An Interview with

CARL RENCH

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Conducted by William Aspray

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Abstract

Rench, an NCR employee since 1946, surveys the company's growth from a manufacturer of cash registers to one of the largest suppliers of business computers. He begins with NCR's 1946 experiments with vacuum tube arithmetic devices, work during the Korean war on the A-1-A bombing navigational system, and the acquisition in 1952 of the Computer Research Corporation. Rench points to Joseph Desch's role in moving NCR into electronics. Rench highlights the major products of the 1950s: the Post-Tronic machine for reading magnetic strips on ledger cards and doing financial transactions, and the Magnetic Ink Character Recognition (MICR) device. He mentions a 1959 joint venture with General Electric to produce one of the first all-transistorized business computers. He explains how, in the 1960s, NCR returned to its earlier specialty in peripheral devices, and contrasts this approach with IBM's concentration on the sale of systems. Rench focuses on the company in the early 1970s as a major producer of metal oxide semiconductor chips and as a multinational corporation. He discusses at length NCR president William Anderson's decentralization of the company, the resistance among Dayton employees, and the advantages of this policy to the company's livelihood.
CARL RENCH INTERVIEW

DATE: April 18, 1984
LOCATION: Dayton, Ohio

INTERVIEWER: William Aspray

ASPRAW: Mr. Rench, can you tell me something about how you came to what was then National Cash Register and something about your career since that time?

RENCH: Okay. Mr. Aspray, I joined the corporation in March of 1946 after several years in the U.S. Navy. During my Navy career I was fortunate enough to go to the MIT radar school, Bowdoin College's advanced electronics school, and a school in Gainesville, Georgia for radio aids to navigation. Therefore, I had quite a bit of background in electronic techniques. I joined NCR in 1946 as an electrical research engineer using the background that I had obtained in the Navy. The company at that time had an electrical research laboratory which was very small, in the range of 20-25 people. Each engineer was given prime responsibility for developing new technologies and new project ideas using new electronic techniques. It was exciting and really fun at that time. Well, that went on until the Korean War when most industries had to face up to becoming a part of the movement towards solving the production and technological needs of the wartime. NCR entered into the production of the A-1-A bombing navigational system and they needed systems engineers and people to help manage that effort. I joined that activity about 1950 or 1951 and spent a year and a half or so in that area. As an aside, you might be interested to know the Navy forced me to give up my commission at that time. I had to make up my mind whether I wanted to stay at NCR or go to Korea. I stayed at NCR and joined that activity.

Right after the Korean War, we reconstituted our electronic development efforts and moved forward on trying to take the technologies that we developed in the ‘40s and the early ‘50s and push them into significant products. Well, the company recognized in the early ‘50s that although we had a lot of electronic patents, and a lot of models of different types of techniques that we could employ in our cash registers, accounting machines and other products; in fact, the thing that the company had not spent a great amount of time on was the classical computer -- the von Neumann approach to computing. So the company entered into an acquisition program and acquired Computer Research
Corporation of Hawthorne, California. That was about 1952 or 1953. In the meantime, we had been developing at NCR an all-electronic accounting machine, and that was under my management. Then we had to decide whether we should continue with that kind of an activity or whether we should pursue the opportunities we had with Computer Research Corporation. We decided that we would go with the drum type, diode logic type computer design that CRC had. It looked very efficient, very effective and had the proper cost picture for what we wanted.

So then in the mid '50s we had a choice to make: Did we wish to expand the production facilities at Hawthorne? How did we want to handle the whole relationship? The company finally decided that it would use Hawthorne, which by that time now was now called our Electronics Division as a prime development force. A lot of the production was planned for Dayton because we also needed to get Dayton involved in the throb of electronics.

So, in 1955, I was put in charge of the Electronic Development Department to do the final production engineering for the products coming out of Hawthorne. Well, we did that for several years and the company produced various models, but the last model that we introduced was called the 102D, which was a drum type computer with decimal-type logic. We proceeded on that program for a while and then saw that we needed expanded activity and a new approach to the market. The company decided to enter into a contract with General Electric Corporation to develop and produce central computers. The Hawthorne Electronics Division would become more involved in advanced development, Dayton would do more peripheral development and manufacturing and GE would do the central processors, central controllers and the like. At that time, I remained in charge of this electronic department, the Development Department in Dayton, which took over the management of the GE contract. We managed the GE contract with technical help from the Hawthorne facility. We established systems control, specifications control and we undertook, here in Dayton, the development of advanced peripherals: high-speed card readers, high-speed paper tape punches, and high-speed line printers. These were items that at that time seemed to be the key peripheral base for NCR’s needs. That culminated in the first production of what we called the 304 in 1959. We did not have the software responsibility in my area but that was done in our marketing arm under Dr. Everett Yowell. Ev Yowell, by the way, is still in the Dayton area doing other things.
Anyway, Ev and I observed the first unit to be shipped from the GE facility, which was located in Phoenix on Black Canyon Highway. We observed the first unit and felt grateful that we were in the position to ship that first unit out of Phoenix in 1959. I would like to add that we felt this was a pioneering machine in the sense that it was all transistorized. It maybe was not the first all transistorized computer but certainly one of the first business-type computers that was all transistorized.

I had the role then into the early '60s. We sold a reasonable number of 304s, but not enough to keep that particular program going, so we felt that we had to take a different direction. Since the company had this advanced development work going on at the electronics division, at Hawthorne, California, we said, "Gee, we have some new techniques and new technologies. Why don't we exploit those now for the next generation of our computer products?" So, we pulled away from GE and turned the central processor and controller work back to our Hawthorne facilities in the early '60s and kept the peripheral work in Dayton as had been done under the GE contract. In the early '60s, I managed that work and established a full relationship with Hawthorne for them to do central processor development.

Then, in I think, '62 or '63, I took over all the engineering in Dayton and became what I think was titled the "Director of Product Engineering." This meant that I had all the cash register development, all the accounting machine development, all the electronic development, and the peripherals in addition to -- and a major activity which we picked up in the late fifties -- developing very small computers. In about 1962 or 1963, I became the director of all engineering in Dayton. A year or two after that, I think it was '64, I was appointed an officer of the corporation. During the late '60s we brought out a whole new family of peripherals for what we called out Century family of computers. We brought out new proof machines for the banking field. We brought out many new models of cash registers and our 390 and 590, which were computer-based machines using magnetic ledger file devices. I didn't mention earlier that in the '50s, the company became very successful at using a particular version of the ledger card with magnetic stripes on the back as an automatic file device. By the mid-'60s some of those machines, particularly the Post-Tronic, had made a lot of money for the corporation. So, we pulled that magnetic ledger card system forward to small computer-like devices like our 390 system and our 590 system. Obviously, these used other peripheral
devices, too, such as tape units, printers, and card units. But, we were very successful with that ledger system so we did employ them in small computers. In the ‘60s, we pushed small computer devices of various types forward. We pushed hard on taking input from our various cash registers and accounting machines to make sure we had a lot of our information flowing into the computers for whatever purposes were necessary -- analytical purposes, record purposes, etc. So, in the ‘50s and ‘60s we had a lot of different devices to capture the data from cash registers and accounting machines which could then be read through tapes or cards by the computer for further processing.

In the late ‘60s then, I became in charge of all the engineering and product planning for the corporation. By 1970, I became Vice-President of R & D. I'd been appointed vice-president a couple of years before that. I forget my exact titles for those years, but I think they were Vice-President of Engineering-Advanced Development, then later I became Vice-President of Corporate Product Development and then later, in the fall of 1970, became Vice-President of R & D. During the ‘60s, I reported to a group executive, Mr. Robert Chollar. He was a well-known executive in the company and a very exciting chemist who took the leadership in development of NCR's carbonless paper. This was a great success in the entire market. The whole micro-encapsulation process, which was the basis for the paper, was brought forth under Bob. Well, he put me in charge in the late ‘60s of advanced development of the corporation, and then in 1970, he put me in charge of research and everything. In late 1970, he retired, left the company, and became president of the Kettering Foundation, a local foundation in Dayton, Ohio. It's a very large, two hundred million dollar, foundation.

Also, in the late ‘60s, I was instrumental in having the company make a major decision about going into the semi-conductor development and manufacturing business. We tracked heavily the "Silicon Valley" people and everybody else and we decided, in the middle ‘60s, to dedicate our future terminal designs to metal-oxide semiconductors (MOS). When you make a decision that early in the ‘60s that you're going to go MOS when bipolar and a lot of other things were the key technology, you knew you were sticking your neck out a little bit. We made that decision, and then, in the late ‘60s, we decided to also manufacture MOS devices. I set up a division operation to do the early manufacture of MOS devices in the late ‘60s and early ‘70s. We decided that we would build a facility close by in Miamisburg, Ohio to be our new home for that and take it out of research labs. By 1971, we had moved
into the new building. I had a full fledged P & L operation reporting to me doing the MOS work of the corporation. Both the MOS development and manufacturing, as well as the delivery of those devices to our other operations for incorporation into the terminal products we were bringing out in the early '70s. These were our retail terminal products and our financial terminal products for the banking industry. So, we were rolling ahead. We had major contacts with AMI in those days and other people on the West Coast who were also in the MOS business. I can't remember if it was AMI in those days; my memory fails me a little bit. We'd tracked GME, and then Howard Bobb spun out and formed another company (AMI). We kept track of our yields versus industry yields. Our Dr. Van Tassle, today, verifies that we were the leaders in MOS yield in the early '70s in the United States of America. Very few people realize that. In any event, that operation reported to me for several years. Obviously, though, it was not the kind of thing that a guy who is vice president of R & D would normally keep under his wing. The plan of the corporation, of the president and chairman, was that when that became successful we would spin it off as a proper operating division of the company and get it out of R & D.

In June of 1972, Bill Anderson came in to take over the company. This is well-known history. NCR was having financial difficulty in those days because of the demise of the demand for mechanical machines and the difficulty in picking up the cudgel on delivery of electronic terminals. That's a tremendous trauma to go from one major product line to another. But remember our customers out there were all lined up with huge volumes of the very successful, older, mechanical machines. How in the devil was our marketing arm going to convert them overnight to buying huge volumes of new machines? We sold hundreds of thousands of cash registers. How can you convert overnight to hundreds of thousands of electronic terminals? In the meantime, you know and I know, everybody was trying to take away that business because they saw a golden opportunity to get some of NCR's dedicated business. I had been reporting directly to Stan Lang, the president of the corporation, as vice-president of R&D because Chollar, as I said earlier, retired in late 1970. Then Bill Anderson came in in June of 1972. I reported to him then until the fall of 1974. At that time, they deemed fit around here to reorganize. We'd reorganized several times anyway, but they deemed fit to reorganize again. They brought in Roy Phelan to be Vice-President of R&D and made me assistant vice-president of what we called Corporate Research and Technical Affairs.
About 1972-1973, we decentralized engineering to the different operating units around the country, such as to Wichita, Kansas. We'd already had a decentralized operation in Hawthorne, California and it, of course, retained its role. We decentralized to Ithaca, New York, to Columbia, South Carolina. We started scattering our development forces and production forces all over the country as we entered into electronics full-bent. And therefore, the development function of the headquarters became much less a "doing" function and much more of a staff function.

Anderson thought it would be best if they brought in someone else for that VP of R & D job, and he brought in Roy Phelan, who had been, at one time, with Burroughs and after that he'd gone to Victor Calculator. He set up a special division for Victor for a year or two where he was developing a point-of-sales system. That didn't work out too well for Victor, so they brought him in here as the vice-president of R&D. Roy was an outstanding person in many ways. At Burroughs he had developed-I think it was the "L" series. This was a small accounting machine line with magnetic ledger systems capability. And then I think he was involved in the TC500 development which put Burroughs into a strong position with a lot of the banking industry around the world. So he had a great background when he came. Under Phelan I still handled for the company all of the industrial design, all of the engineering standards, all of the financial work related to R&D, and recordkeeping, the type where you'd analyze how you're spending your R&D buck and how you're getting the most out of your buck. I also handled all the industry standards external to the corporation, all the relationships with other companies on a technical basis, and, several other elements. In addition, I helped Roy Phelan, in a personal staff sense, move into the corporation successfully. And he retained me in that kind of an activity throughout his tenure here.

Well, in 1980, then, our present vice-president came in, Tom Jang. Roy retired, which surprised the heck out of me. We felt that he was moving forward successfully, though we saw some signs that he might wish to retire. He's younger than me, you know. Roy's probably not over 60 years of age at this time. So, when he retired he was about 56 years of age. He moved to Florida and he's playing golf like mad. Great guy! In any event, Tom Jang came in and is one of the real good computer scientists in this country today. He is the father of several of our systems at what used to be our Hawthorne facility. I failed to mention in the late sixties we moved to Rancho Bernardo, California from the Hawthorne; from the L.A. area down to the San Diego area. Have you ever seen that facility?
ASPRAY: No I haven't.

RENCH: It's beautiful up there. The Rancho Bernardo facilities are on a hill overlooking the community. We were the first into that industrial park there. We received some very major financial benefits for going down there. And it's a fantastic community. A lovely living community. The people moved down from the L.A. area and just loved it. That was in the late '60s.

Anyway, Tom became the chief engineer out there and then for a very short span of time he was the general manager. In late 1980, I guess, actually the first of '81, he came to Dayton to take over the vice-presidency of R&D. And I essentially retained the same role with him, so my position hasn't significantly changed since 1974. We have done some slight reorganization recently in spinning some things out of R&D in general. Early in 1981, we went another step in decentralization called our commercialization process, wherein the development of business units at localities like Rancho Bernardo and Clemson are fully on their own with a charter, a P&L, and significant responsibility to be successful. This meant, of course, then that there was slightly more decentralization of the technology activity in the corporation. Moreover, Tom's organization keeps track very assiduously of all advanced work and the like and then we sponsor advanced work. We ensure that there is a strategic plan in place to ensure that the company properly gets those things done that aren't picked up by the business units. We cannot afford to have a P&L unit put the corporation in jeopardy. We have to ensure the future and we do that under corporate R&D.

But that brings us up to date. I am still an assistant vice-president. Tom changed my title to one which I think is a little more appropriate. Instead of Research and Technical Affairs like it was before, it's now Technical Operations.

That's it.

ASPRAY: Very good. I was wondering if we could start at the beginning of electronics at NCR. Some of this is prior to your coming to the company, but I was wondering if you could tell me a little bit about the late 1930s. I understand that several people in the company did some experimental work with electronics in the 1930s and actually built a
vacuum tube device to do arithmetic operations at the time. Are you familiar with that?

RENCH: Yes, I am, very much so, because when I joined in 1946 my immediate supervisor at that time, Bob Mumma, had come in in the late 1930s. Then his boss, Joe Desch who was supervisor of that whole activity had been the founder of the activity in 1938 when Colonel Deeds had insisted that the company should probably do some advanced electrical research. Joe and Bob were superb researchers in many ways. In the late ’30s, they soon were counting pulses, cycles, at a megacycle rate. By 1939 or ’40, patents were applied for by the corporation for counting devices and arithmetic devices. Prior to the war, they were working with, as I understand it, the Navy Department on various contracts to actually measure the velocity of shells and stuff like that using electronic counting methods for time measurements. The Navy Department was so taken by this whole activity that during the war they set up a major function at NCR which has never been talked about openly. I do not know the nature of the work. It is still secret, but engineers were brought in from all over the country under Joe Desch’s supervision.

ASPRAY: Now is this the NCML? Is that the National Computing Machine Laboratory? Is this the same project?

RENCH: I don’t think so. By 1941 or 42, Joe Desch had his own laboratories. Basic laboratories, had put together a type of electronic calculator. I think it filled a fairly good sized cabinet in those days using the vacuum tube. As I remember it, in ’41 or ’42 he had an electronic calculator built. Obviously, Joe Desch or Bob Mumma can give you more details. They also entered into a major contract with the Navy Department which to this day is confidential. That work was very demanding. So, it tore up the staff that he had for quite a few years until he could reconstitute it in 1946.

ASPRAY: Who was it in the company that suggested this research on electronics in the 1930s?

RENCH: Colonel Deeds was a visionary that really thought it necessary for the company to do advanced electrical research. He apparently saw that there was going to be a new type of technology that could be used in the NCR products and felt that research was essential for the future.
ASPRAY: Another contact in the 1930s with electronics in NCR was with Harvard and MIT. I understand that they brought in a number of people from both institutions as consultants.

RENCH: Well, I know from talking to Joe Desch and others that they had a lot of contact and consulting work done by Howard Aiken of Harvard who tried to give them guidance as to how to use the technologies for computing devices and I suppose the NCR product line. I am not too knowledgeable on the relationships with MIT although I do know that they were in and out of that facility many times.

ASPRAY: Now, at this time Aiken was more concerned with electro-mechanical than electronics?

RENCH: He certainly was. In fact, I don't know the value that he really gave to the company in that time frame. I do think there was some controversy as to whether he was at times almost misleading them on the benefits of what electronics or electrical devices could do.

ASPRAY: Was there felt to be any problem with hiring Aiken as a consultant at the time? He had this relationship that was already founded with IBM to build the machine for Harvard which essentially became Mark I.

RENCH: I can't answer that. I have no privileged knowledge of that particular thing.

TAPE 1/SIDE 2

ASPRAY: To wrap up another loose end from this early period, you had mentioned patents that had been taken out. Did they have a subsequent role for the company?

RENCH: Yes, those patents gave us rights to certain calculation and arithmetic type of circuits and certain uses of binary and binary-to-decimal type circuits. It established a position for us which allowed us to proceed to use the technology as well as to cross-license, appropriately, with other corporations. I do not know the details, if you talk to
Mr. Mumma he can tell you the details. We had an early litigation of some kind with IBM in the late '40s and the
litigation was settled by cross-licensing that particular patent, I believe. In other words, we exchanged claims at that
time. But it was very significant because we were able to establish a beachhead in the electronic field.

ASPRAY: Let's turn to the war activities. I understand that NCR suspended commercial activities during the war and
had a heavy role in various military projects. Can you describe some of them?

RENCH: During World War II the company turned to war output not only in its normal production but in its electrical
research area. The company contracted with the Navy for significant technical developments in products. I cannot
describe those in detail because I don't have knowledge of those from my own experience. But I do know that they
were advanced in a technical and leadership nature. They employed technology that later became very effective in
electronic products and computer products of the future.

ASPRAY: Can you mention someone who might be able to answer those questions?

RENCH: Yes, I think either Joe Desch or Bob Mumma can give you more information. They were deeply involved at
the time. I do know that the government felt that the work output of that particular activity was extremely important
to the war effort and they gave some kind of special recognition to Joe Desch for that activity. I'm not sure that I can
name the type of award, but I understand that at that particular time after the war effort when he received it that it was
the highest type of award that a civilian could receive for war contributions. That's an important thing, Mr. Aspray.
We think that Mr. Desch was a pioneering leader at that time and I think the Navy Department and U.S. Government
felt that too.

ASPRAY: It's often the case that people who work primarily on military activities that have to remain "classified" or
just are military rather than commercial ventures don't get the kind of recognition that either academics or heads of
chief commercial products receive.
RENCH: That's true. In this particular case Mr. Desch did receive a very special award of some type.

ASPRAY: Let's look at the period when you came to the company and we can get more firsthand accounts. Could you tell me something about the product line of NCR when you entered the company?

RENCH: Well, the classical mechanical cash registers that most of us remember the rounded keyboards, the flat keyboards, the indicators that move up or down or turned around. We had the cash registers that did the printing of sales slips, detailed strips for the business records. We had accounting machines that did payroll checks and did bank account recordkeeping. We had mechanical machines, one of them called the 3000 machine, that actually had a typewriter on it and a combination mechanical, accounting machine so that you could keep track of records and type names and other things on documents simultaneously. Those products at the end of World War II were in great demand. There was a shortage around the world. The large distribution capability of NCR at the end of World War II built up demand so much that right after I arrived the company was roaring ahead again on worldwide production and worldwide distribution.

ASPRAY: Can you give me some estimates about how much of the business was in cash registers, in accounting machines, and adding machines? Where did the percentages lie?

RENCH: Well, I'm not sure I can give you a very precise estimate, and there are probably people around here that have those records. But I would estimate that we were in 60-70% of the cash register business at the time. 30-40% accounting machine business. But I think you better check the records on that.

ASPRAY: That's fair.

RENCH: That's my estimate, simply. Later on the accounting machine business took a higher percentage of the corporation.
ASPRAY: I understand that the company had acquired an accounting machine company in 1943?

RENCH: Well, I thought ’43 was when we acquired the Allen Wales Adding Machine Company.

ASPRAY: Maybe that's right.

RENCH: Prior to that. What was the name of the other company? Ellis? No. I can't remember the exact date, but in the early ’30s they acquired the machine that was the accounting and typewriter combination machine. I have to be a little cautious about my history and we've got the history around here, but I thought that Col. Deeds had something to do with that acquisition after he came back to the company. I can't be sure. It was at the time he came back in the early ’30s that we had this combination machine.

ASPRAY: I've taken you a bit off the track. You were saying that accounting machines really took of as a product line for the company.

RENCH: Yes, in the early ’50s we brought out the Class 31 which was a newly-designed Class 3000. It provided a lot of typing and accounting facilities in a mechanical machine, and it became very popular around the world. We sold many, many thousands of those things. It made the company a lot of money and a lot of revenue. We used that 31 base. The typewriter, keyboard and a mechanical storage capacity. We used that base in fact to add on electronics. We added just arithmetic electronics on one part. In other cases we added on computer devices, stored program computer machines. Some of our very first, small, stored program computers used the Class 31 accounting machine as its console. Very effective, too.

ASPRAY: This would have been what year?

RENCH: Well, the 31 came out in the early ’50s and again I'm hard pressed for an exact date. But the late ’50s was when we used it as a console for the other devices.
ASPRAY: At war's end and throughout the rest of the '40s were any of the products electro-mechanical? Had you introduced electronics at all yet?

RENCH: Not electronics, per say, at the war's end or in the '40s. Remember the company felt it had some electrical products in the sense that it sold a telephone credit system. "The O.K. Telephone Credit System" I think was the specific title of it. It also had machines that had solenoids on them to open and close little doors and the like. If you were going to deposit a check in a certain area, it might open the door for you automatically by solenoid control. But we didn't really bring out an electronic machine, per say, other than the acquisition of the Computer Research Corporation, until the middle '50s when we brought out the Post-Tronic machine.

ASPRAY: What about electro-mechanical?

RENCH: Well that's what I was describing before. We had solenoids operating different devices. In the early '50s, maybe '52-53, we brought out machines that would punch paper tape from the output of a cash register and some accounting machines. Those were electro-mechanical, obviously. Other than the obvious need for a solenoid or two here and there, we did not have much electromechanical in the late 1940s.

ASPRAY: I understand that between 1945 and 1952 the company had resumed research in electronics by doing some work for the government. Particular electro-mechanical bombing navigation. Can you describe some of this?

RENCH: Well, you're talking about the work they did during the Korean War?

ASPRAY: I assume that's right. I don't know much about it.

RENCH: About 1950-51, again, I'm not very precise on the year, we undertook this manufacturing of the A-1 A bombing navigational system for the government. It was used in B-52s, or whatever was the big bomber in those
ASPRAY: I think that's right.

RENCH: Anyway, it was used in the big bomber of the Korean War, and we didn't do development on that. We strictly took the drawings from AC Spark Plug, Sperry and people like that and made sure we produced a high quality product for the needs of the war effort. By the way, that was a tough, damn thing to produce because it had a lot of electro-mechanical devices in it. It had a lot of servo-mechanisms and a lot of three-dimensional cams that had to be precisely manufactured. Basically, it gave you all the magnetic corrections for the whole earth in cams. It gave you all types of calculations in cams of trajectory and distances and all kinds of things. And the servo-mechanism preciseness was at that time, the highest probably in any product in the country. So we had a tough time doing that job. But we did it, and we turned it out. We needed every skill that we had in production. You know NCR was an ingenious mechanism company. We could produce more queer looking gears and cams and shafts than almost any company in the world, and put them together and cause them to effect motion and arithmetic operations. Something that would tell you what was going on in the machine, etc. But those ingenious mechanisms, although they had very tight tolerances in thousandths of an inch, didn't go down into the millionths of an inch. Nevertheless, you get some of these servo-mechanisms and you were in the sub-thousandths of an inch tolerance. So we had a hell of a lot of challenge to produce that machine, the AIA, effectively.

ASPRAY: Was there any research going on in electronics; independent of product development basic research?

RENCH: Let me make sure I understand what you mean by basic research. You are talking about research of producing a new tube. A new vacuum tube?

ASPRAY: For example, or working on circuitry or counters.

RENCH: In the '40s?
ASPRAY: Up to the time of the purchase of CRC. So say up to ’52.

RENCH: The answer is definitely yes. Joe Desch was deeply involved in turning out new thyratron types. He actually turned out a decade thyratron-type counter -- a gaseous discharge tube which actually counted in tens. I don't know the year he turned this out; now here is where Joe or Bob Mumma would have to give the answer. Desch was the leader in doing that. He and Mumma had researched by actually blowing the tubes and placing the different gases into the tubes. They turned out a miniature thyratron which was very small and inexpensive to do accounting work for what they thought and what seemed to be the needs of the NCR cash registers and accounting machines at the time. Though thyratrons wouldn't count over ten to fifty thousand cycles per second, that seemed quite adequate. They were inexpensive for the use of cash registers and accounting machines. They already had been able to count in the millions of cycles per second with vacuum tubes. They knew exactly how to do that using all the way from duo-triodes up to pentodes, and tetrodes, etc, etc. So they had a lot of skill in the area already and they were trying to find low cost means and techniques for doing the basic calculations. They did a lot of basic work on these tube types. (But our contractor, the people that helped them, made the prototypes, etc., General Electric and others could do that.)

In addition, we did a lot of research on circuit types on the minimum number of devices, the best speed, the best reliability, recycling binary-to-decimal counters, specialized decimal counters, etc. The company was somewhat hung up in trying to do things in a decimal mode. If you talked hexa-decimal, octal or things like that the interest wasn't too high because they wanted to have immediate indication in a decimal mode. The speeds and the characteristics of what record keeping requirements seemed to be quite adequate for decimal mode work. So we had a lot of patents of flip-flops, trigger circuits, and counting circuits of the nature that was done for decimal use.

In 1947, I turned out a CRT with digits on it, but I couldn't get a patent. I don't know why and I can't remember why, but I've got the old report around so I can say, "See, you talk about macho modern - VDTs with screen with information. Well, I did that in 1947!" We also had worked on signature transmission. We thought, "Well, gee we're
in the banks in a big way with our accounting machines and the like. There's always a problem of verification of signatures. Why don't we take a signature and move it around by video means from the desk to an office and let somebody back there have a high-speed file system to look up the thing.” So we were transmitting signatures around via regular coax, as well as using the power line. We were doing carrier current research at that time moving video information around in buildings. We also did a lot of drum and storage research. We felt, "Well, gee we've got to have extremely low cost and very high signal type of drum storage for these small accounting machines." So we developed a wire wrapped drum which had an extremely high signal output. It wasn't of great density, but it didn't matter for that particular application. We could store thousands of digits and that would probably be quite adequate for what we needed at the time. We proceeded to develop more modern versions of calculators and adding machines using electronic counting means. We did the research in the '40s for the Post-Tronic machine. We did the actual recording on magnetic ledgers and had that available for development organizations in the late '40s. Let's see, can I remember any of the other precise areas? I did work on data capture and data reading from cash register detail tapes, the record tapes in them. We felt that we needed to take advantage of that resource of captured information. So I worked on the development of a coding system. We printed the 2 of 5 code on the tape and then we read the information photo-electrically. I also built a little sorter that would sort the data and reduce it into sorted format for sales analysis. We also felt that we could take that same tape and run it into a computer and do further analysis if we wished. About the time I got that thing running and demonstrated and everybody got excited about it the Korean War came along. After the Korean War we picked up the work again and it became a little more obvious that we should really use the more standard teletype punch tapes as an output rather than the detailed tape that I had developed in the '40s, the one with the special coding.

ASPRAY: Why was this?

RENCH: Well, there were so many readers out there in the world for teletype tapes that you could go out and easily fit in that environment. It was a practical environmental market situation. When we picked up the work after the Korean War, we picked it up with the idea that we were going to develop products this time -- practical products. After we did a lot of research, we accrued a lot of patents. We decided that we would aim at new products in a
pragmatic sense of taking advantage of the data capturing mode of our products. And we did that. We turned out, in the early '50s and middle '50s, a lot of punched tape devices that fit with our cash registers. Our engineers developed a set of switches that they would put on the back of a cash register which essentially took the information that normally went into the indicators that displayed information to a customer and operator. Those switches were very simple in design, and they put out electrical signals to a tape punch. The tape punch had a simple stepping rotary type of switch in it that would scan the switches and convert to pulses for driving the punches on the punched tape. I don't know how many of those punched tape devices we turned out. We called it the Class 461. I remember that very well because I developed a little board of silicon diodes to use as decoding members for that particular product to simplify its design and make it more reliable. We didn't want a gob of relays in it so all we had was the one stepping motor, a bunch of diodes, and the punch. We sold hundreds of thousands of the 461 for punching tape out of our machines. A very fine piece of electrical work that was done in the later '50s by our people in Hawthorne, California was an optical tape reader. It was remarkable work, I thought, actually using printed stylized characters off the detail tapes in the cash registers. I think that was called the 421.

ASPRAY: Now this was the first such product on the market wasn't it?

RENCH: Yes, we were pioneers in that market. I think Hawthorne did another very fine job. We pioneered a random access file system called the CRAM (Card Random Access Memory). It lost out to disks obviously. In the early '50s we heavily pioneered on-line banking systems; Mutual savings and loans and the like used the Card Random Access Memory as a key file system. We felt that between the optical tape reader that Hawthorne turned out and the Card Random Access Memory, some new major opportunities had been tapped for NCR in that period of time.

ASPRAY: Before I turn to the acquisition of CRC I want to read you a short section from one analysis of NCR and ask you your comment on it.

RENCH: Sure.
ASPRAY: In the opinion of many of the original engineers and more future-minded marketing men, NCR didn't move fast enough. Some NCR executives point out the difference between IBM's and NCR's business in the pre-computing era. IBM sold punchcard equipment, an aggregation of specialized machines, the card punch, the verifier, and so forth which sat in the central accounting department of a large organization. The movement of the voluminous information through them required a primitive form of systems design. Information had to be converted to machine-readable form. Once entered it could be organized and retrieved in different ways for different purposes and the equipment was maintained by specialists. This then was a rudimentary data processing department and the engineers, salesmen and executives of the company that made the equipment had already mastered many of the fundamentals of the computer business. NCR on the other hand sold ledger card machines which were self-contained, operated by clerks with little special training, distributed through large organizations or used by small ones, and relatively inexpensive requiring no coding and only limited systems design. They were essentially a combination of a typewriter and an adding machine. First of all, I want to ask you if you think that's a fair statement?

RENCH: I think that's a fair statement. We felt in the middle ‘50s when it was obvious that what had been happening in the marketplace was that IBM had a systems base they could build upon because their systems were in that central department that you read about. Each of their products were a special function device, a punch, a reader, a tab device, etc. And ours were in fact, as you said, sort of a composite. We didn't know at the time that we were in the distributed processing business then and IBM was in the centralized processing business. But, yes, we felt we had that disadvantage.

ASPRAY: And the irony of it all is that you return to distributed processing in the ’70s.

RENCH: Right.

ASPRAY: On the other hand it seems clear to me from reading your annual reports throughout the ‘50s that the company had a very strong sense that, although they didn't have past products which led to systems, systems was really the way to go. That was the area in which to do research: putting pieces of equipment together, tying
computers to their past equipment as input devices and looking at the whole systems content for business purposes.

Is that accurate?

RENCH: That is accurate. We were promulgating a total systems concept, heavily in the ’50s, from both a development and marketing viewpoint. In the answer to why didn't that turn into more growth at the time, which I'm sure is your next question, I think that NCR's strength in the marketplace and (sales force) was deeply imbedded in the knowledge that the company had in selling accounting machines and cash registers in a distributive sense rather than in a systems sense. So the strength of the company might have been its weakness in its marketing efforts.

That's what we in development felt, at least.

ASPRAY: I'll come back and ask you some questions about marketing later. I'd rather leave that subject now unless you have something directly you'd like to say. This brings up the question about who you felt your competitors were?

RENCH: You have to remember that we felt our competitors, historically, had been more of the Burroughs type. The people that were providing the cash registers like the Swedes or the Anchor from Europe, and later (TEC) and people from Japan (constituted our competition). We did not perceive that IBM or the Remington corporation (punched card companies) were our primary competitors. We perceived these others to be that, and maybe that was an error.

ASPRAY: So in the American companies you include the Burroughs, Monroe and Marchant?

RENCH: Maybe not so much the Monroe and Marchant. Remember although they had certain products that fit into the distributed offices, they really didn't have the types of products that we had. Burroughs did, though. Yes, they were competitors in a slightly different sense, but not frightening competitors.

ASPRAY: Anyone else?

RENCH: In the cash register business we were pretty solid except for the international people trying to sneak in the
picture. In fact, that might have been one of the weaknesses of the corporation. To have such a strong position in the cash register business, as it was known and thought of at that time, led one to believe that you didn't have to worry too much about some of these new facets of business. I have to admit that Burroughs was the key company that we looked at.

ASPRAY: Can we now turn to the acquisition of CRC? Is that accurate?


ASPRAY: Can you tell me something about the company's reason, for deciding to acquire Computer Research Corporation?

RENCH: Again, if you wanted more specific information, Joe Desch was deeply involved in the rational at that time. Joe told me the characteristics of it and then my good friendship later with Don Eckdahl, who was one of the key managers of CRC lead me to other information on the subject. But at the time that the acquisition was being considered it was pretty obvious that NCR had not researched, had not developed the capability in the type of computer technology that was emerging. I can't remember exactly the date of Univac and so forth, but all the people who were using stored program devices were emerging as being significant in the handling of information and we had not done a lot of work in that area. When we stored a program, we had it in a separate box, in wires or something else. When we had an arithmetic unit, it was separate from the programming unit.

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RENCH: I know that Joe Desch also advised the Colonel and Mr. Allyn that they should proceed in this area. He was instrumental in providing that advice. So the opportunity arose, but I don't exactly the nature of that opportunity. I know that CRC did need some funding and some other things at that time. And they investigated it thoroughly and really did feel that CRC had a leg up on providing small computer designs.
ASPRAY: Now if I remember correctly CRC had gotten into the business of building small machines for use in flight.

RENCH: I can't give you all the background. I do know that they had a contract for a large machine with the Navy Department which was in Washington, D.C. I know that they had done work for the government -- had contracts. But I also know that they had developed, at least on paper, whether it was in production or not I'm not sure, a general purpose binary type computer using drum storage as the main storage element.

ASPRAY: Now CRC was a spin-off from Northrop as I understand it. At least the engineers came out of (Northrop).

RENCH: That's right.

ASPRAY: I also had the impression, though no clear facts, that NCR had had close ties to Northrop in doing work during the War and maybe later on. Is that accurate?

RENCH: You know I can’t answer that question. It may be true but I don't know that.

ASPRAY: I was just wondering if that had some bearing upon the acquisition.

RENCH: I don't think so. From my knowledge of it the answer would be no, but I can't swear to that.

ASPRAY: Do you know if NCR considered acquiring other companies?

RENCH: No, I really don't know.

ASPRAY: Because I know that about the same time that the Electro-Data Company was acquired by Burroughs.
RENCH: Yes, I remember that. I can't answer that. By the way, I wasn't in the management circles at the time all that information was passed.

ASPRAY: Are there people besides Joe Desch and Mumma that might be able to help answer these kinds of questions?

RENCH: Don Eckdahl could answer that in a big way. I consider Don a real pioneer in this business -- a wonderful guy, good friend of mine. In fact, you know between Joe Desch and Don Eckdahl I'll die someday happy because I've had some great friends. I consider Don a genius in many ways. He really knew how to throw that Boolean algebra around and put those diode networks together. He really was superb at that stuff. Don moved up into management ranks with the CRC organization. I think he was Vice-President of Engineering or Manufacturing, or something like that, when NCR acquired CRC. He would know that background.

ASPRAY: Had the original intention been for NCR to actually market the products that CRC was developing?

RENCH: Well, right at the beginning I think that they were going to let CRC continue for a while until NCR could get its planning lined up, and determine how to take advantage of the product. I think at first (and this is my faint remembrance now) the tendency was to let CRC go on their own and see if they couldn't create their own market. It wasn't long after that they pulled the thing into a central planning function. They decided they would like to have a decimal machine, which I mentioned earlier. One of the revised designs of the original 101 or 102 family was a 102D which became a decimal-type machine.

ASPRAY: If I remember correctly the company had announced the 102D. Did it ever market any of these, produce any more?

RENCH: I don't think so.
ASPRAY: Was the company nervous or did they become increasingly nervous about marketing military and scientific machines when it felt that it was in the commercial business?

RENCH: I think when you talked about a binary machine, you scared our salesmen. And the answer therefore to your question was yes. So the 102D was one of the first attempts to try to make that transition.

ASPRAY: I see. So it was really intended to be applicable to the business world?

RENCH: Oh, yes. That was the plan of attack. It became obvious, though, that it was input/output "bound." The 102D was not going to gobble up the information we wanted it to gobble up, fast enough. That was one of the key problems.

ASPRAY: One of the things you see very strongly in the annual reports of NCR at the time is a very strong feeling of difference between scientific and commercial computers. And one of the things that's mentioned is the differences in needs of input and output devices. Can you speak to those?

RENCH: Yes, in those days a lot of computers were designed for massaging a lot of information internally -- doing differential equations, and different types of high arithmetic, mathematical calculations which required tremendous iterations of the data -- while most business records systems did not require that kind of data massaging. However, you always had a tremendous volume of input. If you have transactions for a department store, you'll have many, many thousands of transactions per day. If you're processing the teller records for a bank, you've got thousands of transactions. Now the calculations on these transactions and the recordkeeping is not all that complicated, but it's just a high volume. So the thought was, and I think there was a lot of fact in it, that the machines of the day were not designed for that volume processing; they were designed more for the high arithmetic and mathematical calculations. That probably imbued our people enough that they wrote the annual report in the manner you describe.
ASPRAY: Throughout the '50s that suggests that the company must have paid a higher premium in terms of R&D work and product development in peripheral devices.

RENCH: That is true and therefore the late '50s saw a tremendous push in that direction. When the company decided to go into the General Electric contract it decided at the same time to have a family of peripherals that could process data at very high speeds. So you're right. In the late '50s we developed card readers that processed, I can't remember the exact speed, thousands of cards a minute. We felt we had one of the highest speed cardreaders in the world. We had paper tape readers processing thousands of characters per second, if I remember right -- maybe it was per minute. I can't remember. Tremendous speeds. I could get those exact figures if you need them. We spent a lot of money on those type of devices. We also decided that high-speed line printers were a significant factor and bought NCR from the Shepherd Laboratories somewhere in the mid '50s, a drum printer design. We proceeded to improve that and turned out a lot of drum printers out of NCR itself in the '60s.

ASPRAY: Shepherd Laboratories?

RENCH: Yes, it was over in New Jersey somewhere. A one-man show. If you ever want to go back into history, you'll find that Shepherd had a significant position in the whole world in rotating drum printers. Anyway we bought his design. In fact, we used some of his models for print quality and solenoid/hammer design evaluation. We also entered into major contract work with Ampex in Redwood City, California, to turn out a very special type of mag tape for file management in the late '50s.

ASPRAY: Can you compare NCR's work on peripheral devices with the other major companies in the development of computers?

RENCH: Well, I'm not sure I can do a total job on that. We spent a lot of money of course. We spent millions of dollars on these particular high speed devices and the printers. We also, and I think I mentioned this earlier, spent a lot on random access memory drives at our Hawthorne facility which became our CRAM (Card Random Access
Memory). We spent a lot of money on that, feeling that we had to solve the problem of access to this data. We had to do that access in a hell of a hurry if (the records were to be updated effectively). We also did not want to be totally limited to batch processing. The high-speed paper tape input, the optical detail strip reading, and the high-speed card reading only meant that you were really going to, in the end, collect a lot of information and then read it at high speed into the system on a batch basis. Then you were faced with batch processing, with all the internal sorting and organizing of the data associated with that. We sure didn’t want to sort the cards and the data before we put it into the machine. It was obvious that a lot of business in the future could be handled by direct ties to wherever the data was captured. We said, “Gee, we’ve got a great place to go. We’ve got those teller terminals. Why don’t we just tie them directly to the computer some way.” But you can’t do that unless you can some way access the file in a random way. So, in the late ’50s, Hawthorne spent a considerable amount of money on different optional techniques of storing and accessing the file data. Oh, we looked at discs. We looked at the CRAM cards we ended up with. We looked at tape strips and all kinds of things. We had a heck of a big investigation going on. Don Eckdahl really headed that up with his research group out there in a big way. Then we turned out the Card Random Access Memory we used in the early ’60s for on-line systems. I can’t tell you what other companies beat us to the punch; I really don’t know. But when you look at the Bowery Savings Bank or the other banks in the New York area (a lot of these were on the East coast), we obviously had the big on-line business for a long period in that part of the world. Later, as you know, The Sumitoma Bank in Japan became probably the largest on-line system in the world. That was our installation. So we went from the high-speed batch input to the random access file management system and on-line systems in the early ’60s.

ASPRAY: Now when the company pulled back from the CRC 102D, or maybe it was called the NCR 102D...

RENCHE: Probably was.

ASPRAY: What activities went on until the time of the 303/304 in 1957 through 1959? Was there any type of development work on electronic computing devices?
RENCH: Well, there was. Remember we had advance work always going on at Hawthorne. We had actually what we called a research department out there. They were doing all types of work on advanced computer techniques. The people in Dayton, Ohio, were not, however. By that time they had pulled back -- well, I have to be careful of that. That's not fair. We did have a group, Advanced Development under Joe Desch (it was not under my management at the time), that was looking into advanced techniques for very small computer systems. I can't remember the dates on this, but Tom Holloran here locally could tell you date when he turned out a small computer using the Class 31 as a console. I can't remember the exact date on that.

ASPRAY: Can you remember the name of the machine?

RENCH: Well, later on we turned it into a production machine called the 390. But he had another name for it and I can't remember. I think he pioneered that in the late 1950s. We'll have to check with him. Maybe I've got my dates mixed up on that. Tom Holloran, in many ways, was the internal seer, prognosticator and dreamer on very small computer systems.

ASPRAY: Now in 1955, if I'm correct, the Post-Tronic was introduced.

RENCH: Yes, I think that was the year.

ASPRAY: Ok. Can you describe the machine to me?

RENCH: Sure. The Post-Tronic was built upon the basic mechanism of the 2000 System, the old 2000 mechanical machine, but it had major enhancements put into it for moving a ledger card in and out of its mechanism and reading the magnetic stripes on the back of the ledger card. The timing was very carefully designed into the machine; for instance, as the ledger card moved in and read certain signals it actually stopped certain mechanism motions in the basic machine, so that you transferred the digital information on the stripes directly into mechanism positions inside of the mechanical machine. It had a large keyboard on it for doing the entry of any kind of deposit that you made in
your bank to your bank statement. It allowed you to enter the kind of checks that you withdrew so that you could keep a full record of your account in the bank -- all your withdrawals, all your deposits, all your business with the bank. Then the mechanism did the calculation of all this information and then as it pushed the ledger card out, it restored the new balance information on the stripes in the back of the card, so the information was there for the next operation. You read the old balance and made your entries on the machine for the period of time that you collected this customer's particular information. Then the calculations were done, the printing done on the front of the ledger card and the posting done on the back in the sense of storing the new balance information on magnetic stripes.

ASPRAY: How successful was this product?

RENCH: I have to give a little background before I tell you that. The company was really mixed up as to whether this product was going to take the marketplace by storm or was going to die because of lack of interest. It was a product that had a very special purpose. It did fit some of the type of sales capability that we had, but obviously the fact that it didn't have a new file system and automatic input system (except for the old balance line), it looked like it might be restrictive. So there was a group of people inside the company that said, "It'll never fly." There was another group of people that said, "Give me the chance. I'll make it fly." And they really argued internally as to what to do about that product. A fellow by the name of Owen Gardner, who was a very senior manager of marketing at the time, told Mr. Allen, "Give me a chance and I'll get your money back." Owen Gardner is a fantastic salesman. He put that machine on the market and sold so many more than we ever anticipated producing that it became a fantastic success for the corporation. Roy Phelan, himself, told about how they at Burroughs didn't think the machine could fly, and he said when they saw the success of it, they were scared to death. But it was exactly something that the banks wanted because it took away the fears that the balance information would be mishandled by an operator. It did speed up the posting operation. They gained two benefits: much higher accuracy and higher speed operation. With the capability of the NCR salesman, it was very, very profitable for NCR. Neil Jorgenson, the current Vice-President of Manufacturing of the corporation, at that time was the electronic engineer on the job. He did a very fine job in designing his elements of it. And a fellow by the name of Konrad Rausch, who was a department head and a good, German type of engineer, turned out a fine mechanism. It was a good machine.
ASPRAY: This was developed here in Dayton?

RENCH: Yes, yes.

ASPRAY: Was there discussion at the time in the company about the impact that these electronic computers were going to have on the marketing of machines such as the Post-Tronic? What was the relationship between the two?

RENCH: Well, I can't give you all of that [information] because I wasn't privy to it. But yes, there was discussions about "This is a special purpose machine and computers -- what will that do in the future?" -- discussion that maybe the Post-Tronics life in the marketplace wouldn't be long because of the... but I can't give all that because I'm not all that knowledgeable about that.

ASPRAY: Who would be able to?

RENCH: Well, I think Neil Jorgenson, our Vice-President of Manufacturing, could. Neil was very close to it and also he worked with banks there-after in successful installations. He knows a lot about the whole process at the time. However, both he and I were fairly junior in the corporation by comparison to later years, so we may not have heard all the strategy discussions by any means. Who the heck would be the strategy guy? Well, the fellow who would know the most about it is Charles Keenoy. I think he was Vice-President of Engineering at the time and [was in charge of] development and product planning. I believe he had that role at that time. And Keenoy would have been right in the heart of all that strategy discussion. Now, he's a retiree, probably in town.

ASPRAY: Let's move on the development of the 303 and 304 machines. Now, if I have the story straight, the first consideration was to market a 303 which would be an entirely vacuum tube machine. The company then decided it would take the initiative to try to develop transistorized machines. Maybe you can fill in some of the details.

RENCH: No, that's essentially it. At the inception the plan had been to come out with a new machine that was going
to have high-speed input, capable of really gobbling up the information. It was recognized that the 102D was constipated, as we always called it in those days, we needed something else to do that. The thought was that we'd come up with a machine that would solve that problem. Since we were a diode and a vacuum tube company at that time, the thought was that you'd go in that direction, and that would be a 303 type machine. I can't put a focus on time in all this, but I remember a great discussion [where we thought], "My God, getting away from germanium and going to silicon now, there wouldn't be all that heat sensitivity problems you have with germanium types." That had held us back [from transistorizing] as it did for a lot of people for quite a while. "Gee, with a whole new family of silicon transistor products coming forth we better take advantage of it, and we've got the opening to do that." In any event, Eckdahl came to Dayton with a proposal to go that direction. It would take a little longer to get there and a little more money, but we felt that the benefits were outstanding. I'm lost in the details of the decisions, but I remember working with Desch and Eckdahl, the three of us, making a recommendation that management go in that direction.

ASPRAY: How far had the plans for the 303 proceeded?

RENCH: Well, I can't answer that exactly. Don Eckdahl could answer that. In the meantime, remember, there was another move going on in the corporation. Allyn and the Chairman of the Board of General Electric got together and decided they should find a better way for the two companies to use their resources and assets. They just felt that we didn't have the problem of overlapping markets, but we certainly had an overlap of product need. Why couldn't we find a way to work that out? Also, as you probably know, somewhere in there (and I can't remember the dates of this either exactly) the whole B[ank] of A[merica], maybe A[merican] B[anking] A[ssociation] plan was rearing its head.

ASPRAY: I'm not familiar with that.

RENCH: American Banking Association and MICR (Magnetic Ink Character Recognition).

ASPRAY: Oh, yes.
RENCH: Stanford and then later SRI was deeply involved, GE was involved and we were involved. I can't put it all together in my mind on the history, but in any event, Allyn talked to the top man there [at GE] and they said, "Gee, why can't we find a way to work together to develop these products? You've got to spend money. We've got to spend money to find the best answer. So we made a tour of the research facilities in Schenectady or Syracuse. I can't remember.

ASPRAY: Schenectady.

RENCH: Schenectady. Gee, that's a long time ago. We were very impressed at that time with what they were doing in research. We came back and Allyn really wanted to go ahead with using the resources of that organization. See, the thought would have been if we'd stayed the way we were, Hawthorne would do the original design. Then we would do a fast production cut on it and turn it into a production product for Dayton, Ohio rather than the Hawthorne facility. (By that time they had decided most of the production was going to be in Dayton.) (Inaudible comments) In any event the decision was that there was going to be a lot of production in Dayton, and they were probably also going to do the central processor production in Dayton. In any event, after the Schenectady visit we said "We have limited resources in Dayton. Unless they want to expand the resources in Hawthorne, it looks like a good opportunity to consider going with GE. Also, maybe we can get the advantages of volume. They could use some of our parts. We could use some of their parts. We should find the best solution on that." So they entered into a gentleman's agreement which was put into a development contract later. We thought they were going to do it in Schenectady. Then they announced they were going to Phoenix. Phoenix. That didn't scare us particularly, except that we did know that the resources we had seen in New York state and Schenectady, would not be used. They would have to drag a whole new crew together for the Phoenix operation, but we felt they also had the resource to do that. And as you know, they did set up the operation therefore in Phoenix on Black Canyon Highway.

ASPRAY: Do you remember the major people?
RENCH: I remember the guy I worked with all the time down there who managed the development for us, Bob Wooley. Terry Lasher was one of the general managers down there at one time. I can't remember the general managers; Joe Desch may recall some. But Bob Wooley was my counterpart. I managed the contract from here. He managed it from down there. Well, anyway, the advanced work on the transistorized circuits were passed from Hawthorne to GE. GE took advantage of that advanced work. Remember now, the Ekdahl 303 activity had turned into transistorized activity. And of course we wanted GE to continue on the transistor program and they certainly concurred with that. They wanted to do that with their product line also. They were going to build a central processor for ERMA; that's the reason why I brought in the B of A, I mean the ABA, the whole standards activity on Magnetic Ink Character recognition, and then the ERMA project for the Bank of America. They were going to build that in a contract. We thought that we'd probably be able to use common design or parts between the two. That did not turn out to be practical. That did not come about. In any event, the GE engineers traveled a lot to Hawthorne. They certainly spent a lot of time in Dayton. Dayton was going to do all the peripheral design and production as we had planned earlier, and we did do that as I mentioned a few moments ago to you... The specification control was under my management. I set up a systems requirement department. Tom Mitter, who is in the company today, was my key man in the department. He's still one of our senior product planners. We set up a liaison organization in Phoenix under Armand Miller. Maybe you've heard of Miller in your searches.

ASPRAY: He's sounds vaguely familiar.

RENCH: He designed a disk system after he left us, up in the Bay area, in-contact heads. I think it was bought up by Ampex. I'm not sure. Remember now we had this high-speed actuator development contract out of Dayton with Ampex for the tape deck. Bob Wooley was the GE resident person in Phoenix managing the central processor and the controller design. And we needed a very special tape controller. What we said was we were going to process high volumes of data through the system.

TAPE 2/SIDE 2
RENCH: The controller, therefore, for the magnetic tape was designed to manage gapless tape -- gapless between records. I forget the precise nature of how we did that, but it required a very great degree of accuracy in the design of the actuators for driving the tape. So, Ampex had a very special contract with us to bring forth the high precision necessary for managing the tape drives. What else should I go into?

ASPRAY: Are there other technical problems involved in the design or the features of the equipment?

RENCH: Well, GE designed basic boards that were probably as reliable as anybody ever had in the industry at that time. The flip-flop circuits, all the drivers or anything that they had were extremely reliable because the transistor design just gave us a whole new world. The thing we had to be careful of was just a plain old connector quality problem. When you push a board into a connector, are you making good contact? We also designed a family of circuits then in Dayton for peripherals. The 304 system was a pretty methodical design from the ground-up in the sense that it used very standard families of circuits for different peripherals and it used a very standard inter-unit communication system. It was a well-architected system at that time and we were able to run huge volumes of information through the unit very fast. We did use our line printers on it and I'd have to say the first system installations almost went better than we could dream. The first one, if I remember correctly, was at Camp Pendleton, a Marine installation. We not only shipped a good unit, but we had one of the top-notch guys managing the installation and he really did a great job. We had some very fine results from that installation. The 304 was a good system. The problem that we ran into was that we had designed it too well, the cost was too high. Therefore, in order to manage the profit margin properly, we had just needed to price it too high. Ultimately, the 304, although it did a good job in entering certain markets for us, had to be withdrawn because it just wasn't profitable enough for the corporation.

ASPRAY: Let me read you a statement that came out of a recent book on IBM and U.S. Data Processing Industry. "Although senior NCR managers testified that the 304 was NCR's major entry into general purpose computing systems, it's marketing strategy was to sell the 304 to selected customers only, since this was product was considered as an experimental entry in the EDP marketplace." Do you recall that?
RENCH: No, I don't recall that. In fact, when you say experimental, I would say that that's not quite an accurate statement. We felt that we were entering our field of endeavors. If that's selective I guess that could be thought of as being shrewd then. For instance, we felt that we were striking at the large department stores, large retail industries in general and if that proved successful then the large banks would also fall in line because we could use the power of the system for processing those large volumes of data. But, we definitely were aiming at those large retail operations.

ASPRAY: I remember Johnson Wax Company was one of the big companies.

RENCH: Yes. In fact, I visited that installation several times and that beautiful Wright design building of theirs... Where is that Racine? I'm trying to remember.

ASPRAY: It's in that area of Wisconsin, I think.

RENCH: Yes. But, that building in itself was a sight.

ASPRAY: I understand that the 304 was installed eventually in 33 locations.

RENCH: That's probably right.

ASPRAY: So, how successful does the company view it then?

RENCH: Well, the company obviously felt that from the viewpoint of experience and technology and getting it's feet totally wet in the business equipment world, it had been very successful. Financially, it was not a success.

ASPRAY: I understand it was a very large amount of money in spending and in the development.
RENCH: That's right.

ASPRAY: This was probably the most expensive venture that the company had ever had.

RENCH: To that point in time, that may be true, yes. I do know that there was two facets that were disappointments, of course. One is we did spend more money than anticipated and the second we didn't get the volume we expected out of it. So, when you come right down to it, it did turn out to be a financial problem.

ASPRAY: In hind sight, how did the cooperative venture with GE work out?

RENCH: Well, I don't think we gained the objectives we thought we were going to gain. I don't mean that in a nasty sense because undoubtedly, both companies were learning as to how to get this business really rolling. But, we anticipated more common usage of parts and elements between ERMA computers and other computers that GE was building and ours. That didn't work out. We also anticipated it might be the advantage of the joint development itself, but that didn't work out. It essentially ended up as a special development for NCR. Now, maybe that was our fault because we were pushing this specification in a certain direction, which we felt was essential for the kind of work that we had to face up to. In any event, I think they felt the same way. On the other hand some of the things that they wished to exploit they couldn't manage with us because of our perceived needs.

ASPRAY: One author who's written about the industry has claimed that because of the decision to have GE do the work with the transistors primarily, that the company lost some valuable experience it would have gained and that subsequently the company had reliability problems with its future developments and transistors.

RENCH: Oh, I don't think that's true at all. I'd refute that 100%. In the first place, we designed many, many circuits in Dayton, Ohio; granted, not for central processor work, but transistorized circuits for peripheral use. We were very successful in those. In the meantime, while the development was going on, every facet of information about
problems, reliability, component selection, and vendor management was fed thoroughly to our Hawthorne facility. Hawthorne was tracking that completely in an advanced work sense. So, when the 315 came out, the 315 had the advantage of all kinds of inputs from the 304 product.

ASPRAY: How did the group of researchers in Hawthorne learn the new transistor technology? Do you know anything about that or should I ask Eckdahl about that question?

RENCH: Well, I think Eckdahl would be a better source, but certainly we spent money there. We spent advanced development dollars there and they kept a cadre of people diligently working in that area. They also worked with us on advice and counsel and problem analysis of the 304 family.

ASPRAY: Can you give me some idea of how large the R & D team was? Hawthorne and here?

RENCH: Well, we probably had here two or three hundred people. I can't answer directly on Hawthorne, but I would imagine about that time they were in the 100-150 range. Don would give you a better figure than I. It may have been bigger than that, come to think of it, because I remember they had supporting service requirements and total independent facility requirements. So, in a total sense, it may have been larger.

ASPRAY: This brings up a topic that's a little off to the side, but I'll bring it up now anyway. Did the R & D people, whether they were at Hawthorne or here, have any responsibility for service, for going out to sites if there were problems on jobs?

RENCH: Well, our philosophy at NCR for many years has been that the development guy -- I'm talking now about not the advanced developer or a researcher, I'm talking about a person that was given the project responsibility of the development -- is never done until he has had a successful product in the field. We've had that in place for a long time around here. So, you see, in the late '50s and early '60s, when the 304 and the 315 were going into the field, our project people who were initially on a project, followed right in the field on all problem and complaint solving. By the
way, we don't tend to drop things over the fence from one development group to the other. We tend not to do that in the corporation. And there's good and bad about that of course.

ASPRAY: Would you like to expand on that?

RENCH: Sure. The good is that, you know, you know what accountability is and you know who's going to help solve the problems in the end and they'll have a total history of the project development. They'll know everything from design inception, through production and into field use, everything so they can relate all the factors together and the problem's solved. The bad is that if you have a very creative person that you've used in the inception process and you hang on to him through the total field success process, you may be wasting a creative guy. So, we do at times spin a couple of guys out of the organization, but we don't spin the key accountable person out of the organization. We hang on to them and push them right through to the ultimate success.

ASPRAY: How much of a gamble was it to make the decision to go fully transistorized with the 304?

RENCH: Well, looking back, you could say it wasn't much of a gamble at all, but at that time, to us, it was a big gamble. We were faced with the unknowns on absolute reliability, although we had a lot of testing at that time of different circuits under different environmental conditions. We were faced with the question, "Is the industry going to stay this way?", and, "Are you going to have continued sources of the product and good vendor relationships?" (because we didn't produce those things). You really had to bet your whole program on the cost characteristics. It was tough. Remember, a lot of us were also old tube circuit designers and that in itself was a problem. There was a whole new breed of young engineers telling us the advantages of these current type devices and everything. We had a little problem of shifting our gears, technically.

ASPRAY: In the 1955-6-7-8 annual reports there are very strong statements to the effect that the company has an evolutionary rather than revolutionary attitude towards the development of electronic business equipment and it said that they would start with some basic product that they could put out and then add various peripherals and control
devices and then eventually build into a full electronic system with perhaps a computer at the base of it. The
Post-Tronic seems to be a good example of that, starting with that and adding devices and then a control unit and
then later on report generators. Do you think that's a fair statement of the company's philosophy?

RENCH: Yes, I think so. I'll have to admit, trying to think back in that time frame I'm a little confused as to how we
meant that. But, generally speaking, the company has said, "Well, gee, we're going to provide a service to a customer
in a field of activity where he needs a product and a capability and most likely he will need to expand that capability
with time and we will grow with the customer and with his product needs." I presume that some of that statement is
related to that desire. For instance, if more report generation was necessary from a Post-Tronic something, we
probably would be able to add some output to this system which would give some automatic way of feeding data
into another system for doing analysis work. We always tended to say that the guy's going to need more and we will
provide that in time. He can't afford it all at once usually, either. He will want to grow on capabilities.

ASPRAY: I somehow see NCR's philosophy as being contrasted with IBM's at that time, IBM saying, "Let's go
whole-hog with the modern electronic computer and see that it can replace the previous kind of business equipment,
but let's go with this big system right away."

RENCH: Well, I think you're right, except that in a sense, looking at IBM, remember they had card-in and card-out of
the new computer just like an old tab system for many years. So, did they do as much change as they talked about in
some cases? Well, I don't think so. Obviously, they were pushing new systems, probably much more so than we.
We were still trying to grow with customers. By the way, it may well be that one of the differences between the two
companies for many years was the IBM lease -- base of equipment out there, which NCR did not have. We were a
selling company. On the other hand, we had a very religious attitude towards protecting the inventory and asset of
our customers. If the customers had bought 1,000 cash registers, we didn't feel that it made any sense to make those
obsolete over night for him. What we felt an obligation to do was to help them take advantage of that investment by
adding functions and features to it. Even if necessary, to retrofitting those and adding to them in the field. In the late
'60s and the early '70s, when we had to face a total conversion of all the terminal type of equipment, we had - even
then -- we had a heck of a time saying how, if Sears had 10,000 of a particular type of cash register, how can we help them take advantage of that while we bring out the new electronic machine to sit beside it. We just felt that we had to help those people with those huge inventories. Now, maybe IBM didn't have that same feeling, I don't know.

ASPRAY: I'm not sure, either, though... In 1958, the company introduced at least three new products, Computronic, tape recorder and NEAM.

RENCH: That's the one. National Electronic Accounting Machine. That's the one that uses the little computer with the 31 console. I couldn't remember the date.

ASPRAY: I see. O.K.

RENCH: Well, did we actually introduce NEAM at that time or did we just announce it at that time?

ASPRAY: As far as my records show that it was introduced then.

RENCH: I will tell you about the Computronic and don't laugh. The Computronic, (don't use this the wrong way), was essentially a device that was developed in the '40s. It was nothing but an electronic multiplier (I guess it has division on it too, I forget) added to an accounting machine. I developed, myself, the basic circuits for that unit in the '40s. We thought it was going to be produced by 1955. It was not produced until what I considered was too late in corporate circles. The market window would have been, I believe, before '55, very reasonable for our type of product and sales and customers. By '55, I think the market window was too late. Nevertheless, they brought it out as just a calculator element on top of the old class 31 machine. They did sell a certain number of those. I guess I feel more pinched about that particular product than anybody because I developed the circuits in 1947 and 8 and it really truly wasn't produced until late. It was somewhat redesigned obviously by the time it came out. They used the same names for the circuit types as I had put together in 1947 and 8. The NEAM, National Electronic Accounting Machine, if I remember right, is the one where we did use the name for the first time... Are you sure it was that time for
the NEAM?

ASPRAY: I may be wrong about that.

RENCH: We didn't introduce the product to the marketplace I'm sure. I've got to check that one out. My remembrance of the NEAM is this: we did a special design, which we gave up about '57 or '58 and turned all of our attention to the other product lines, the computer-based product lines. I thought NEAM was killed. The NEAM was a special purpose type of electronic design to process data from our cash registers and accounting machines at very high speeds. In light of the various programs, stored program computers, the company felt that the special purpose design was not going to accomplish its objective and it should be canceled. It was canceled somewhere around '57 or '58.

ASPRAY: The only thing I can tell you about the tape recorder was, "which makes a data processing input device of the cash register, accounting machine, or adding machine. It's also been on the market for some time."

RENCH: O.K. That would have been I'm pretty sure what we called the class 461 paper tape punch, which essentially from the various kinds of accounting machines and cash registers could take the data and put it in tape, and then, since we had these high-speed tape readers for our computers and other devices, we could slam that data into the computer at high speed. We sold hundreds of thousands of 461, a high quantity around the world.

ASPRAY: Were these used with a variety of computers or primarily just with NCR?

RENCH: You could use them with anybody's computer. In fact, that was part of our idea that we said, "Well, gee, we have the data capturing capability, why don't we make that available to anybody else's system. Obviously, we'll make it very effective on our systems, but we'll make it available to anyone." One of the things they did, which I felt was a little ineffective, some of the customers took the tape and converted it to cards and put it into the system. But, nonetheless, it became widespread in capturing unit data.
ASPRAY: The next product that I know about is the 310. Now, I understand that this was a machine that wasn't actually designed by NCR but was taken from Control Data.

RENCH: That's true. We needed a very small high-speed processor that could process our paper tapes with a very low-cost high-speed paper tape reader and the 310 seemed to be a natural when we saw it announced. It was actually the CDC 160 and we purchased it from CDC and renamed it our 310. If I remember correctly, we put the paper tape reader on it. We did find a few small electronic bugs in it and we helped CDC correct those. Seymour Cray thanked me one day for helping him correct the memory design and I'll always remember that. In fact, Bill Norris was riding in an airplane with our, then, Vice President of Product Planning, a fellow by the name of Bill Carroll and he told him how good the relationship was between the two companies as we purchased this unit and used it and he also thanked Bill Carroll for correcting the memory design. And I'll tell you, when you correct a memory design that Seymour Cray has done, you feel like a hero. In any event, the 310 product was sold in small quantities around the country to process tapes. I forget the total utilization or quantity we had with that machine.

ASPRAY: Was there any natural reason to go with CDC -- a cooperative venture with CDC?

RENCH: Well, I think we had a good feeling for the CDC management because of Bill Norris. This had come about years before by Joe Desch and Bill Norris being good friends. We also had some engineers that had gone to CDC and had come back to visit with us and they told us about the technical programs in progress at CDC. One of those guys that did come back and visit with me was Howard Shekels. So, we had a good feeling for their technology and their strength and the fact that Bill Norris was a good friend of ours.

ASPRAY: I have the feeling that it was a quite valuable venture for CDC because at that time they have all this technical expertise, but they were having, still are having quite severe financial problems and being able to spend the money to develop...
RENCH: Well, we kind of believed that we were one of their white knight's at the time, yes.

ASPRAY: One thing that I've read about the 310 was that NCR had trouble with sales of the machine because they made the decision to have it sold by the machine salesman who had been selling accounting machines rather than in the way that the 304 had been sold.

RENCH: Yes, I think that's true. We had this transition problem, the machine salesman getting in the systems business and I think the 310 probably had some problems of that nature. That lasted for quite a while, too, in some parts of the company.

ASPRAY: Do you want to say anything more about that?

RENCH: Well, it's a personal view of mine. You have to put this in perspective. Rench was a developer. Rench was very close to manufacturing and very close to certain marketeers, but not basically accountable for marketing results. I always felt that the strength of the company in marketing was also its weakness, in that the people built up these tremendous relationships with the customers, these salesmen that had these close and useful contacts with the customers had them so close knit, that when it came to a new system, a new technique of doing business, they saw that more as a conflict or an affront to that relationship that they'd built up, rather than a tool or an aid. So, I felt that part of our original problem of getting to the marketplace was the fact that the salesmen [did not desire to sell systems]. I'll forget the capability viewpoint, you can argue that pro or con all you want to, because we always said our salesmen knew the customers systems. And a lot of our salesmen did know the customer's systems. They knew how every piece of information was processed from the beginning to the end in a customer's house. But, I believe that the incentive was not proper for them to desire to sell systems.

ASPRAY: O.K. Let me read you a rather strongly worded, fairly negative comment about NCR marketing so that you have a chance to respond to it; it's in the press. "Like Burroughs and UNIVAC, NCR faced the problem of fitting computers into its sales operation. Should the company hire computer salesmen or train its own salesmen in
computers? Who should sell what? Are the computer men kept aside as a chaise intellectual elite or do they mingle with the accounting machine people and does the customer see only one NCR salesman or several pushing different product lines? And how on earth do you pay everybody? For NCR with its core of aggressive, individualistic, well-paid, old-time drummers, these issues seem particularly difficult to resolve and the company was revising its method of assignment and compensation, which were probably the most complicated in the industry well into the '70s. After all, all computers were sold from the home office. Later, the computer salesmen were distributed among the larger branch offices, but by this time they had lost their knowledge and inclination to cover the territory. They would sit in their offices waiting for the telephone to ring. Their accounting machine colleagues turned into hard-driving competitors. 'Why buy computers?', said the man on the beat to the customer, 'when three accounting machines will do.' No accounting machine salesman in his right mind would give up a commission to a computer salesman. He called his colleague only when his customer seemed dead-set on IBM and then the computer salesman would spend six months trying vainly to rescue the account."

RENCH: Well, that's a very vivid description. I can't answer that in great detail since I wasn't in charge of the marketing, but I think my previous comments indicated that there was a threat which was not resolved, because the salesman had the strength in the marketplace. Therefore, I concur with that. Of course, Bill Anderson understood that well when he came to Dayton in the '70s and he worked assiduously with his knowledge to solve that problem. And, when he solved it, it became a bloody situation in the company. I can tell you it was very bloody in the middle '70s as the marketing arm was being reorganized. I don't want to be quoted on that. I think marketers should talk about it rather than me, but I can tell you right now, that to reconstitute, change it, and have a new direction, it hurt a lot of those old-timers. It hurt them badly.

ASPRAY: I understand that the 310 was a vacuum tube machine. It seems awfully late for a company to be marketing a vacuum tube machine.

RENCH: Yes, I agree. I think that the 310 was only expected to have a special niche in our needs and not to be a long term product. We didn't anticipate selling huge volumes then, we just anticipated filling that particular niche for
reading the tapes and putting out the data in such a fashion that we could satisfy certain customers. So, the strategy was just a niche filler.

ASPRAY: I see, and it succeeded in doing that.

RENCH: As far as I'm concerned it did, yes. I can't tell you the actual volume, but I do know that we delivered quite a few to customers that had the need for tape reading and it worked.

RENCH: Okay, let me tell you how the business units operate. They each have a charter. Let me give you a few examples of charters. Our Rancho Bernardo facility has a mainframe charter. Now mainframe to us is not a huge processing unit; it's our 85-8600 Class or our 9300 Class. We consider that a reasonable mainframe business.

Columbia, South Carolina has the next smaller size of computer engines. Our Tower system comes out of there, which is based on the M68000. A facility like Wichita has peripherals and disk responsibility. Now a lot of their stuff they actually buy, process and stick some electronics on it and sort of integrate it into our system. So in some ways they are luckier than some of the others -- they can depend on other vendors to provide them equipment which in turns allows them to provide the peripherals to the rest of the company. Cambridge, Ohio has certain point-of-sales system responsibilities. Oiso, Japan has smaller electronic cash register responsibilities. Dundee, Scotland, for instance, has the automatic teller machine responsibilities. Waterloo, Canada has all the proof and encoder responsibilities for banks. Orlando, Florida has responsibilities for manufacturing floor systems. Ithaca, New York for general purpose terminals. That gives you an idea of some charters. Let me give you some other things. We have in addition to the plants that don't have a large marketing arm, some integrated business units out there which have their own total marketing arm. Comten in Minneapolis has their own marketing arm and their own total P&L -- they're almost like a separate company. Bill Gotschall, head of that organization, is called President. As you probably know, if you know
Comten, they essentially do front-end processors primarily for an IBM environment. I think almost all of their installations are. No, I take that back. Well, I'm not sure. But a hell of a lot of what they turn out is for front ending into IBM systems. They sell an awful lot of stuff to AT&T. I presume also those for IBM front-ends somehow, I'm not sure. Their largest customer is AT&T. Our largest company customer is AT&T, I think. ADDS, Hauppauge, Long Island is a totally integrated unit. Our Micrographics Division in, I think it's Mountain-View, California is a totally integrated unit. Each one of those survives on their own. System Media is a totally integrated unit. Now that, primarily, as you probably know, is the one that handles all of our forms, media supplies and the like.

Those are the integrated units and they have their marketing arms. Now they may use some other resources within the corporation, but they really have all, in general, responsibility for all of their marketing. The other plants, what we call our development production (D & P) plants which are business units in this new commercialized sense, are allowed to have marketing departments and people but not a huge sales force. They must sell to our large marketing arms. As you know our USDPG (U.S. Data Processing Group) is a mass of people across the nation in hundreds of offices that both sell and service our main product line. These D&P business units must sell to them. They must sell on a reference price basis (a list price type of thing, allowing certain discounts). They must provide all kinds of information base so that the marketing arm can develop their own service aids and whatever they need. In other words, good documentation must flow from the D&P business units to those marketing arms. This includes European marketing arms, the Middle East and Africa marketing arm, the Far East marketing arm, and the South American, Latin American marketing arms. Each one of those marketing arms are located here at headquarters. They have a vice-president and they have a reasonably sized staff, as necessary, to manage their relationship with all the different countries in their region. We don't call them regions anymore, I got called out on that the other day. We call them "groups". I'll call them regions for a while. Those regions have, obviously, no rights to absolutely tell each and every country what to do. Each country is a wholly owned subsidiary in turn. Britain has its own internal company. We wholly own that. We wholly own the company in Germany, etc. So there is a lot of local responsibility in those companies to do their own thing. They're allowed to buy products from the outside. USDPG is allowed to buy on the outside. If they don't want to buy it from our internal units, they can buy it from the outside. The commercialization has gone so far that there's concern that they might buy too much on the outside. But that's the risk that Exley and
Anderson feel is rational to take in this thing. By that I mean they're forcing the D&P production units to be competitive as they see it. Otherwise, USDPG would try to sell what they had to sell if it was a forced situation, and there'd be no internal competition. Or there would be no way of internally seeking a level of success automatically, other than by some forced play. Let's take RB for example; that might be our best example. If RB products are not deemed to be the type of products that USDPG can sell and USDPG really wanted to go to DEC to by on an OEM basis, they would be allowed to do that. Now, there's two factors that would probably keep them from taking that too seriously. One is that the internal discount is better than an OEM discount from DEC. That's the first thing. The second thing is if they're smart (and they are) they communicate with Rancho Bernardo about their future needs. So Rancho Bernardo has a leg up on knowing where the future lies in the minds of USDPG. And so if Rancho Bernardo does their planning right and applies their technology correctly, they should always have a built in advantage for selling to our U.S. marketing arm. We'll see if that happens in the future. It's easier to say that perhaps for some of our retail products or even some of our financial products. You take the proof machine product line. We're probably the predominite proof machine manufacturer in the world. You take our ATMs [Automatic Teller Machines]. Outside the U.S. we are the largest supplier of ATMs. That's not true of the U.S. Diebold has a good handle on this product in the market place in this country, and IBM is strong too. But outside the U.S. we are the largest supplier. The guy in charge of the operation in Dundee [where ATMs are designed and produced] is a phenomenal entrepreneur. I just know, with his skill and capability, he is absolutely wily in this business. I wish we had about twenty of him. He's going to turn the U.S around too, I can see it coming.

ASPRAY: Who is this?

RENCH: Well, you wouldn't know him. Jim Adamson is his name. He is our general manager. But he is a real entrepreneur. And we need about twenty more like him. We have some other good entrepreneurs, don't get me wrong, but this guy is good. The process is bloody. If the organization can't survive, it dies. And we've had some deaths in organizations. At the same time some of the business units are entering into new business opportunities and building new sub-business units which in turn become free-standing business units. We have, as you probably saw in our film today, a major effort in automatic ticketing system machines which we hope to sell a reasonable
number to airlines, bus companies, and other services. We have a version of the same machine being used for hotel check-out. After all, if you can handle information like the ticketing machine, you can sure handle a check-out. And you know and I know that hotel check-out is a pain in the neck. We have used elements of that machine and other machines in another opportunity at the gasoline station. You probably saw that in our film, where you can go into a self-service station and self-service yourself -- just get your gasoline, put your card in and let the card do the job for you. Who knows how far they'll go. We call this our public service sector. We hired some outside consultants and we did a big research job on the question, "How can we help the business units consider what public sector products require?" We gave them a big study and a walk-through of all kinds of mockups, and models and considerations. With automation going the way it is, you and I as the end consumer and user of a particular service will interact directly with the system rather than through a clerk. We think it is going to be a major growth area and we want to be there in a big way.

ASPRAY: How does this organizational structure work with any of your government or military contracts?

RENCHE: What government and military contracts? We have so little business in contract government work that we stink. We're just not in that business. However, we provide computers to a lot of county offices and sheriffs’ offices. We provide a lot of stuff to -- what do you call it these days, post exchanges? Whatever the military retail operations are for their personnel. We provide a lot of stuff there. We have had major relationships with the U.S. Postal Service in designing and providing special models of our devices for the post offices. I can't tell you where that's going cause a lot of that is still in the study stage. But the pure government contract business, in a classical sense, that Control Data, IBM, and others do -- we have not been in that business.

ASPRAY: Is that historically true?

RENCHE: Yes. During non-war years that's historically true. The reason is very simple in the minds of past management. Whether that will continue, I don't know. That always requires commitment to a customer that has a great moral control over you. If you start defaulting on a contract you ethically feel you have to pour resources into
it to satisfy that particular customer. That's the way NCR would feel at least, regardless of how much money you were going to lose or make. [This would] divert the resources from the commercial market. So NCR has said that we're not going to do that. [We have suggested and at one time we felt we were going to do it. We set up a division and acquired ECI to do only that and not entail the corporate management so to speak]. Back in the '60s, ECI in St. Petersburg, Florida. Electronics Communications, Inc. What they did was design air to air and air to ground communication systems for the Air Force and the Navy. They managed that well. It didn't work out too well for NCR. I don't know how much later it was, "X" years later, the organization had fallen in size rather than grown in size. We spun it off to Dressler Industries. So the company has, historically, very little interest in getting into the military contract business. We know those advanced technologies provide huge potential for advanced commercial technology if you have the right contract. That can feed capability across to parts of the corporation. We're not doing it.

ASPRAY: While we were off tape for a while you mentioned that there was a whole line of products that we hadn't talked about.

RENCH: I felt that we hadn't talked about the whole area of MICR, magnetic ink character recognition products, which we really pioneered heavily from the '50s to the '60s. The kinds of machines that work in the back office of every bank branch to process the checks that come into the counter of that branch. Those machines are either encoders for putting the magnetic ink code on the bottom of the check or they're encoders with proof operation, which means you sort the checks and keep track of information about what clearing bank they're going to go to or about what Federal reserve bank they are going to go to for further processing. [They will] in turn send them to the bank where the guy that wrote the check had his account. All of those proof machines and encoder machines during the '50s and '60s gave very fine cash flow to NCR [and] very fine profit margins. By the late '60s (I can't remember exactly) we were the predominant supplier of that kind of equipment to the banks. We were so successful that when we decentralized we decided we'd set up a plant that did that work alone. So we put that in our Waterloo plant in Canada. It solved two problems. The Canadian government was very anxious to have a product which was heavily exported to the U.S. And we knew the banks, our customers, we understood them well. Also we didn't want the
Canadian government to start putting any import duties on cash registers and the other products that we were flying across the border to the north. So they saw value added for exported products and jobs in Canada by our setting up the Waterloo facility. We saw that they would treat us kindly then in any legislation on import restrictions.

We had a small facility in Toronto for years which had taken machines and customized them for the Canadian market. It wasn't real large. It was successful in the sense that it helped us build a good strong Canadian market. But it wasn't going to have a long term benefit to us. So we established a facility in Waterloo. We knew the University of Waterloo was there and other good things about that area. That, in the '70s, has been an explosively successful operation. While we were successful in proof machines in the '60s, in the '70s we were far more successful. In fact, we were so successful I think it almost diverted us from some of the other things we should have spent time at, like electronics funds transfer. The selling force of the United States could always fall back on selling proof machines, which it did so well. We have banks just littered with the damn things everywhere across the nation. We must have between 60 and 70% of that business. Burroughs is in there, but they're about the only people besides us. It's a tough business. Handling media is not easy, but we had the art and the capability. We moved people to Waterloo, Canada. In fact my current director of engineering standards was moved up there as a chief engineer to get us started. Then he moved back later and had built quite a staff of competent people. That is one area.

Another area I think is something we should talk about. The company had always been strong in the cash register business and the check-out field at supermarkets and the like. Well, in the early '70s the Supermarket Institute decided that it had to help its members provide more automation in the supermarkets. So they formed committees and everything to study the situation and you probably know that they ended up with a uniform product code which is the bar code used on the supermarket merchandise. Our standards group, the same people that worked so well in the outside world... I have to give Dick Mindlin the most credit for that. He handled the MICR area and then later he handled the UPC area. He made sure we were right in the heart of all that out there. We helped the Supermarket Institute. IBM was in there heavy. They did a lot of technical work for the Supermarket Institute. We did too. But by the grace of God, since we were strong in supermarkets, we had the first field trial in Marsh's Supermarket in Troy, Ohio, my old hometown. We had the first field trial out there.
ASPRAY: This was when? What year was this?

RENCH: Oh, that must have been what? '73? I'm not actually sure, it's somewhere in that time. In any event, we had that up there. And we are now - we're the largest supplier of supermarket scanning systems in the United States. You know, we don't have this 60-70-80% of the business we had in cash registers at one time, in these new fields. We're the largest supplier. I don't know the actual percentage, whether it's 30% or 40%. I don't know. We have some fine competition -- IBM in that area and the data checker put out by National Semiconductor.

ASPRAY: While we're on that topic, what percentage of the cash register business do you have?

RENCH: What percentage in the United States? I don't know that I can answer that. I really don't know that I can. I have not seen the figures for a long time. What they tend to do is analyze the sales percentage not by the whole as you suggest, but by market sectors. It's not even fair to talk about the cash register business anymore. You have to talk about "What do I have in the general merchandise field?", which is the Sears', the Penny's, the Federated's and so forth. "What do I have in food distribution?", primarily the check-out at supermarket businesses.

ASPRAY: And this would include the point of sale terminals and some other equipment? Is that right?

RENCH: Yes. That's the other thing you get in to. Immediately you have the in-store computer and maybe there's host computers that you don't have. We interconnect with a heck of a lot IBM host computers from our store-level computers. They might maintain central files, central buying, all kinds of things. And as we process the data for the local people from our equipment, it may well be that they have two levels of reports coming out -- two levels of information. One from the store level, which not only control the terminal's and, if you will, the controller level. They also provide certain kinds of processing as well as, perhaps, report generation. But then in turn, you're communicating with other host computers in many cases. But IBM is out there in spades. So I can't give you a market percentage in this area. But I can tell you this; in the general merchandise area we are very strong. In the
supermarket we are very strong. Yes, IBM entered the field in the ’60s or ’70s. I guess it was the ’70s. In any event, they entered it with their huge resources and they’ve captured a significant part of the business. I would have to say in the area of supermarkets, National Semiconductor is a significant competitor and has probably outstripped IBM as a major competitor for us. And in the general merchandise area IBM is the significant competitor.

ASPRAY: What about in the microcomputer?

RENCH: Okay. When you say microcomputers I want to be sure I know what you’re talking about. Are you talking about microcomputers in the sense of PCs?

ASPRAY: PCs, but possibly 8, 16, possibly 32 bit machines.

RENCH: Well, you know if you look at the 8 and 16 bit field, we essentially buy more of our components that we manufacture. We're not very strong in manufacturing the central unit if you're talking about the chips. Now if you're talking about the usage of them, of course we are in the PC business. We have two PC manufacturing facilities in the world today. (Chuck Exley got asked about that you know), we have one in Augsburg, Germany. It's producing our DM V. Clemson, South Carolina has produced some DM Vs and they're bringing out a new family of products. And as you've probably heard it's going to be able to run IBM 16 bit software -- PC-DOS, MS-DOS. The DM V is an MS-DOS based system as well. It’s an 8 and 16 bit 8088? Anyway we run 8 and 16 bit stuff. The Z-80 type stuff. 16 bit MS-DOS on the DM-V. The program has gotten off the ground fairly well for the company. There are hitches in it. We have a huge distribution capability as you know. And just filling our pipeline is profitable for a plant. The product may end not profitable but at the beginning the plant can make money. So the Augsburg plant made money. Now the pipeline says that the DM-V is going around the world. However, there is another version of a personal computer in Japan because Japan wanted another version. So we have a version up there. In addition, our ADDS organization in Hauppauge, Long Island has their personal computer. We have personal computers hanging out of our ears, buddy. Who knows which one will be the predominate supplier to our customers in the end, but remember all we're doing internally is commercialization? Each one of these guys is going to live or fall or his own. You could
say, "Well, geez, you're not optimizing the use of your resources that way." That's the first argument that comes up.

Well, what we're searching for, believe it or not, is maximum innovation -- technology application, marketing, whatever it may be. Remember ADDS sells right in the old discount catalogues and other places just like everybody else. A lot of distributors discount ADDS. The Viewpoint terminal is down to $400. And you'll see the ADDS "Viewpoint $400" or whatever it is right alongside a Televideo or something else. So we're right out there in a dog-eat-dog business with ADDS. They produce a Mentor microcomputer which uses the -- what's that operating system, (it's database oriented)? It's one of the first users in the country at the microcomputer level of that operating system which has database characteristics to it. I'll think of it later; you know my access process is a little slow. But the Mentor computer for ADDS just turned out to be very successful. In fact, the application of that operating system and the success and the profit they're making off the Mentor is turning into a very profitable item and we're going to give them technical recognition for it at one of our awards banquets tonight. The ATMs coming out of Dundee are a very fine business. We have a lot of factory floor terminals and systems at our Orlando facility. We acquired Data Pathing in the past. I don't know how long ago. I can't remember. Ten years ago? Seven years ago? We acquired the company and they were already selling to the Fortune 500 companies at the factory floor level data capture. You have a guy that's on a job a certain amount of time and you want to capture that information. So he puts his card in at the beginning and at the end of the job and now you know how much time it took him to turn out that number of parts or whatever it is. Well, they were really able to handle the factory floor data capturing. We have environmentally designed terminals to fit those dirty factory floor conditions. You look at what we're doing in Japan. We're not only turning out ECRs (Electronic Cash Registers) over there. We also turn out Kanji printers -- the chinese character type of printer. NCR Japan buys ATMs on an OEM basis in Japan and markets ATMs in Japan. We probably have the most business in Japan on that basis. The Japanese ATM requirements are significantly different than anywhere else in the world. So we have not tended to design specifically for the Japanese market, but to OEM in Japan and manage the market instead of the technology. I can assure you Jim Adamson in Dundee is trying to decide if he wants to tackle the Japanese market, too, because he's quite an entrepreneur. We manufacture in Pueblo, Mexico. We have a plant in Sao Paulo, Brazil. Historically, there, we've tended to manufacture mechanical machines or spare parts for mechanical machines. Recently the company has decided that they would sell internally a replica of one of these brass antique cash registers and San Paulo is going to do that job. They had planned on
producing a small number, but they found that they're getting so many orders they're swamped. The demand for a brass replica type old cash register is beyond belief, and that's what Trip (Trippet) was talking about on the ride back from the convention center. Well, as you know our manufacturing of MOS chips is significant. We have plants in Fort Collins, Colorado; Colorado Springs, Colorado; and Miamisburg, Ohio.

ASPRAY: Do you produce them for other companies?

RENCH: Yes, if you remember, Mr. Exley said at our meeting this afternoon that we have commercialized that area this past year. Yes, we are selling a fantastic amount of read-only memories to the games industry. Coleco and Atari use a lot of our chips. The reason being our chips are more dense; they cost less per bit in the storage. We have a leg up. We also have some basic patents in this field where we can essentially store a couple bits per cell. We're very strong in that crazy field. We also have a very fine position in non-volatile ROMS and RAMS.

TAPE 3/SIDE 2

RENCH: As the company was planning its new point-of-sale electronic system and teller terminal systems for early 1970 deliveries, it was essential and necessary for us to do the right development work for the circuits. A decision had been made to use the MOS (Metal Oxide Semiconductors) integrated circuits. We further planned to produce some of those ourselves. We probably are one of the first companies in the world to dedicate a new major total product line to MOS type circuits. In fact, there were many people who didn't even understand what the developers were doing at that time and what risks were involved. We had developers internally in the corporation who couldn't understand why we weren't using hybrid circuits, why we weren't using standard off-the-shelf bipolar circuits, and so forth. It was predicated that if we wanted the right cost performance, we should stick with the MOS integrated circuits. Probably the risk wasn't even known by the developers at that time. But the decision was made and the plan moved forward accordingly. The other thing that was so essential for a whole line of terminal products was the gadgets that go with it, such as printers, new display systems, keyboard systems and any communication devices that were essential for them to communicate with either peripherals and/or computer systems. So we really, literally,
had to architect a whole new family of products from the ground up. We were doing that in the late '60s and we told
the company that we would deliver those in the early '70s. The huge amount of technological effort was beyond our
capabilities to accomplish in that precise schedule. We were a year to two years late on delivery of those -- which
was against the plan. It opened the door, in some regards, for the competition to move in and buy away some of the
electronic business. Singer bought a lot of the electronic point-of-sale business -- [utilizing] bi-polar designs with
prices that were very competitive. We found out later that these were not very competitive prices because that were
losing their shirt all the time for every unit sold. We know that for a fact. In any event, we were challenged by those
people trying to buy our business with electronic systems, and we were not right on target with our schedule. So in
the early '70s we started losing cash register orders. We started losing accounting machine orders as other systems
started filling the bill from competition. Mini-computers moved in more. Our 399 System had been moved
appropriately into the field to cover those gaps. We brought forth a new mechanical cash register called the Class 5.
It was a superb machine -- the last of our mechanical lines. It was almost too late as a mechanical entry into the
market place. By the way, it was a highly programmable machine. We could satisfy customer needs like mad. But the
fact that it was late and we never got the volume we wanted out of it made it very difficult to make a profit out of it.
Our usual 100,000 per year sales or very high sales just didn't come about as with some of those old mechanical
machines. So we saw orders being tightened up on us badly in the early '70s. Unfortunately, the Century family, still
with a couple of bugs in it, didn't grow as rapidly as we wanted and profits were tight on it, too.

ASPRAY: When were the machines first delivered in the Century family?

RENCH: Well, I thought we delivered the first ones in ’69, but I could be wrong. The announcement was early ’68
and I think ’69 was first delivery. I’m hardpressed to remember all those dates. Anyway, the point-of-sales terminals
were having a tough time making schedule. The orders were tight. So the early ’70s were very tight financial times for
the corporation.

ASPRAY: And this is the time that the company decided that a major change had to made in its management at the
top level?
RENCHE: Yes. About 1972, the Board of Directors decided that they would bring in a new president. They left Mr. Langgo and brought in Bill Anderson from the Far East. Now Bill had two things going for him. One is that he had restructured the marketing in Japan around vocational selling lines such that a salesperson could go in and sell a whole product line for a customer -- a whole system selling capability. He really knew how to handle that. Bill himself, I think is a superb salesman and he knew what system sales required. So he had that at his grasp. The other thing that he had was -- we had set up engineering in the late '60s in Japan. And they had done some advanced work and produced an electronic cash register. So, he had a feel -- a very good feel. I used to travel a little with Bill and work with him on the project so I know it very well, too. But Bill had a good feel of what electronic design might do for a customer in the electronic cash register sense. He used that when he came here. Also, I still believe that Bill really had the nerve, the guts, the ability to execute what had to be executed. A remarkable person in that regard. So, when he came in he took a strong hand in trimming the sales force. He brought forth the discipline necessary for the company to turn around. He took advantage of things already going on and restructured the engineering and manufacturing -- decentralized it heavily. He knew how to do that. He had the guts to do that. It took a lot of doing. We had to move a lot of people to a lot of places around the nation. We had to take certain risks on whether we were going to [get behind] on certain development projects in that process and we had to work hard not to lose our momentum as we decentralized.

ASPRAY: What was the rational behind decentralization?

RENCHE: Very simply this. We had a large force of manufacturing laborers in the Dayton area doing the mechanical machines. One, they basically were not going to fit electronic assembly work. Two -- you have to be honest about it -- they were paid at very high rates, almost at UAW, if you will, union scale rates which we couldn't afford [if this effort was to survive]. Thirdly, the demand for those products dropped off so dramatically, which we really didn't want to happen, that we couldn't use those resources. Those people were a fantastic resource. Boy, they could really build a mechanical machine that was very reliable. They were good. We had some of the best people in the world right here in Dayton, Ohio. We had a lot of them. So we had to just decide what to do. The decision was to
decentralize [electronic assembly] to different parts of the country where we would have small operating units that we could manage with a charter. [Each unit would be small enough] to tackle any project and overcome the bureaucracy of a large centralized unit. We felt that would give us innovative advantages. We certainly wanted to take advantage of the labor rates in those areas and the skills available to us in those areas. Somewhat challenging decisions in all of that, but I can assure you that was the plan. It was really heart wrenching to lay off the thousands of people that we laid off in Dayton. We had some 20,000 people around here and today we have 5500. We laid off, over the period of time, the difference between about 22,000 people and 5,500. Now I have to be careful about that. Some of those key professionals moved, as I told you earlier, to other operations. There were a few thousand people that moved, which was a problem in itself. Part of the picture on decentralizing and, saving the company by having to cut back on certain types of staff included our cutting out the majority of our central research activity. It was heavily chemical-based in that we had done encapsulation work, we had major experts in inks and dyes and various material capabilities, including plastics. The survival process said that we had to keep the strength but not spend money that we didn't have. Of about 110 people, we sent about 15 of them to our Appleton Papers division at that time. They were the key scientists on encapsulation and paper technology. The others, in the range of 90, we let go. We were very careful how we did that. We told the American Chemical Society how we were doing it to make sure there were no problems. We had a terrible time having to lay off some very good people. I think I probably motioned that we cut back dramatically on manufacturing, slowly but surely, during the next few years.

ASPRAY: [You hadn't told me about that.]

RENCH: Well, there were thousands of people that had to be laid off as we decentralized and move the manufacturing to other sites. And of course, we were no longer really producing many mechanical machines.

ASPRAY: Ah, yes. We did talk about that.

RENCH: Okay. Just over a few years period of time we cut back on a lot of mechanical machines. Now, there were some of those being produced at our Millsboro, Delaware facility and some being produced at our Cambridge, Ohio
facility. So we didn't lose all production. We also produced an electro-mechanical machine at Wichita. But we did cut back considerably on mechanical machines. Anderson was very, very logical about how he did it. He was fair and he was demanding, all wrapped up in one. As a result of the activity we had to face up to a large overhang of inventory. We had a lot of mechanical parts in inventory. As a result they wrote that off; I think it was in '72, if I remember right. Maybe it was '73. Anyway in '72 or '73 we wrote off a large mechanical inventory and ended up, of course, losing on it. Showing a negative profit of about $60-70 million. I forget the exact figure. In any event, that turned the company around. The next year under Anderson we were profitable as we started picking up different business. The 280 point-of-sales system and the 270 financial terminal, which were electronic, came out. They were in delivery somewhere around '72 or '73. As I said earlier, although they were a little late to the market place, they became significant factors for our business. While the 280 had a lot of competition from Singer and others, it rapidly picked up speed. In the middle and later '70s it became probably the predominate point-of-sale retail terminal in the United States. It was very successful, a very reliable machine, that used our in-house, in-grown MOS devices which were also produced in parallel on the outside by General Instruments. We had other sources of chips. We did not try to say we were going to be the only sources of chips for ourselves. But our first big volume usage of chips were in those particular machines. We had started in the early '70s the full production at the facility in Miamisburg and they were pouring chips into those particular product lines. Then the terminal control unit, a card on each one of these things which was essentially a small micro-processor in the unit, was put in a lot of other devices in the company. So we got a lot of mileage out of designs at that time. The printer, for instance, at that point-of-sales system became a very successful printer in our bankproof machines. The keyboards on some machines were used on other machines. So we had standard designs at that time that spread right across the company and conserved our design resources and manufacturing resources.

The Century computer in the meantime had become fairly successful in the marketplace, so a new product line was scheduled for the middle '70s and I guess it actually came out about '76. We were going to call it the Criterion Family. Actually in the end it became the 8500 Family. It was a fabulous new design. We still are using a lot of principles from it today. Anyway, Anderson cut the staff and cleaned up the design and manufacturing. A couple of years after he did that, maybe it was '74 or '75, he then had planned and structured the reorganization of marketing totally
around a vocational marketing system, like he had done in Japan. A salesman could go into a customer and sell the entire product line. He could sell a total system. He could sell everything. He was accountable for the success of sales to that customer. The concern before that was when we had product specialists, the specialists would cross over each other in a customer's office and really would cut each other up rather than help the company. I think in fact you talked about that earlier. The reorganization meant that we could go in and sell systems appropriately to a customer. Anderson pioneered that and took the tough brunt of reorganizing marketing at NCR. I'm trying to remember the exact year. Was it '74 or '75? I don't know. It was in the timeframe of 1974 when he did that major change. So that followed essentially about a year the decentralization of manufacturing. Of course, Mr. Oelman retired in '74. He turned the CEO reigns over to Bill Anderson, as I remember, in '73, and then he retired in '74 when he became 65. So Bill Anderson then retained the title of Chairman and CEO and President and anything else you might say for about two years there, until the Board brought in Chuck Exley as president in fall of '76. Bill was just beautiful on the side of discipline and bringing ethics back into the corporation. I really think the company needed that resurgence of ethics and morality and Bill Anderson did that with what I thought was great vigor and propriety. He made sure that the officers were sticking to their game. They weren't running around wasting time with other matters for personal gain. He cut out a lot of outside Board memberships. He wouldn't take on Board memberships. The key thing was to make NCR successful and survive.

A lot of people felt that [NCR] had a predominant community position in Dayton, Ohio ever since John H. Patterson's days, and that did not stop right up through the Oelman days. Then, when Anderson came to town, he turned it off, they thought the company had really turned against the city. Well, Anderson didn't do that at all. What he really did was say, "I've got to save NCR. Survival is at stake." We had over 100,000 people in the corporation at the time, and he had to pair it down to 65,000 now. I don't know the exact count. I think they quote 62,500 in the annual report. You know, survival was at stake. So he did not forsake the community. In fact, several years thereafter he entered into a major support of performing arts in the Dayton area. In fact, NCR has been hugely responsible for performing arts -- the symphony and the Victory Theater, all kinds of renovation of the theater. A lot of funds that roar into the performing arts comes out of NCR and NCR people in Dayton. I give Bill Anderson and his wife huge credit for that. It's is a very significant part of our cultural climate here, and you've got to say Bill has really done a lot for it. After he
brought Chuck in, the other tuning of the company came about because of Chuck's genius in finances. The restructuring of certain product prices and service prices, the analysis of costs and the control of costs. Chuck is fabulous in that area, plus the fact that he has a great feel for the product line, as I think I've told you before. So when you take the morality, the discipline, the gutsiness and willingness to do that job right on Bill Anderson's part, and the genius of Chuck Exley in financial matters and product matters, I think we've had one of the best teams for the last few years of anybody in our industry.

We were not yet turned around by the middle '70s. We still had some of the dregs of the past. It's my personal opinion that it has taken us until a couple of years after Exley arrived, probably '78 or '79, to see the real -- you're a mathematician, you know what I'm talking about -- rate of change characteristic to show up properly. I think today we are a different corporation entirely. Now, in 1980 and '81 we entered in to a new facet of decentralization which we fondly, internally, call commercialization. Chuck and Bill have philosophized on how you make sure a company like ours is not too bureaucratic, that the headquarters staff isn't all overpowering, and that you can, in fact, have sufficient innovation at all levels to ensure that you're going to survive in that tremendous information explosion marketplace out there. I think you heard some of that in our afternoon session. So they, literally, said every plant, although not significantly placed to handle marketing, was going to be a chartered operation and it was going to survive on its own by its own business entrepreneurship. We all shuddered at that. The reason being that we knew the decision-making in the corporation for many years had been heavily centralized. That's not true of everything if you look at our forms business. It wasn't being handled by central headquarters. If you look at a lot of customer support services, that wasn't all being decided by headquarters although they were deeply involved many times on things. When we had Appleton before we spun them off, they were making their own business decisions. And other little facets of the company here and there were making their own business decisions. But for the broad product line, about 90% of the decisions were being made right here at headquarters. So when they changed it in the beginning of 1981 and turned it over to these operations we said, "Where is the skill? There is going to be a lot of people that are going to die on the vine that have to be replaced, and new candidates selected for their position." Exactly that has happened in the last 3-3 1/2 yrs. There were a lot of people who were unable to make the grade and new managers took their place. In other cases some guys just showed up where we didn't realize they had the skill and then become
entrepreneurs and successful risk-takers.

So it's an interesting situation. The trend back in the middle '70s was to make plant managers out of successful development engineers or chief engineers or directors of engineering, as we call them here. There was a great tendency on that part because the manufacturing and the technology content of the product, the servicing characteristics of it, in many cases, was best understood by the development engineering people. So there was a great tendency to have them take over these positions. Since 1981 however, there has been quite a shift. In some cases people with marketing background have actually taken over some of these plants. In other cases, people that have had a lot of ability in the area of programming and software have taken over plants. In fact, I am surprised at the number of software people that have taken over running plants in the corporation. Perhaps I should say "systems people" rather than software - not hardware types per se. Our Ithaca facility is run by a very fine systems guy who had managed MIS programs for quite a while. The guy running our Wichita plant is a very fine fellow who ran a software development division. Just amazing to me, but wonderful nevertheless. The guy running our Waterloo plant now in Canada has a lot of software development and management background. Of course a lot of the glue in the products is software and a lot of the problems of getting the product out of the door is software. So there is certainly good logic in having these people do those jobs. But they have turned out in a lot of cases to be very fine entrepreneurs which is the most significant aspect of what's happening. There has been a lot of turnover. The turnover of directors and engineers has been considerable because they are now expected to be far more entrepreneurial than they were before. Before that, a product description or a product direction could come out of headquarters as a part of a strategy study, or strategy plan of the company. Then all they had to do essentially was drive the technology energy into that description and ensure the specifications, which they would generate themselves at the plant level, would in fact yield a product. Today we don't tell them a damn thing like that out of headquarters. They and their general manager have to decide whether they're on the right track. Now each of the plants is involved in being a part of a division, and they do have a divisional vice-president. There'll be anywhere from two to four plants in a division. But the divisional vice-president is told that he is not supposed to make those decisions for them. For instance you met the Vice-President of Retail Systems Division, Dick Kruze, this afternoon. Dick Kruze has a plant at Cambridge, Ohio. He had another plant in the States and he was able to close it down.
because he felt he didn't need it. He has a plant in Oiso, Japan. He also has what we call a Systems Engineering House which is located in Dayton. Now a Systems Engineering House is sort of a systems integrator and a developer of high level applications which they must also sell and make profit on. They are not allowed just to support the division in the sense that they will coordinate the systems design. That's not the purpose of that house at all. It will take minicomputers from another division, it will take maybe, some other devices, peripherals, from another division and it will take from Dick Kruze's own operations, the point-of-sales systems, and integrate them in such a fashion that they provide a service type of solution, for a kind of retail customer. That customer could be a fast food organization, a large department store, a supermarket, a discount house, whatever. And certainly they were one of the important developers that did our first major test in the country, in Iowa, using "debit" cards on EFT systems for on-line banks and supermarkets.

ASPRAY: How does the allocation of R&D money, then, take place?

RENCH: The R&D within a plant must be paid for by the plant's P&L. The small R&D staff at headquarters, which is an auditing, strategic planning group, and standards group (our organization here) -- that money is allocated as an expense across all the units of the corporation in accordance with what we (the small R&D staff at headquarters) evaluate to be their use of our services. For instance, for most of the plants that do development and have hardware and software in the plant, -- not just software, not just hardware, -- and communication products or communication needs, we will essentially say, "Well, gee, just do a dollar spread against the R&D dollar they had internally of our dollars." If on the other hand they just do software, we'll tend to just take our software bucks at headquarters and allocate it as an expense across them. If they just do hardware we'll just allocate our hardware dollars across them; we have a big algorithm for this. We do, out of headquarters, also provide money to key advanced technologies that are not being covered well by the plant. We feel if there's a [need] in some communications protocol or something that must be met for the future, and if there's really not short-term need for the plants then we will spend the money out of here for it to be done somewhere. We select very carefully a site for it to be done because we want them to, in turn, be involved later in taking first advantage of it. We do that for hardware pieces and software pieces and just advanced technology considerations in various cases. We also do that for standards in some cases where standards
must be developed. We do not do those things at headquarters. We spend quite a few million bucks every year. Those dollars also are allocated as expense again, in accordance with the various plants' need for that particular technology. Our algorithm of allocation is pretty complicated, but we think fair. However, we tolerate and do get considerable challenge from the business units as to whether we've been fair in the allocation method. We sit down with them and go through it. We have changed some of our allocations based on the logic they provide to us. In other cases we don't agree with them and we just go ahead with the allocations. We do have the right, although it gets a little bloody sometimes, to force the allocations if we feel we're being fair. We don't spend that huge a sum so the bucks are not as bad as maybe the G&A for the corporation, the general administrative costs that get spread across the business units. Mind you, the big marketing arms also get some of our money because each one of them does software application development for customers. So quite a few of them catch our allocations too. Let me go back to how a business unit operates.

TAPE 4/SIDE 1

RENCH: In the '60s we pioneered with the Westinghouse Corporation non-volatile storage techniques for semi-conductor devices. They had some basic phenomena in their research labs that they wanted exploited and we desired to have non-volatile storage for chips so that we could store cash registers totals, counting machine totals, or any other kind of business totals in case power was lost. We wanted to have that ability. We entered into a joint development relationship with Westinghouse on the basis that they would have certain patents and we would have certain patents and we would share the end results. Well, they got tired after a few years and bowed out and we stayed in it. We ended up very successfully with non-volatile ROMS and non-volatile RAMS. We licensed quite a few firms around the country and in Japan in that technology in the '70s. We produce a lot of those today. [Later], of course, C-MOS came along and low power was available so you could use batteries with C-MOS about as well as you could use some of the non-volatile circuits. So some of the great significance for that field hasn't paid-off. But we were one of the pioneers in the whole industry in that business. We do have C-MOS capability in Ft. Collins and we do have M-channel capability in Colorado Springs. I don't know all the technologies that we're really good at in that area. You'd have to talk to Dr. Jim Van Tassel.
We are one of the luckiest companies in our business, I think, to have a guy like Jim run that business. He came in from TI a few years back and has managed the operation ever since. He is just a wonderful fellow and a damn good businessman. The thing that they actually didn't tell you today in that meeting was the P&L on that thing is turning around -- roaring around. His growth is phenomenal. Of course, we're in an up cycle for the semiconductor industry and we all know what that means. "Beware of the future" is what it means. But we are doing good. We have good technical strength. We also have a very fine custom design capability. He teaches our customers how to use our CAD. Of course, the first customers he teaches he's very careful about this -- he teaches the internal users how to take advantage of it. And he certainly teaches the external customers, too. I don't know the resources he uses. A certain manufacturing representative kind of marketing resource in the marketplace. He's got good acceptance. We really think the micro-electronics operation as a commercial operation, selling internally and externally, is going to be very successful. We've got a good management team there.

ASPRAY: Does NCR have any activity in CAD or CAM?

RENCH: We have it only in the sense of our internal needs. Well, I have to be careful now. [There is] the custom design capability that Jim Van Tassel fosters for his own selling effort. The more the customers can design to his custom rules, the more apt they are to come to him to buy the product. We don't go out and try to pedal CAD or anything like that as a general rule. Internally, we obviously are capable of doing our own chip layouts. We have several facilities for CAD that are related to electro-mechanical or assembly operations, three-dimensional rotations and stuff like that. We'll probably promulgate that heavily across all plants. You find that there are advantages there for us. For the kind of development we do, we don't find it overwhelmingly economical to rush into all kinds of mechanical or electro- mechanical CAD. We have a major program with General Electric right now; a big pilot activity in our Ithaca facility. We are making sure every value of CAD that they can feed us is utilized and understood. We're videotaping the hell out of that and we're providing all kinds of documentation to go with it. We're going to promulgate that across the corporation. Remember we sell, we don't try to force. Some of the other plants are going in the CAD direction with local people or other organizations. If you're talking about silicon compilers or a level of
that, we're into it more or less. We will be there as strongly as we know how to be there. We all know that the
specification to chip process is here or around the corner. It depends on the matter of degree. If you want to identify
a product by very broad terms, it's not here yet. When you identify it by specifications it's partially here. If you want
to identify it by design rules it's here. So, where does CAD start or stop. I suppose some day we'll wave our arms, do
a few magic words and a chip will pop out of the other end of the machine. That's what they're all betting on, you
know. Silicon compilers.

I might mention a few other things. Out of headquarters we provide engineering standard publications which are the
preferred standards for the corporation. We categorize the ones we feel they should consider as musts. However,
other then legal characteristics of some of them where you run into regulatory matters in different nations, a
divisional vice-president can make a business decision not to use those standards. For the commercialized world
we're in, we say he must be successful and that comes first. He cannot harm the corporation in the process of taking
risks that are illegal, of course. We have other standards at different levels that are optional. Hopefully, if they take
advantage of them they use them totally in a comprehensive manner so that other people who use the same standard
can, in fact, communicate, interact, or interface. We provide all kinds of other guideline standards which are strictly
practices and things that they can choose to use parts of or anything they want. We have a four volume set of these
damn things and we have gone through the obvious hell in the last three or four years of trying to decide what are
our standards in a commercialized environment. We think we've arrived at some very fine decisions in that matter and
we're promulgating that information across the corporation accordingly. From the viewpoint of industrial design the
company is very interested from the top level down in having an integrated visual image, a consistent visual image,
across the product line. So we put forth, after major external studies, consultants and internal activity, deep
documents and guidelines to all operating units. I mean every operating unit. We said, "Hey, this is the way we
think you should execute your design. Here are the color standards and so forth." Then we, in this particular case,
go through an approval process with them and bring it to the attention of the top boss of the corporation. The
company wants a visual image projected that says, "We're modern. We're consistent. We're technologically - based
and we fit the office or the work environment in the best manner possible."
I have a very capable director of industrial design. A very adroit person. The former Vice-President of styling for Chrysler. He has put together a major set of guidelines and then he moves around the corporation. His whole staff moves around the corporation. We actually do, in some cases, industrial design for some of the people because they want us to help them out. We're very dedicated. If you'll look at our product line in the last six years, you'll see a tremendous movement towards the consistency of color, appearance, shape and style. We continue to have arguments on that point because saving a nickle in a product is important for P & L, the bottom line, but we still want that consistency of image. It's a fuss, a negotiating factor, but [possible] with the leadership we've got and with the interest of the top management; Chuck Exley himself. In fact, Dick Macadam, my Director of Industrial Design, said, "Well, I'm the director of industrial design but the chief industrial designer of the corporation is Chuck Exley." Chuck is very capable in this field. He understands it well and he believes in the visual image. He has capabilities of his own. I think his second career could be in that field. So we have a lot of interaction with Chuck in industrial design.

The area of leadership, here in our corporate headquarters, includes pushing all forms of artificial intelligence, expert systems across the corporation -- wherever we perceive the niche and advantage that should be exploited. We just feel that the next high level of applications -- and NCR has been strong in customer solutions in the past -- is artificial intelligence in these expert systems.

ASPRAY: Can you give me some instances of where it has been applied?

RENCH: Well, at this point in time we're working on the front end of this whole thing. So our first area of applications, internally, is for order processing of computer orders at Rancho Bernardo. We replaced the experts that were doing that job with machines. We're more successful than with the experts although they were dedicated and wonderful people. We hope to, internally, move that to the market force and into our marketing offices so that they can complete orders right there. We have a lot of other areas we want to exploit and we have some business opportunities which I don't want to go into at this point in time. We'll build on this base and move in to it. We see that opportunity as computing power keeps growing and the chips keep coming down in cost. Density on all those memory chips keeps building to the mega-bit range. You know memory is going to be cheap. The processing part is
going to be variable. It's just going to have to use these systems for a higher level application. Artificial intelligence/expert systems are the key to the future. We're pursuing vigorously with Tec-Knowledge and others in this field. We've made giant strides forward internally (you're never satisfied) in software development and productivity increases through software engineering tools and techniques.

We are dedicated to our role with MCC. We feel that MCC can offer some advanced capabilities to its members that we often draw upon as time goes along. We're dedicated to the transfer of the technology future from them to ourselves. It doesn't sound easy, however. Our staff at headquarters here and Tom Lang himself, who is on the board of MCC and, by the way, also head of the Board Audit Committee for MCC, spends a lot of time in Austin, Texas. We feel that we have a potential opportunity there for the future that exceeds our investment considerably. Our headquarters staff relates to certain patent evaluations, lawsuit support, etc. The usual stuff that you do to make sure that a company continues day-to-day business.

END OF INTERVIEW