTLER: Yes, it was used in a few products. I think we had a recording seismic instrument which would sit on the ground, and when some seismic event would occur, the tape would start rolling and the head would jiggle and that could be played back to record the event. It could also be recorded electrically and there were some applications with electrical recording. I've forgotten just what they were, but as I recall the advantage was that you got higher fidelity, more dynamic range or something. I've forgotten the details. Also, later on Daniels' group became quite involved in a project with the Great Northern Railroad, which involved weighing ore cars as they moved past a weighing station. They were weighed with an analog strain gauge instrument that was digitized and then they were some simple calculations, to subtract the tear weight of the car from the gross weight to get the net weight of the ore. It turns out not all ore cars weigh the same amount, so they had to read this through a number on the side of the car, subtract the two numbers, and then print out the net weight. This was installed up in Northern Minnesota and used by the Great Northern for many years.

NORBERG: How was the information read off the car, visually?

BUTLER: I think there was a marker attached that was photoelectric.

NORBERG: That early?

BUTLER: Yes.

NORBERG: I'm impressed.

BUTLER: Yes, it was a very ingenious thing. The old timers of the Great Northern still talk about.

NORBERG: Now, does this suggest then that the activity under Cohen, with which you were involved, was new system development, or new systems, as opposed to general engineering, as it was called, being associated with other problems around the company and with the products already out in the field, or changes, or modifications of one kind or another, the new products coming along out of Cohen's activity.

BUTLER: That does sound reasonable. As a matter of fact, my memory is a little vague on just what the rationale was. The company got big enough and it needed to be divided. It was a somewhat arbitrary division, perhaps along the lines that you suggest.

NORBERG: Do you recall then when the first product planning committee was formed?

BUTLER: I'm very hazy on that and, as I said, I didn't keep any notes. When was the purchase by Remington-Rand, do you recall?

NORBERG: '52.

BUTLER: 1952. Perhaps I can get a clue from your notes. At what point was I reporting to Cohen?

NORBERG: It's going to be very difficult from my notes. I will be glad to show them to you of course. I have just a series of organization charts, which I obtained from the Defense Division. The first time that your name shows up in these is here, in, this would be January 6, 1954, as a particular individual. It doesn't show up before that. Now, the first indication I have of a Product Planning Committee is May '56, after the sale to Sperry, which would have occurred in '55. In this case, Norris is serving as Chairman. Then there are these other people. Eckert is from elsewhere. I don't really know where Knorr(?) was from. The others are all from Minneapolis/St. Paul.

BUTLER: Obviously, I reported to Norris. More or less, it was a staff position.

NORBERG: Well, that's an interesting difference, because if Norris is the Chairman of the Product Planning Committee, then that suggests that the Planning Committee had a good deal more, let me call it, authority than I might have guessed from your remarks last week about product planning?

BUTLER: This committee ultimately made decisions. My committee more or less fed data and suggestions to them, occasionally recommendations. Perhaps I could give you a little more background. One day, back in the '50s, I was reading I think it was an article in the *Harvard Business Review*, stating that General Electric had started a new function called Product Planning. I read the article and immediately became an expert on the field, because it was a new subject. So, I wrote a memo to Norris, copied the article, and said that maybe ERA was to the point where it needed product planning. So, and I've forgotten the timing, but at some point later he said, "O.K., why don't you do it?" What I'm trying to say is, my preparation for product planning was one magazine article. The thing developed rather slowly and never did really achieve much finesse in terms of what we think of as product planning.

NORBERG: Let me approach it another way, Bill, and that is let's shift back again to about 1952, after the sale to Remington-Rand. When did you begin interacting with the people in New York or Philadelphia?

BUTLER: Well, my first interaction of any substance had to do with this joint project on the tape-to-card convertor, because they were supplying the magnetic tape equipment and all the standards for reading the magnetic tapes. Also, they were the customer, because the machine ultimately was delivered along with the Univac 1 or a Univac 2, to their customer, so I was both a customer of theirs and they were a customer of mine. So, there was some to and fro at that point. Then, after product planning was formed, I was back and forth quite a bit. We had some meetings in St. Paul and in Philadelphia, Norwalk people came to St. Paul. I think we rotated. It would meet one month in St. Paul, one month in Norwalk, and one month in Philadelphia. So, I was there about every three months for a year or so, but the calendar dates slip my mind.

NORBERG: How did those meetings run?

BUTLER: No two were exactly the same, but what do you have in mind?

NORBERG: Well, just simply describe one of these meetings for me?

BUTLER: Normally, we'd establish an agenda, either at the end of the last meeting or during the month. Generally, each meeting was concerned with one or two topics. I don't recall that we tried to cover a lot of different topics in one meeting. And typical topics were standardization questions. For example, the whole area of punch cards was very much involved with the question of what to do with punch cards. Some involvement with what to do with magnetic tape, although by this time Univac had established standards which weren't questioned too much. Some time was spent on what to do with punch tape. During that time IBM and some other vendors got into the act and established the 8 level tape as sort of a standard. We'd been using both 5 and 7 level tape. So we didn't have much influence in that decision.

NORBERG: What does 5 and 7 level tape mean?

BUTLER: The original teletype tape was called 5 levels. There were five big holes and one little hole, a so-called sprocket hole. This handles, let's see, 2 to the 5th is what - 64? So that handled the 26 letters of the alphabet and the 10 numerics and a few symbols. Then, when they started introducing fancy things, like checking and some other things. This came out of Teletype Corporation, in the communication industry. Then, for some reason, for special projects, they added two more levels, I've forgotten if it was a 3 and 4 or just how that went. But, the Navy then was using some 5 level for communications, but mostly for computers using 7 hole tape. These were all communications standards. Then, as computers came along, people decided they wanted a special tape for computers. So there was a meeting by the computer manufacturers. For some reason, Remington-Rand was represented by a guy out of Norwalk, a patent attorney in Norwalk. So he gladly went along with a recommendation for 8 levels, which made all our stuff obsolete. Then people started to develop 8 level tape readers and punchers. It didn't really hurt us that much. I remember being a little chagrined that we had so little input in the decisions.

NORBERG: How wide was the 8 level tape?

BUTLER: I believe that was one inch. I've forgotten the exact dimension. The 8 level I think was one inch and I think the original 5 level was like 5/8ths. I don't know if the 7 level was 7/8ths or what. I think about an 8th of an inch average.

NORBERG: Once this general decision was made by people in the industry, then you people would have to set some sort of a standard within the company to manufacture the 8 level tape?

BUTLER: We didn't ever make any tape equipment ourselves. By that time, the Ferranti Electric Company in England had developed a very fine photoelectric paper tape reader, and the ERA division pretty much standardized on that as the reader. The Teletype Corporation was building what was considered a high speed punch. It did about 60 frames a second and they pretty much standardized on that. They both immediately switched to 8 level. So in a way, our mechanical problems were solved for us. We had some obsolete tapes lying around, but most of them belonged to the Navy, so it was more their problem than ours.

NORBERG: When you say ERA, you mean the ERA Division. This is after the sale?

BUTLER: Neither Norwalk nor Philadelphia had ever used paper tape to any extent. So St. Paul was really the only place where paper tape was used.

NORBERG: I still want to learn some more about the three different locations of the company within Remington-Rand. I still haven't gotten to the Sperry Corporation. Thinking about product planning in the three divisions - can you characterize for me, in so far as you know it, the different approaches at the three locations? You talked about how you did it, and how other ERA Division people were interested in doing product planning, can you tell me a little bit about what you know of Philadelphia's approach to it?

BUTLER: Well, I think at the outset, of course, Eckert and Mauchly did all the planning. Then as the company grew, they were organized into departments and divisions and so forth. As I recall, and I could be wrong on this, when the merger took place, they did not have a formal product planning activity. Now, as I recall, I think when Norris called his meeting Eckert did represent Philadelphia. So for a time, what little product planning went on was probably done pretty much at the level of Norris, Eckert, somebody from Norwalk, possibly Bob Sorenson, who became head of Norwalk. It took place mostly at the time of budgeting. In other words, we'd say we got a million dollars for new product development, we'll give $500,000 to Eckert for Univac II and we'll give $200,000 to Norwalk for new punch card equipment and $300,000 to ERA division for whatever they want to do. You see, both Norwalk and Philadelphia came out of a product tradition. It had key punches, sorters, tabulators, collators, and all those things. So they had a going product line. Univac division had built Univac I. That was a product on the market. And they developed the magnetic tape peripherals for it.

Up until that time, the ERA division had been pretty much a job shop. We built what the Navy told us to and we just struggling to launch our first product, which was the 1103. Well, the 1101, which didn't do much, and then the 1103. So in a way, ERA was playing catch-up as far as getting from a custom developer into a product developer mode. So

I think some of the growing pains were more evident right there in St. Paul, because no precedent had been established. Furthermore, there were a lot of creative people in St. Paul, many of whom had ideas, you know, "I think we ought to do this; I think we ought to do that." And I think there was a tendency in those early days to sort of say, rather than make some hard decisions and policies, "Well okay, we'll give you a little money and give you a little money." In fact, as an amusing sidelight on this, after working on magnetic drums for a while I recall a lot of talk about going from drums to disks. At that time, all the work was with very rigid disks and they were very difficult to machine and maintain this complete flatness which was desired. So I had the idea that if we had a disk made of some soft material and spun it at high speed that centrifugal force might tend to flatten it out. So I mentioned this to Norris and he said, "Fine, why don't you take $500 and see what you can do." So needless to say, with $500 we made something that didn't work!

NORBERG: So at the other places then they must have had a more consistent approach to this. It should have been obvious to you when you went to these meetings.

BUTLER: They were more monolithic organizations to begin with. Eckert was a very strong leader in Philadelphia. Leadership was not quite as strong in Norwalk, but their charter was fairly clear. ERA was really a bunch of entrepreneurs, who had been developing custom projects, each of whom would say, "Gee, we could take these good ideas I developed in this custom project and make a neat product out of it." So there was a lot more competition of ideas and a lot less consensus as to what we should do.

NORBERG: It seems to me there are two differences here that I'd like to clarify. One of them in your talking about the million dollars as an example - I won't hold you to the million figure - the example of spreading around the money would seem to be a decision from elsewhere, that would have to be higher up.

BUTLER: I was not involved in that.

NORBERG: Now, what I'm trying to get at is, if that is being made by some other group, let's say some management

committee, then wouldn't that be shifted down to the separate divisions and then a product planning group at each division would have to use whatever was allocated to them to do their product planning? Or to implement product planning? If that's the case, then that would suggest that the interaction between the various product planning committees would be to assure something else: either smooth cooperation or integrated products, or maybe just to make sure there's no duplication?

BUTLER: I think the integrated product was the most important, because, for example, punch card equipment was being developed in Norwalk, however, it was used in St. Paul and in Philadelphia. So it was very necessary that St. Paul and Philadelphia have some input as to what the characteristics of the next keypunch or the next photoelectric card reader, whatever, would be. Also at that time, there was some development on optical sensing. There was a lot of questioning about how optical sensing would interact with punching holes in cards, marking some cards versus punching holes in cards. Those issues affected all three divisions, so they were high on the agenda. Similarly, with tape, any decision made in one division about tape should be satisfactory to the other divisions as well.

NORBERG: This would seem to put Norwalk at the low end of the totem pole, though.

BUTLER: Somewhat, yes.

NORBERG: As opposed to the other two. Who was in charge of Norwalk?

BUTLER: A chap named Bob Sorenson, eventually. He had been an ERA employee and when Norris was given charge, Sorenson was sent out. Previous to that General Leslie Groves had been running the Norwalk lab.

NORBERG: Running the laboratory? That's a surprise, I would have considered him to be farther up in the management chain.

BUTLER: At the time he was hired, that was pretty much the top of the engineering technical chain. When Univac

was acquired, they recognized that that was outside his capabilities and he was getting close to retirement age. So neither Univac or ERA were put under Groves.

NORBERG: Who else attended the meetings beside you? Meetings of the product planning coordinating group.

BUTLER: Well, the chap heading up in Philadelphia was a fellow named Stoval, Robert Stoval. The chap heading it up in Norwalk was Olaffson, Cliff Olaffson, I believe. And frequently, each of them would have one or two buddies along. I'd say typical meetings were about six people, perhaps a recording secretary.

NORBERG: Any guests besides these others?

BUTLER: Yes, frequently, we would invite guests in for input on specific subjects.

NORBERG: Did management ever show up at the meetings?

BUTLER: Eckert was, I'd say, more interested than anyone else. I think he was the most frequent guest from management.

NORBERG: Who did you report to then after the meetings would be over?

BUTLER: Norris.

NORBERG: Directly?

BUTLER: Yes.

NORBERG: Not through Cohen at all?

BUTLER: I don't think so, but I know eventually it was direct. Well, I shouldn't say eventually, because for a while I reported to Cohen, and then for a while I reported Norris. Then Stutsman was brought in, and Cohen and I reported to Norris through Stutsman. He was called Director of Research.

NORBERG: Did you ever receive any instructions from Norris of what to do at the coordinator meetings?

BUTLER: Norris, in those days, and I think still, ran with a pretty loose rein. He read the minutes and occasionally commented, but I operated more or less on the theory that no comment meant approval, and if there was something he didn't like he would say so. But there was not a lot of direct supervision.

NORBERG: There were minutes of these meetings?

BUTLER: Yes.

NORBERG: How lengthy were they?

BUTLER: I usually wrote them, maybe a couple of pages.

NORBERG: Was there ever any challenge from Philadelphia about what was contained in the minutes?

BUTLER: I don't recall that being a big issue. Well, not after they appeared anyway, a lot of challenges during the meeting when they were being created.

NORBERG: During this time when you were in Remington Rand from '52 to '55, did you ever have any interaction with New York headquarters?

BUTLER: Yes, as a matter of fact, I omitted an important point there. New York did have a representative on the product planning committee. I can't think of his name now, but he was one of the more senior people reporting to the vice president for sales. He had a wealth of experience in selling and installing punch card systems. Perhaps the most experienced of the whole crew, when it came to dealing with customers. The rest of us had come through an engineering background, we could imagine what a customer might need, but he was, I'd say, the one guy on the committee that really talked to customers. Although as time went on, Miles became more sophisticated and knew more of the customer needs, but in the early days this chap from New York was very important.

NORBERG: I'll mention a few names in a moment. Did you learn what Remington Rand's management believed they bought when they purchased ERA?

BUTLER: A computer company, I guess.

NORBERG: But you were not close enough to know what they thought they were purchasing and for what reason?

BUTLER: No.

NORBERG: Did you ever come in contact with either James or Marcel Rand?

BUTLER: Yes. I attended a number of meetings with father and son.

NORBERG: Can you describe any of those meetings?

BUTLER: The setting was interesting. The Rands, Remington Rand, had taken over this very beautiful old home overlooking Long Island Sound and converted it into the headquarters office and converted I guess what had been bedrooms probably into offices and used the living room and dining room for meeting purposes. And I did attend a number of meetings there. I don't recall the business in any great detail. But at this time Mr. Rand, senior, must have

been in his 80s, so he was alert but not terribly knowledgeable of what was going on. And he'd surrounded himself with his cronies who were alert but not terribly sophisticated.

I recall one chap named MacNamara, who was head of the electric razor division. He seemed to be the senior vice president, because his division was the only one that made much money in those days. So although he knew nothing about computers, he frequently had the final say in any major decision.

NORBERG: And what effect might that have had?

BUTLER: I just don't know. I wasn't that close to him. This is from hearsay.

NORBERG: How about Thornton Frye?

BUTLER: Frye came in later. I think Frye came in shortly after Sperry bought in and merged. He was sort of slipped in between Stutsman and Norris. So Stutsman and several others reported to Frye.

NORBERG: Thornton Frye, April 15, 1957, apparently, he became VP and director of Univac engineering. Both Eckert and Norris were set up to report to Frye. Each of them was a VP, but they were chief engineers - one in charge of military products and the other in charge of commercial products. And the St. Paul manager of operations was reporting to Eckert on commercial products. Philadelphia and Norwalk were reporting to Eckert. Stutsman became acting director of product planning reporting to Frye. A very complicated structure in '56, '57, which certainly affected things back in St. Paul. Do you remember any of that?

BUTLER: Vaguely. I was canned toward the end of '57 and it was a rather confusing period there. By the time Frye came aboard, he didn't really assume power immediately, as I recall. It was kind of faded in. By the time he had sort of gotten in the driver's seat, first Norris jumped ship, then several of us who were close to Norris were asked to leave.

NORBERG: I'll come back to that in a moment. How about interactions with people like Arthur Draper?

BUTLER: I saw a lot of Art Draper.

NORBERG: Can you tell me something about Draper? I don't know much about him.

BUTLER: Well, I'm not quite sure what Draper did before he joined Remington Rand. However, I have the impression that he may have lived in that Norwalk area before. He certainly had a very nice home, also overlooking Long Island Sound. He was kind of a high level staff assistant to General Groves, as I recall. And he seemed to have a lot more clout in some ways than Groves did. By that time, Groves had slowed down a lot and appeared to be a bit of a figurehead. So anyhow, when Remington Rand first bought ERA, he was one of the first people to come to St. Paul to look over their purchase.

NORBERG: Did you say Remington Rand or Sperry?

BUTLER: When Remington Rand bought ERA, he was one of the first people to come from Remington Rand to look over the purchase, along with some of the other senior vice presidents. He did have a certain amount of input in the product planning process. Although again, I'm a little vague on it. One of his claims to fame was that Remington Rand had received an inquiry from Eckert-Mauchly company about their electric typewriters. So he went down to Philadelphia to see what they were looking for and was quite impressed with this young company making computers. Apparently he and Eckert hit it off rather well. They were always quite good friends. I think he perhaps went back to Norwalk and convinced Mr. Rand that they ought to look at Eckert-Mauchly as an acquisition. Rand had a long history of acquiring other companies. Early entrepreneurs put conglomerates together through acquisitions. So anyhow, that did go through. Then eventually, for some reason, somebody ran into John Parker and they acquired ERA. But he seemed to be active in the acquisition end of things, high-level planning.

NORBERG: Did you interact with him after the purchase?

BUTLER: Yes.

NORBERG: Did he ever attend any of those product planning meetings?

BUTLER: I think so. At least I recall having a fair amount of interaction with him.

NORBERG: Did he visit St. Paul afterwards? After this first visit you've been describing?

BUTLER: I really don't recall any subsequent visits, although I'm a little hazy on that. I think most of running into him in Philadelphia and in Norwalk.

NORBERG: What does the name Albert Ross mean to you?

BUTLER: Albert Ross was vice president of manufacturing at the time ERA was acquired. His office was right there in Norwalk headquarters with Mr. Rand. He was a very pleasant old gentleman. We always enjoyed each other.

NORBERG: In what way?

BUTLER: I think Mr. Rand sort of appointed him to find out more about ERA. What the heck was this thing he had just purchased and Norris appointed me to furnish the information. So we were kind of the liaison for a while. I remember getting some phone calls at odd hours asking questions about strange things. They were starting to read through... Apparently somebody had - Norris or Parker or someone - put together a kind of a dossier on ERA telling them who we were and what we did. And apparently as they'd read through this, somebody would say "What the heck is this, better call Butler and find out." I remember that Bob Gutterman had been working on an invention that was rather unusual. It was a camera that could be lowered down inside a bore hole and it was made to rotate so that

as you dropped it down it could take a continuous spiral picture of the inside of the hole. And if you brought this thing back up, developed the film, and then laid the film in a spiral, you could sort of stand back and look at the inside of the hole from the outside or something. It was called the bore hole camera. I know that really triggered their imagination. I think maybe they thought they had bought into something really important with the bore hole camera.

NORBERG: Let me mention one other name that I am fishing for some information on: George Ellsgroth.

BUTLER: I can't remember George at all.

NORBERG: Doesn't mean anything to you? What about other people that I have not named, who might have been significant, either in your direct responsibilities, or that you saw as significant within one or more of these divisions?

BUTLER: I'm trying to think of the chap who headed up the patent department at Norwalk. He was someone involved with product planning and in our liaison, but I can't say his name right now. One of the senior engineers was a guy named Cliff Helms. He was heading up a project to develop an 80 column card reader, as I recall. He was a former ERA employee. Let's see, I mentioned Bob Sorenson. He was appointed to head up the Lab.

NORBERG: How did the division fare under the management of places like Sperry? Do you think it was in a better position as a result of having joined the Sperry organization?

BUTLER: That's awfully hard to judge.

NORBERG: Well, what sort of criteria would be best to make such a judgment if one could?

BUTLER: The computer industry was very cash hungry, of course, still is, but even more so in those days. There are

all kinds of opportunities to develop new products and they all required a lot of working capital. Now when Remington Rand bought ERA, there was a small infusion of cash, so that we were able to accelerate and do things more rapidly than we would have it we'd had to grow from our own income. Then of course, when Sperry bought Remington Rand, there was another infusion of cash, which perhaps pushed things forward. I guess my own prejudice is toward smaller organizations. I feel when an organization gets too large, unless there's a real management genius at the top, they tend to start stumbling over themselves. The competition and confusion pretty much counterbalances the advantage of financial resources. So for me it's hard to judge if things got better or worse. Furthermore, I got out of there shortly after that.

NORBERG: Were you involved in any discussions about the founding of CDC?

BUTLER: No, not really.

NORBERG: So you were not part of the Norris in-group that had anything to do with that? Were you in any way friendly with Robert MacDonald?

BUTLER: Acquaintance, but not really, no.

NORBERG: Well, then after Norris left, what happened? Did your responsibilities change at that point?

BUTLER: According to your notes, it must have. I've been reporting to Stutsman.

NORBERG: There was a formalization of the product planning committee in 1956. Now a year later though, Norris resigned. What happened then?

BUTLER: Before he resigned or after he resigned?

NORBERG: After he resigned.

BUTLER: Did he resign in July or August?

NORBERG: July.

BUTLER: I was let go in November, so August, September, October. Only three months. It was a confusing period, but I don't remember too much about what specifically went on. One of the things that I do recall is that I'd been given a fairly large budget and asked to expand my operations, so it went from a one person, then a two person, up to about thirty or forty people, most of whom were as green or greener than I was.

NORBERG: When did that expansion take place?

BUTLER: Sometime in late '56 or late '57.

NORBERG: What was the expanded group designed to do?

BUTLER: I hired a couple of top guys out of the bureau of labor statistics to set up a market research function, because up to that point the company had really not done much of what I consider market research and had not accumulated very good statistics on the industry. So these guys were going to try to set up to do this statistical work. We had a group sort of specializing in the punch card end of the thing. Some people with a punch card background trying to plan what we were going to do on punchcards. Another sort of computer systems group who were supposed to be planning computer systems. But with the confusion of interviewing, hiring, playing supervisor, and calling staff meetings, I don't recall a heck of a lot was accomplished. It was mostly in organizing, running around in circles, getting new space.

NORBERG: Is it possible that the lack of production then in that group could be responsible for your being asked to

leave as opposed to your association with Norris?

BUTLER: Quite likely. We were certainly vulnerable. Then having gotten to that point of confusion, a fellow named Byron Smith had put together a group of mathematicians to do mathematical analysis. And for some reason, which I never quite understood, he opted to take some kind of a staff job and got Norris to transfer all of his people under my wing. So I think he saw the handwriting on the wall. So at the end there, I went from about 30 people to about 50 or 60 people, and by that time confusion was ultimate and we were very ineffective. I was really frustrated. In a way, I was sort of relieved when they asked me to leave.

NORBERG: Who asked you to leave?

BUTLER: Stutsman told me that Frye had told him to ask me to leave.

NORBERG: Who else was asked to leave at the same time?

BUTLER: Well, a fellow named Jim Woodbury, who was heading up personnel, and a fellow named Sandy D. Beck who was heading up the field service. We three left about the same time.

NORBERG: Was any reason given to you for asking you to leave?

BUTLER: What Stutsman said was - and, in retrospect, I think he was just being polite - that I was considered to be too close to Norris. Obviously since I couldn't help this, I felt good about it. But I think it was pretty obvious that I had an overblown and inefficient operation.

NORBERG: What did you do then, Bill?

BUTLER: Well, started talking to friends who were outside. One of them said, "Have you ever thought about being

a manufacturers' representative?" I said, "No, 'cause I don't know what that is." And so he explained it to me and it sounded good. So I set up a little office at home and started writing letters. I got a book of all the people who were making electronic instruments in those days. It told who their sales representative was in the area. So if they didn't have a sales rep in the area, I sent them a letter and a resume and told them I'd be interested. I was getting into the rep business. So I immediately picked up some sort of second rate lines and then over the next few years got some first rate lines. I did that for about seven years.

NORBERG: What was the name of the company?

BUTLER: I called it Engineering Products Associates. People accused me of using my old ERA calling card.

NORBERG: Engineering Products Associates, but that's EPA.

BUTLER: Yes, that's right. I'd erase the stem.

NORBERG: I see. Did you take anyone else with you from Sperry?

BUTLER: Not immediately. Eventually a chap who had worked for me came around and said that he'd like to join me, and subsequently did. And eventually Sandy D. Beck who had been let go about the same time I had, went to work for another company, then he came around and said he'd like to do something, so he joined me, too. Eventually there were three ex-Univacers in the group.

NORBERG: Bill, in looking through my notes, I find that I'm reminded of quite a significant change in organization in late '56 and early '57 when the Univac division was formed, such that Bill Norris became head of the Univac division, and therefore reporting directly to New York management. Under him were a series of staff people including Stutsman, who you mentioned, who was head of the research division, and then a separation of the St. Paul, Philadelphia and Norwalk operations. Now in an organization chart dated January 2, 1957, which sets up this new

organization called the Univac division, the St. Paul manager was MacDonald. And my information indicates that the project and planning coordinator was a man by the name of Berkoff. Where did you end up in this change is the question?

BUTLER: I wonder if Berkoff came in after I left?

NORBERG: No, because Norris didn't resign until July 26th of 1957 and Mullaney went along at the same time. It was at that point that MacDonald succeeded as manager of the military division, which was bigger than St. Paul, and Hanson succeeded Mullaney and became chief engineer of the military division, and so on. And that goes along for a while. In September, Crany was still around as manager of the NTDS department, and Kisch was still manager of the Advance Design Department. So, it isn't until October or November that these people begin to resign and go off to CDC.

BUTLER: I think I can clarify that. My product planning really never did involve the military to any extent. It was primarily product planning for commercial products. And so, many of the people who worked on commercial pro?ducts had come out of the military background. So there was a lot of communication there, but organizationally, they were separate.

NORBERG: I see. So you would still have been reporting to Norris at that time?

BUTLER: As soon as Stutsman came aboard I was transferred to him.

NORBERG: All right, so that would be a staff line through to Norris. You to Stutsman, Stutsman to Norris.

BUTLER: Right.

NORBERG: So Berkoff is quite different in this whole scheme.

BUTLER: I guess he was my counterpart over in the military side, although I wasn't even aware that they had one.

NORBERG: All right military side. Was the military side identical with St. Paul?

BUTLER: In Philadelphia, yes, I guess so. I think Philadelphia bid on one or two military contracts. Of course, their original contract was with the Army, but that was at the Moore School. But yes, it was primarily St. Paul.

NORBERG: There was a memo in April of 1957 from Marcel Rand, which starts out, and I quote directly, "Our military systems operations are be?coming so important to the long range plans and objectives of Remington Rand that it has become necessary for us to materially strengthen the management of the military systems group of the Univac division." And it was Norris who became VP and chief engineer in charge of military products reporting to Frye at that point. But these things are all outside your ken, I take it, in terms of direct involvement?

BUTLER: That's very interesting. I'm not sure whether I was not aware of that at the time or for some reason it's escaped my memory, but I recall that Frye was elevated to chief engineer or whatever it was.

NORBERG: Director of Univac Engineering.

BUTLER: Norris and Eckert reported to him.

NORBERG: Doesn't this strike you as a demotion for Norris?

BUTLER: Oh yes, definitely it was.

NORBERG: But then Stutsman was shifted to report to Frye at that time.

BUTLER: That's right.

NORBERG: So here you are working for Stutsman?

BUTLER: Who was working for Frye.

NORBERG: How could anyone have claimed that you were too close to Norris?

BUTLER: Well, I guess historically I had been. I tend to agree with your theory that that was probably just a face saving comment.

NORBERG: I don't know. I'm fishing. I haven't any evidence.

BUTLER: Well, I don't know. Let's see. Let me just think about it. Both Woodbury and Beck and I had all been promoted within the last year or so to fairly important jobs. And then Norris left. I think the feeling was, "OK, we'd better put in our own people." It was a typical takeover. I'd met with Frye a few times. He was a rather cold fish sort of guy. I don't recall ever warming up to him particularly, and I don't think he ever warmed up to me particularly.

NORBERG: What was the morale around the place during this period?

BUTLER: It was rather low. On the other hand, things were happening so fast, it was also kind of exciting. I mean it was kind of a combination of consternation but also excitement.

NORBERG: When you say that things were happening so fast, which things?

BUTLER: Reorganizations and hiring. We'd been in a heavy recruiting phase. Woodbury was brought aboard to do a lot of recruiting of engineers. We tried to recruit from other companies, primarily IBM. It was spectacularly unsuccessful. After a year and a half of heavy recruiting, we hired one engineer or something like that. We did hire

young engineers from other places. We did build up a staff considerably.

NORBERG: How about product development during those years: 56-57 ?

BUTLER: The file computer was a major commitment and it turned out to be a fairly successful product. St. Paul was quite heavily involved in the Univac 2 program which was an improvement of the old Univac 1. A lot of that engineering was done in St. Paul.

NORBERG: How well did you come to know Bill Drake?

BUTLER: Fairly well. Contemporaries. We knew each other, you know, reasonably well I guess when he was stationed in St. Paul. When he was moved to New York, we frequently got together there. If I'd come out he'd be the familiar face for me and I'd be in a tie with St. Paul for him. We were fairly friendly.

NORBERG: Just to summarize this a little bit, as I recall you mentioned that when you started the manufacturer's representative business you continued in that for 7 years.

BUTLER: Yes.

NORBERG: That should bring it up to about 1964. What did you do then Bill?

BUTLER: Well, two things. As a manufacturer's rep, I was concentrating on entirely industrial or sales to industry. But I was approached in the early sixties by a company that had a product for sale into university computer labs, the so-called logic trainer. I was somewhat intrigued with this and so they sent me a sample to play with and I took it over to the University and got a very good response. I took it down to Iowa State and they liked it and took it over to Madison and they liked it. So I did accept this line and started to selling to schools and eventually established another division, actually a second company, to sell electronic training equipment to schools. So those two went on

concurrently for awhile. Then, in the early sixties, I decided to try my hand at manufacturing and we decided to start building a line of products for schools. So we started a third company called Technical Systems Inc., which I operated until four years ago. And that company manufactured laboratory equipment for high schools and vocational schools. We didn't do much work for the universities. And eventually I sold the instrument company to the employees and more or less dissolved the educational sales company. Used some of the old employees as commission reps for the new company.

NORBERG: Technical Services?

BUTLER: Technical Systems Inc.

NORBERG: Who else was involved in Technical Systems, just you? In terms of founding and financing.

BUTLER: It was pretty much my own. I have a friend named Ed Pardee who had some space and we rented space from him. He also had a machine shop and we used his machine shop facilities for manufacturing for awhile. He was on the board of directors. Then I hired a young fellow named Bolus, who came in initially as a draftsman. He had a flair for selling, so he became a sales manager and eventually general manager.

NORBERG: How large a your company was this, in terms of people and income?

BUTLER: I guess we got up to about a million dollars a year and a dozen people or something like that.

NORBERG: Has this been included as a spinoff of things like Sperry?

BUTLER: I don't know. I'm not aware of it.

NORBERG: It was not included in ours, that's why I asked you about it. Anything else, Bill, that I haven't

mentioned?

BUTLER: I sold TSI and helped found this company called Commbase. It's my latest, one of my later activities.

NORBERG: Tell me a little bit about Commbase for the tape.

BUTLER: Commbase is a company formed in cooperation with Control Data to develop training aids, particularly computer based training aids. Many of our projects have used the Control Data Plato computer system. We've developed courses in agriculture, hydraulics, pneumatics, we're working on a course in welding. We've also developed a line of proprietary products in a completely different field. These products work with the Apple Computer and go into elementary school libraries and teach youngsters how to use the school library, the reference and the card index and stacks and so forth.

NORBERG: What is the connection with Control Data?

BUTLER: Control Data is a shareholder, owns about 20 percent of the stock. They have also been our principle customer, up until recently. Well, still are. We're hoping to make them a minor customer rather than a major customer.

NORBERG: Thank you very much. This has been very helpful.

END OF INTERVIEW