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Interviewee: Mark Torfeh

Interviewer: Robina Mapstone

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MAPSTONE:

Today is March the 8th, 1973 and this is Bobbi Mapstone and I'm talking to Mark Torfeh that's T-O-R-F-E-H at Xerox. And this is an interview for the Smithsonian Computer History Project. OK. Shall we start by maybe where you graduated from, which university? And then the events that led up to when you joined ALWAC, including Clary, and so on.

TORFEH:

Well, UCLA is the school I went to. After school I wanted to get into computer business, and a friend of mine who was working at Clary, at that time, took me over and introduced me to a fellow named John Lynn Smith who was the head of computers, head of computer programs. And I started working there as an associate engineer. At least that was the title. Doing logic and circuit design, checking circuits and putting them in their logic networks. We vacuumed tubes. The structure of the machine was not too obvious to me, because, as far as I could see, there was no plan, no architecture evolved of the machine. However, we all knew that, all of us, the team of us, was perhaps six people. We knew that there would be something that eventually would come out of it, which would be what we call now a desk size computer. The reason Clary was interested in it, I think, was because Clary was in a read-out and cash register business. And they had the read-out keyboard and the stuff that was used for inputting and outputting, they competed. However, for getting into the opposite book in business they wanted to get into office size computers. Or desk size computers. And, however, I think the corporate management, which was Jack Clary, headed by Jack Clary, wasn't too knowledgeable about what goes into a computer system and what is required. How much talent and how many monies. As a result, shortly after they started, they decided to cancel the project and let the people go. I ended up working there for no more than six months, as I recollect. And after that I went for a short period of time to Main-Wells [?], and then I went to ALWAC, which was late '54 or early '55. However, going back to Clary, I recall that after I left ALWAC in September of '57, Clary wanted to get back into desk size computers, but by that time they had called another team from NCR, they had hired a team from NCR to do that business. And I did have an interview with those people. They did seem to be interested in hiring me; however, I didn't think the program was steady yet, because everything was still unstable. The conversation--no system planning, no market planning. ALWAC is where I really learned logic design. And I learned it from a fellow named John Lynn Smith, who came also from Clary to ALWAC and he was the guy at ALWAC, from ALWAC that hired me. He was also at Clary, and he

hired me there, and he went to ALWAC and he hired me there, too. Effectively he saved my life getting me out of that geophysical business.

MAPSTONE:

[laughter]

TORFEH:

Because I found that awfully dull. After a couple of years with ALWAC--well, let me go more into the ALWAC business. ALWAC business was very, very wishy-washy. By the time I got there I think the third General Manager, whose name I think was Baker, had taken over. And Baker, from what I heard from the other fellows, was one of the guys who was hired as a technician in the stock room from Hughes Aircraft to help the logic design and the circuit designers. And since Hagen, Watson-Watt, and I don't know who else that followed him, they didn't change, because, you know, every six months or a year ALWAC had decided to let the engineers and the designers go, and eventually Baker had been elevated to the Director of Engineering and subsequently General Manager of the corporation.

MAPSTONE:

What was his first name?

TORFEH:

I can't remember. But I know his last name was Baker. But I can't remember his first name now. He was together with a guy named Tracey. He was Comptroller assigned by Wenner-Gren to run the finances of the corporation. This fellow had come from Canada. He was in Wenner-Gren's team in Canada. It was sent over to take care of the books. But the story that I heard was that this fellow Tracey and Baker had gone to Federal Reserve with a couple of the key engineers--I think one of the engineer's names was Joe Hawkins, the other one was Jackson--and made a deal with the Federal Reserve Bank to build a business data processing machine for banking purposes. It was for the Federal Reserve Bank. Which we called ALWAC 800. ALWAC 800 was really a concept on paper that--nobody saw it working. However, these people had promised the Federal Reserve Bank they'd make deliveries in fifteen months after the contract was signed. The technology concept in that machine was so new in industry that even the people who were negotiating didn't really know whether it would work or not. And by the time fifteen months came about, we hadn't really designed the first circuits, for that machine.

MAPSTONE:

Oh, gosh.

TORFEH:

let alone the logic. Of course, we had logic design on paper based on what the circuits would do. But the circuits themselves were not developed. And, of course, these circuits, which were supposed to be magnetic circuits which would have much longer life, or what we call 'mean-time between failure', than such things as vacuum tubes and even, some people were saying at that time, better than transistors or semiconductors. But nevertheless, we had to have some of the electrical circuits to drive these magnetic elements. And people were working on the driving circuits, the magnetic elements; switching circuits were not working yet. By the time, you know, I got laid off, and a lot of other people got laid off, because Federal Reserve had expected delivery in fifteen months and didn't see anything coming, they came around and observed that they were not going to get a machine for the next few years. As a result the project fizzled out and they let people go. The only crew that ALWAC maintained was a crew to sustain the ALWAC 3-E's, the ALWAC 1 through 3-E's, in the field, and make a front end system for those 3-E's. So that's where my venture with ALWAC ended. And three months after that, ALWAC let go of all the people. In fact, they sold it to another company; they sold the ALWAC Corporation to another company, which was called Electro-something. It was in Hawthorne.

MAPSTONE:

The Systematic? Does that name mean anything to you?

TORFEH:

Select—

MAPSTONE:

Systematic? Or some name like that. Because I have Charley Williams and Glenn Hagen going, after Logistics Research, that would mean ALWAC,

TORFEH:

Yes.

MAPSTONE:

They went into some company called Systematics. I don't know if that was—

TORFEH:

No, no. It was a company in Hawthorne, I think, that bought it out. I'm trying to recall that what they did--they maintained--they installed base, in other words they took over the customer base and they just hired the field service operation and some of the system people, but they let go of the others. The interesting thing there was that when they let

everybody go, they didn't--they froze some of the pays. In other words, they owed some, I don't know, a hundred people or something, two or three weeks of the month's paychecks. And all of these people ganged up together and sued ALWAC. I don't know what happened there. I know something. When I came over here in 1963, a couple of years after that, a fellow named Wayne King, who was the head of the Field Service at ALWAC, came over here to head the peripheral engineering. And another fellow named Red Grant, who was a test engineer in the final test of ALWAC, was hired here to head the, some of the administrative functions in engineering. I think it was drafting and documentation of control functions.

MAPSTONE:

So the ALWAC project, when it was beginning to clear up--originally it was called Logistics Research, Incorporated?

TORFEH:

Right. It was--when all that was at Redondo Beach, it was called Logistics Research.

MAPSTONE:

Then did the company actually become ALWAC?

TORFEH:

Yes, when the big move was made. In other words, when the, I think the big move was made when the big commitment--right after the big commitment for the ALWAC 800 was made. The Logistics Research real estate area was not big enough. So they moved the corporation into a place near Cranshaw and El Segundo Boulevard. Near NCR--building. Near NCR and Northrop building across the street from NCR. And from then on, as I recall, it was called ALWAC, I'm pretty sure. Do you know what it stands for?

MAPSTONE:

I presume it's something to do with Axel Wenner-Gren.

TORFEH:

Yes, Axel L. Wenner-Gren's Automatic Computers.

MAPSTONE:

Ah.

TORFEH:

[Laugh].

MAPSTONE:

OK. So now, the 800--when did that start? The ALWAC 800.

TORFEH:

It started in 1956. I think the contract was signed towards the end of 1956. And we started working on it feverishly in the remainder of 1956 and 1957.

MAPSTONE:

And you talked about the magnetic elements.

TORFEH:

Yes.

MAPSTONE:

Is this something--Are we talking about something like magnetic core, or is this something—

TORFEH:

No, no, these were magnetic switching. What they call mag M's [mag amps], half cycle mag M's [mag amps]. ...those they were using in the other, in the aerospace industry, for, I don't know what purposes, other purposes, but this was to be, two of those elements were to be used as a switching circuit, as a flip-flop.

MAPSTONE:

Had they been used in computers before?

TORFEH:

I don't know. The people like Hawkins and Jackson were talking about it. They were used in military and space efforts. I can't--I was too junior in those days to really understand what was going on. [Laugh].

MAPSTONE:

OK, so when you joined: you joined ALWAC in 1953, is that right?

TORFEH:

ALWAC, I joined in 1955, in late 1955.

MAPSTONE:

Ah. OK. And prior to that you were with Clary and that geophysical company. So what was actually going on at ALWAC when you joined and what were you primarily doing?

TORFEH:

I was hired into what they called Systems Department. The Systems Department function was to tailor-make ALWAC 3-E computers for special users. We designed a special front end. But I didn't really get to do anything to systems functions before I was assigned to the 800, the ALWAC 800 development team.

MAPSTONE:

The 800 then was a completely different direction to—

TORFEH:

Yes, yes. It was not compatible with the 3-E at all.

MAPSTONE:

It was business data processing?

TORFEH:

It was supposed to do, you know, processing of accounts, businesses, you know, whatever goes with Federal Reserve systems.

MAPSTONE:

As opposed to the first--the earlier ALWACs?

TORFEH:

Yes, the Is and 3-Es were all compatibles. They only had improvement in the throughput, effectively. But mainly those were just like LGP-30s and G-15s. They were scientific machines. Well, the 650 wasn't, it was more or less the same, except if I recall correctly, the 650 had a larger repertoire for business applications. Whereas, ALWAC was typically a scientifically oriented machine. People like Litton Industries, for instance, and North American bought a few of the machines.

MAPSTONE:

Of the ALWAC.

TORFEH:

Of the ALWAC.

MAPSTONE:

Maybe you've answered the question that we talked about earlier; about, you know, why did 650 get such an edge on the market?

TORFEH:

Yes.

MAPSTONE:

And maybe one of the reasons is that it was a data processing machine.

TORFEH:

It was business oriented.

MAPSTONE:

It was a business oriented machine.

TORFEH:

Of course, in those days the difference between the two models, the two applications, wasn't that much. I think we were sort of limited to what we could put in the outputs of the machines. Not limited in resources, but the technology. So it forced you to stay within certain limits. You couldn't have a wide repertoire, because the control portion of any computer with vacuum tubes would get way out of hand. You'd make it too big, too wide. I think the success of the 650 was fundamentally based on the marketing capability of IBM. And I think everybody knows that. Why IBM was ahead of UNIVAC and that sort of thing. IBM marketing--IBM has always been heavy front end, whereas almost all the other computer organizations emphasize the back end, the development and the capabilities of the machines. Whereas IBM emphasized the marketing, the market place, they put all their, I think, two thirds of their money into the front end, rather than development and the capabilities of the machines.

MAPSTONE:

However, they still must have had some back end backup

TORFEH:

Oh, sure.

MAPSTONE:

to warrant the front end, and, you know, people not saying—

TORFEH:

Oh, yes. Sure. They had the resources. Obviously they had much more resources than any other company for developing a computer software or hardware. However, if you analyze, for instance, the logic design of a given portion of an IBM computer you sort of get the feeling that they must hire the worst logic designers in the world.

MAPSTONE & TORFEH:

[Laugh]

TORFEH:

But there is a reason for that. I've just realized that within the last five or six years. There is a reason for them--I don't know whether it has happened that way or was planned that way. I sort of suspect that IBM planned it that way. Any time you simplify the logic design it's a lot easier to maintain. It costs you a lot less to fix. That may be done intentionally. They can avoid hiring sophisticated logic designers to save money in the back end, I mean in the field. That's a very good reason, for those field costs are life costs. And IBM business is mainly lease business, so they have to take care of that in the installation. So the installation costs, the maint[enance] costs, are a lot lower than the computer people who sell could use.

MAPSTONE:

Maintainability would be a good point, because I have a feeling that maybe this is where--this was a very important aspect in what made some computer companies work and some not. Whether they—

TORFEH:

I just realized that. Well, not just--but for the last four or five years. I really appreciate that now. And I sort of feel why, for instance, most of the scientific computer manufacturers were typical--and rather than scientific, I'd rather say: typical computer manufacturers, GE and RCA included. They emphasized something which was not really contributing to money making aspects of the computer business. They emphasized

sophisticated design. They hired more sophisticated engineers.

MAPSTONE:

Mhm.

TORFEH:

When I was with GE they had probably a terrific nucleus of good scientific talent. Good computer scientific talent from the east as well as west. I'd come to Phoenix, which was not a bad area. But the main thing that it forgot, the two main things, I think, that it forgot--one is that IBM had almost all the resources to make the computers, including the triple devices and semiconductors. Whereas GE was buying, GE and us and other companies, were buying the triple devices from Bendix. And, of course, that vendor is going to make money on his own stuff as long as he sells it to us and we have to take care of maintaining it, he is not going to put any maintenance features in it. But we have to maintain it all the time.

MAPSTONE:

That's right.

TORFEH:

So, you know, when you analyze the whole thing overall, you sort of appreciate why IBM is in business and making a lot of money and everybody is envying and everybody is suing them. [laugh] And the rest of them are not.

MAPSTONE:

Do you think that, looking back on the ALWAC machines, were they relatively good in the maintainability area, or did they have all the faults?

TORFEH:

No, they had all the faults of everybody else. In fact, the fallacy in the design, especially of all the old computers, including the 650, was that the main memory of the machines were drums. So everything was circulating. Everything was dynamic. So you had to develop experts which were much higher class experts than nowadays. Nowadays you, the experts you have for the field should be more software-oriented than hardware. In hardware, you know, you always have power [?] transfers and you have static registers that you could look at, you can single clock things that you could look at. But in those days you couldn't do it. Everything was dynamic. The drum circulated when all was going. So you had to find a sync point to look at something to understand what's going on. There were certain experts in the field. I specifically recall one fellow in the test department at ALWAC that--he could listen to the clicking of the relays of selecting

drum and could say whether it did it the right way or it didn't.

MAPSTONE:

Oh my. [laughter]

TORFEH:

He had lived with this for so long, he was pretty smart.

MAPSTONE:

However, when you are writing a maintenance manual, that's not exactly what you need.

MAPSTONE & TORFEH:

BOTH: [laugh].

TORFEH:

Not yet. It's not a black and white type of thing. No, it's a feeling that he developed. And a lot of that stuff, you know, still, when you get into the sophisticated scientific computers, you have to depend on highly skilled people who develop their own methods of the machines. Versus IBM, which is pretty straightforward.

MAPSTONE:

And then as the machines got into the more basic data processing areas, you weren't dealing with engineers and you weren't dealing with mathematicians. You were dealing with computer operators, accountants--probably not accountants, but people who just didn't have the feeling towards the machine as being the great problem solver that you guys had.

TORFEH:

Yes, they--you are right. The business data processing system user doesn't have to know what goes on, and doesn't know. Doesn't have any interest in what goes on inside the guts of that. As far as he knows that's a computer and it is supposed to do a service for him. Whereas a scientific user, generally, out of his own curiosity, he wants to get in there and see what's going on. In fact, nowadays in Xerox when we put maintainability features, for instance, lately we just announced our system 530, Xerox 530, because we have been inheriting a lot of the past customers of the Sigma 3, the questions we are asked are typically scientific users' questions. Like, for instance, "if you put this maintainability feature in such and such an area of the software, how does it connect to the old software"? [laugh] You know, the business data processing user doesn't have to know that as long as we give him that tool. As long as we give ourselves that tool. He

doesn't care; whereas the scientific user wants to know. Especially the real-time scientific user, because typically they give you the xth time report for tracking a satellite or something. He's got to know. And I don't blame him. He's got to know where--does he need that modular function or not? Should he plug it in or should he unplug it? So he won't suffer time lag. But the general purpose user, most of them aren't going to use--As I say, they don't care.

MAPSTONE:

Going back to the 800, can you describe the machine somewhat, or in as much detail as it is possible to do so?

TORFEH:

I can do somewhat. All I know, the core memory portion, that central memory portion of the thing--you should know that that was just the beginning of having commercial core memories as the central .. memory. It was supposed to have, if I recall correctly, five or twelve words capacity for the core memory. But it had, in the planning phase at least, we were supposed to have a lot of magnetic tapes on it for file storage. And several drums, special high speed. You can refer to those now as--well, they operate just like the fixed disks. Head to track disks they use now. Those were really drums. And those were the devices that they were going to use for that storage. The storage part. But the main core memory that was doing most of the operations was the 512 word core memory. And I don't seem to remember very correctly, but I think it was a thirty-six bit word. So ... That's the structure I know. It didn't have--it was a single processor machine. As far as I know the--it was supposed to have a fairly good I/O throughput capability. Because of search and sort, searching routine of files--file management problems. They had to have a fairly good storage capacity. The instruction repertoire--well, for those days it was fairly sophisticated. It was in the class of better than the Burroughs 220. You know Burroughs 220 was called ElectroData at the time.

MAPSTONE:

Can you recall what were some of the things that maybe made it more sophisticated?

TORFEH:

The instruction repertoire?

MAPSTONE:

Yeah.

TORFEH:

No, I can't really--I remember it had fairly elaborate logic instructions, shifts and written

information instructions that I don't think the 220 had. The 220--I think it was a bit older as far as the concept was concerned. I guess you realize that you--it's pretty easy to put an architecture in a machine on paper. You know, especially if you've had some background, without really knowing whether the thing is going to go or not. [chuckle]. I think as far as the concepts were concerned, you know, the planners would simply have said, "well, such and such is doing this much, and 650 is doing this much. We can do better." You don't really know whether you can do it or not. It's just on paper.

MAPSTONE:

I suspect there was a lot of that going on in the computing companies here who were highly competitive, I suspect.

TORFEH:

It still is. It still is. You know, how do you beat--you know, when we sit together to think about how do you beat 370/150? You still want to do something better than they do. The question is how much is it going to cost you to do it? There is no question nowadays, can you do it or can't you do it. Because you can do anything. The only question is cost and the question of usage.

MAPSTONE:

Now, apart from cost, what was the thing you would be trying to beat? I mean, were you thinking this should be faster

TORFEH:

Obviously.

MAPSTONE:

than they are, in our machine? Have more bits capacity--or what were the things that, you know, you really felt would score for you?

TORFEH:

Speed, of course, has always been the criterion for, especially scientific, computer designs. Speed has been the main thing to worry about. How fast can you add, how fast can you multiply, the floating point, and all that stuff. That's been one parameter that everybody's been always considering. The other thing, of course, that particular application that has now become a very serious problem--file management. That machine had better capability for file management than even machines that were designed subsequently. On paper, again. [laughter].

MAPSTONE:

On paper. [Laugh]. Yes. Right. So the machine sort of lived on paper for eighteen months?

TORFEH:

Something like that--yes.

MAPSTONE:

And then, because you couldn't make the contract in time—

TORFEH:

That's it. The deadline--there was a nuclear damages clause in the contract--I never saw the contract; this is just hearsay, from what I heard other people tell me. There was a nuclear damages in there because, of course, no federal agency can live without a nuclear damages clause. And after the fifteen months and delivery was not made, of course, the government, the Federal Reserve people came around and looked at it to see how far are we on it--are we? But they didn't see anything to speak of. There were some drums there, some magnetic tapes. There was a core memory there in the troubleshooting or prototype laboratory. But that was just about all. We didn't have any software to speak of. As a matter of fact, we didn't really have the logic design on the main frame put together. We didn't even have the technology for it [laugh].

MAPSTONE:

Can you pull some of the names of people who were involved in the 800 project?

TORFEH:

Yes, I remember the guy named Jackson, Bob Jackson, was the head of the Development--director developing that machine. And the key man that I remember in his function, who was in charge of the logic design on the main frame, was named Dr. Ernie Ho. H-O. He went to Hughes Aircraft--he's researching now--after that. I got to know Ernie pretty well, because I used to share rides with him. He was an information theorist who taught at UCLA and I think he either participated or by himself wrote a book on the subject. He was the key man I remember. Joe Hawkins was the guy that Jackson was reporting to. Joe Hawkins was responsible for all development engineering problems. Lou Thrall was another man that I remember. He was the head of manufacturing.

MAPSTONE:

T-H-R-A-L-L?

TORFEH:

T-H-R-A-double L. I think I mentioned that to you before. Lou was with ALWAC almost from the very beginning. '51 or so. I don't know where he is now. I heard he went to Aeronutronics.

MAPSTONE:

In '53, I guess.

TORFEH:

Used to be in Newport Beach.

MAPSTONE:

Where did Beek fit into the picture?

TORFEH:

Allen Beek, as far as I remember, he sort of fitted into planning and architecture--development of the architecture of the machine, generally speaking. And later on, he occasionally showed up in the plant. He would be working with the programming time, the software time.

MAPSTONE:

I was going to ask you that question. Were you working with the software people in the design?

TORFEH:

No. I was mainly working with the logic design. I've been always involved with the hardware design.

MAPSTONE:

Actually by you I meant the computer group. As you were building this machine, were you thinking of the user and therefore talking to the software

TORFEH:

Software people?

MAPSTONE:

people and saying how can we build this—

TORFEH:

There was very little activity going on the software development. As you know, the first generation machines--very little thought went into software. You need basically machine language and that sort of stuff.

MAPSTONE:

It didn't matter if you couldn't run the darn thing. BOTH: [laugh].

TORFEH:

Yes, the assemblers, I guess, generally speaking, the assembler was the most sophisticated thing to have. It turned out that once you gave it to a customer, if he wanted to do something sophisticated, he had to come back to the manufacturer and ask him for a piece of software. [laugh].

MAPSTONE:

I see. [Pause]. I lost my train of thought. Oh, yes. We were talking about people. Did you know Glenn Hagen?

TORFEH:

I didn't know Glenn Hagen, no. All I knew, I heard about him. I never met him. I never saw--I saw some papers that were signed by him, because, you know, I think what happened is that Glenn Hagen got assigned to the job when Wenner-Gren put him in the job in '51, and I think by '52 Hagen was out.

MAPSTONE:

Oh. Oh, that quickly.

TORFEH:

Right. That's when Henry Herold and Allen Beek started. Hagen hired them, I think, to do the machine. Allen was worrying about the Hagen architecture and Henry was worrying about the logic. When they put it together, I think it was right after the design, Lou Thrall showed up and the three of them, or the four of them, with a technician, debugged the machine.

MAPSTONE:

And these were the guys who all got fired in one—

TORFEH:

Yeah, they got laid off.

MAPSTONE:

luncheon [laugh].

TORFEH:

Right. Yeah. I think just about the time they finished the design, the company let go of them. And Henry ended up in J.B. Rea.

MAPSTONE:

Aha.

TORFEH:

J.B. Rea, I don't know whether you know that outfit, I think they were in the valley, in Burbank someplace.

MAPSTONE:

You know. I know the name and what--they were peripheral equipment, is that right?

TORFEH:

No, they did make a computer.

MAPSTONE:

They did make a computer. I really have to get that story exactly.

TORFEH:

Well, once you talk to Henry--Henry and Jack Mitchell both of them--that's where they met, at J.B. Rea.

MAPSTONE:

How about Charley Williams. Is he someone you knew? Or had he left, too?

TORFEH:

I have heard that name. If he was there, he must have left. Because I can't remember him.

MAPSTONE:

So, by the time you came in, had the, the ALWAC corporation company--what was it called, ALWAC?

TORFEH:

When I got in, it was still called Logistics Research. I think it was three or six months later that they changed the name to ALWAC Corporation.

MAPSTONE:

ALWAC Corporation. Had it become a more stable organization after Hagen left?

TORFEH:

Oh, no. No. After Hagen. I don't know--either immediately after him or one [telephone rings] person more after him [Recorder off]

MAPSTONE:

We were talking about whether ALWAC had become a more respectable company. [chuckle].

TORFEH:

It had the appearance of a more respectable company. They were giving classes to field engineers and classes to the new engineers who joined to understand what was going on. But, oh, I didn't answer your first question. Did, after Hagen, did it get stabilized? I said no, because Watson Watt took over for only six months. And I think, you know, Watson Watt is typically a scientist. [Telephone rings. Recorder off].

MAPSTONE:

We were talking about Watson Watt.

TORFEH:

Yeah. Watson Watt took over for, as far as I know, for six months. And I joined, I think, just after Watson Watt left, and I think that it was then that they assigned Bob Baker, Dr. Bob Baker to the--I don't think his first name was Bob.

MAPSTONE:

I don't think it's Bob Baker.

TORFEH:

I don't think so. It may be. He keeps coming in my mind. I know another Bob Baker, so that may be confusing. That story by the way is interesting in the way that the whole thing folded up. I don't know whether anybody has told you or not, but I am sure Allen Beek can tell you better than I can. The story was that Baker and Tracy, remember the guy named Tracy I told you about, had done some cheating. That somehow Axel Wenner-Gren, when he sent his people over, he used to have economists, or accountants to go around and check the books to find out what these people did with his money. And once they checked the books they couldn't track something like two million dollars. And the rumor was that these guys had pulled two million dollars out of the corporation resources without any track. And since they had signed a contract with Wenner-Gren to run the company for, I don't know how many, years, when Wenner-Gren found out that they cheated he wanted to fire them. But since there was a provision in the contract, they could penalize Wenner-Gren. So Wenner-Gren, as a penalty, gave them the printed circuit operation of the corporation. BOTH: [laughter]

TORFEH:

The printed circuit operation was still at Redondo Beach. And a guy named Jim Neal got with them. Jim Neal was running the printed circuit operation of ALWAC and they were subcontracting to do printed circuits for other companies. In fact, at the time I was interviewing with Clary, right after they let me go at ALWAC, at that time Tracy showed up and tried to sell printed circuitry to Clary. Until that time, Tracy wouldn't even say hello to me; but when he saw me, he started shaking hands. BOTH: [laugh].

TORFEH:

Jim Neal, by the way, might be another guy you will want to talk to. He works at the Wang Computer Corporation--Wang Computer Products. Do you know where that is?

MAPSTONE:

No.

TORFEH:

In Santa Monica. It's near 22nd street and Broadway. We call it Wang Co.

MAPSTONE:

Oh. I have that. Yes. That's Jim Neal?

TORFEH:

Yes. If I remember correctly, he is still running their manufacturing. Jim Neal used to be our manufacturing man, first SDS manufacturing, then ours.

MAPSTONE:

Well, the flow is interesting. Everybody on the west coast has been involved with, oh say, approximately three computer companies. Maybe more. And there must have been, because of the people, this must have kept thoughts and the flow of ideas going and the researching of the—

TORFEH:

Yes. There is really an element of people moving together like a family almost. You know one guy that knew me went from Clary to ALWAC. And then he hired me at ALWAC. And next thing you know, the same guy, or another guy that got to know me at ALWAC, goes somewhere else and hired me there. This is very true on the west coast. I don't know if this has happened on the east coast or not. This has happened on the west coast all the time. For instance, Henry Hill hired me as a logic designer at GE Palo Alto, GE Computer at Palo Alto. And Henry, when he joined SDS he was the first guy to call me to join SDS. So here I am. This can make itself a nice history. How did these people flow together? And, of course, ideas, because these people have so much in common with each other. Ideas can congeal together.

MAPSTONE:

Yeah, in other words, if somebody wants to go into computers, they say, "Well, there is a great guy over at, you know, the XYZ Company, and if you hire him he is going to bring all his disciples. And that nice little machine that is being built there is now going to come, and one similar, but better, will now be built in our company.

TORFEH:

Right. Well, as this company developed, SDS developed, from a nucleus of people from Packard Bell. And some Packard Bell people like Jack Mitchell over there knew Henry Herold, who at that time was working for Hughes Aircraft in Fullerton. And I think Henry was the fourth man who was hired as the head of the logic design at SDS. Of course, there is a personnel practices thing involved here. If you look at the statistics coming out of the personnel offices of different companies, you see that people who come into the company by reference are much steadier than people who are grabbed by newspaper advertisement or other recruitment techniques.

MAPSTONE:

Oh, really?

TORFEH:

Oh, as a matter--you know, the turnover factor is multiple, of the people who are hired by advertisement--other advertising techniques.

MAPSTONE:

There is another thought with designing period, where suddenly you've got all these small computer companies springing up. And not too many people, comparatively, who knew machines [phone rings; recorder off] were you constantly being approached by other companies to come and work for them?

TORFEH:

Well it really depends on your contact base--connection base, I call it. In other words, the business cycle is the first requirement for getting called by people who know you. And the second element, of course, are the people who know you. During the bad times, bad economic times, let's say, in 1970, I was free lancing. I was doing consultant work on my own. I expected some of my friends to call me, and they never did. And it wasn't--fortunately I didn't have to, because, you know, I was living on the stocks that I made over here. And I decided I will pick up some money by consulting. There were occasions that I was feeling frustrated being away from the industry--the hard core of the industry--to see what's going on. And, you know, I sort of wished they would call me.

MAPSTONE:

Yeah.

TORFEH:

Even it it's for consulting, but they never did. '56, '57 was more or less the same way.

MAPSTONE:

Was it slow?

TORFEH:

Yeah; yeah, it was. Because there was a cancellation of the Navajo project with North American. And within a couple of weeks, if I recall correctly, within a couple of weeks, there were fifty thousand people out of jobs. That really mushroomed. It's at that time, you know, that ALWAC actually was--laid us, laid me off, laid the ALWAC people off. And I was just lucky to first get an offer from Bendix and get an offer from GE. And Mark Shirowitz was on that Committee. I was kind of feeling desperate, actually, because when the layoff came about it was just about after Navajo.

MAPSTONE:

Though there was no connection with Navajo.

TORFEH:

Well, the connection was that ALWAC had thirty machines installed for the Navajo project at North American.

MAPSTONE:

Oh, so there was.

TORFEH:

That looked like they were going to return the machines, or they didn't have any applications. Anyhow, I was not in that picture anyway. I didn't have--I didn't really know the ALWAC 3. Just about the time I learned ALWAC 3, I was assigned to the 800 project. I really never learned much about that. But, I got to know Mark Shirowitz who was doing some consulting for ALWAC, and Mark helped me to get with GE.

MAPSTONE:

OK, let's move on to GE then. You joined when?

TORFEH:

October of '57.

MAPSTONE:

OK, [Knock on door. Voice: Excuse me.

TORFEH:

Thank you.

MAPSTONE:

OK. Maybe you could tell me about, you know, what was happening at GE. The kind of work, the people—

TORFEH:

GE--When I got involved, I guess GE had been involved for about six months or a year--I

think about six months, but maybe a year prior to that--with the Bank of America contract, the ERMA System. And a feasibility study was done for ERMA systems by Stanford Research Institute. And once the feasibility proved that it's a working system, then ...[?] looked for a contractor to contract the system and have it done with the latest technology. The SRI machine was done with a drum memory and the vacuum tubes and NYCR system they had at SRI--it was pretty flaky, because they had done it only in the laboratory environment. That wasn't something with a high reliability, so GE got that contract and they formed a team, the first computer design team in Palo Alto, to absorb all the knowledge they can from SRI. Joe Weizenbaum was one of them, Bob Johnson and John Pegrin, Jay Leventhal, all these people that I mentioned before. I think Bob Johnson hired Stan Bancroft [?] to do product design. By the time I got up there, October of '57, the architecture was pretty well formed and there were groups assigned to do various portions of the machine--software portion, hardware portion. I got into hardware logic design My first assignment was to verify the capability of the circuits that were developed for that machine. Which was design of a test adder to do add functions and then effectively verify the clock speeds, the arithmetic capability. There was one particular feature I will never forget that Bank of America insisted they wanted on it--was what you call excess three parity checking for going into the arithmetic unit and coming out of the arithmetic unit. And any time you went into memory, you stored the excess three parity bits and any time you went out of memory, you checked for excess three parity.

MAPSTONE:

Why three?

TORFEH:

It's a two-bit parity. It gives you much better reliability, a much better guarantee that you're working with. You know, for instance, with a one bit parity you have a percentage of guarantee that the word you got is correct. With a two bit parity you have more of that. For some reason Bank of America thought that because they are handling money they have to be deadly accurate in their manipulation. I suppose they learned after that, I think after the ERMA System, after they were through with the ERMA system, which was, I think, late sixties, they bought System /50s or /65s, I think, 65s that won the [?] parity all over the place.

MAPSTONE:

Right, right.

TORFEH:

And, of course, you could do a lot with their software if you wanted to have a lot of checking going. You could do a lot with that software. In that generation of machine, which I can say was the first generation semiconductor machines, ERMA was,

confidence of the users was not strong enough to believe in what the machine could do. I remember, at a given point, during de-bugging of the machine, Henry asked me to look at the amount of circuitry we used in the arithmetic portion of the machine, and find out how much of it was used for checking the generating excess three versus how much was used for real arithmetic functions. And it almost looked like half and half.

MAPSTONE:

Wow--[laughter].

TORFEH:

It was a lot of gear, you know, because you had to look at every character that came out of the register. And in the registers we had digit shifting as we shifted out, say, digitally you would count up or count down the excess three until finally you get to the end total of excess three. Adder was working that way. It was a serial adder--serial by--parallel by character, serial by word. I guess one reason we had to do it that way, if we didn't do parallel, it was because we wanted to do this excess three. Otherwise it would have been a very complex mess to work with excess three. Well, that venture I thought for GE at that time, was probably a very exceptional opportunity for a company to come and get a contract and get into the computer business with a contract instead of building their basic computers and then go out and sell it. However, I thought, by 1958, and between 1958 and 1960, GE then blew it, because that original opportunity had--suddenly in 1958 when we started making deliveries to Bank of America, they decided to build a big organization in Phoenix. To really go in to manufacturing of computers, manufacturing of computers, without really doing a gradual process. In other words, it looked like a step function; going from a nucleus of a few engineers and a bunch of technicians and manufacturing guys, suddenly the statistics of the computing machine show like five thousand people by 1960. [laughter] Which was really strange. The only contracts that GE had, and that was, as I say, was an exceptional opportunity, one of them, of course, substantial one, was ERMA. The other one was an NCR contract. NCR 304 was contracted to GE to be designed and built through a concept that was developed by NCR. And that was a sure bet, too. But you added those opportunities against the costs of development of manufacturing. I think GE was breaking even. For when they started hiring so many people without really having the business plan in mind, that's when they really blew it. I think since the trouble with GE started in '60, in the early sixties and kept persisting...

MAPSTONE:

Now did GE after--you said they had these two substantial contracts--then did they decide to start developing their own machines?

TORFEH:

Yes, they did. That was the problem, because they didn't have any specific business plan

in mind. And general gross statements were made that we would be number two by 1965. And we will have forty percent of the business by 19--. There was a guy named Strickland, who was one of the vice presidents at GE, who constantly made these statements, but anytime you wanted to look at the business plan, how would you get there, he says "You know, you have to go in a continuous manner to venture into business." There was no business plan. They didn't really know which market they wanted to get into. All they knew was that they wanted to get into the same market as IBM was. That was data processing.

MAPSTONE:

And they didn't, for instance, pick up another small company, like NCR picked up CRC and got all the talent developed through the Northrop development? But GE just sort of jumped in?

TORFEH:

Right. They jumped in trying to do it with almost no management know-how in the business. They had people--people who were running the computer business were from the switch key department who had no business ... This was originally, the first five years--Clarence C. Lasher was the guy who was there from the Switch Key Department. I think Switch Key and Turbine or something. And then he brought another guy to do the product and business planning who was also from the Switch Key Department. And I remember I was in some of the teams to make presentations for product planning from the laboratory. And quite often I noticed the marketing manager and the product planning manager weren't really with us. And they would sort of fall asleep and suddenly wake up about the middle and say "I don't even understand what you are talking about." It was really embarrassing to even make a semi publicity type of presentation, because they weren't even with the business and our language--they couldn't even understand our language, which was even more embarrassing.

MAPSTONE:

Yes. Do you know the beginning of ERMA. How did GE happen to get involved with Stanford? How did that marriage come about?

TORFEH:

The marriage--well, what I heard was that Bank of America went for an open bid for contractors to come and bid for the system. And GE was one of the bidders.

MAPSTONE:

OK. Had Stanford--did Bank of America go to Stanford first and say "we need a machine to do this"?

TORFEH:

Yes. The feasibility study project was given to SRI by Bank of America. And I think the SRI and Bank of America people worked the details. I think it's just like any other development. The company sees a need. From what I gathered later on, the first test was that Bank of America had a--this was an opportunity, and actually I examined it myself because I worked part-time for Bank of America when I was going to UCLA. And the talk was that the turnover in the bookkeepers was so fantastic that they had to do something. And, of course, bookkeepers, if you look at them, their operation was very mechanical. And they would hire girls getting out of high school, graduating from high school, immediately, and train them for a couple of months, and put them on these bookkeeping machines. And all she did eight hours a day was punch those keys. Obviously it could be computerized. And once the 650 was there they could see that the computers can take care of that. The only problem was, for instance, how do you read the check? And how do you interconnect a check to the branch and the branch to the bank, and to the clearing house, and that sort of thing--all those numbers that you see on the checks. The MICR numbers that you see. Those were the areas that actually were basically assigned to SRI to locate--to develop a system. To make it actually standard for the Bank of America, which had to be standardized with ABA, the American Banking Association. To be acceptable for all banks. As far as I could see, the major portion of study and research that was done by SRI, was in that particular area--the MICR area. The rest of it was really nothing but a standard--that was a special purpose computer to just read these checks and sort of update the accounts and put out the statements, and that sort of thing.

MAPSTONE:

Yes. Were the--probably a silly question; I'll ask it anyway: The characters which we all now know as check characters, did that come out of this project, too?

TORFEH:

The check characters in the MICR code?

MAPSTONE:

Yes, the ones that now are practically on every check. I guess they are--stamped on.

TORFEH:

Yes. The stuff on the bottom of the check?

MAPSTONE:

Yes.

TORFEH:

Yes. This is exactly what came out of the SRI.

MAPSTONE:

That was it, with the design of each of the letters and the numbers.

TORFEH:

The font and all that. Yes, yes. Later on, when it got into GE, I think we did some improvements on that for better resolution and developed a better advertising [?] on it; more reliable. And, of course, the coders themselves, you know we are back now on just the coders--the codes were just for the amount of dollars. Those coders were developed by other companies. GE bid for it to get it right into the That itself is a very important machine. Because if you have too much slippage on it, it smears, and all that. Then, the MICR in your system would not work.

MAPSTONE:

Oh, yes.

TORFEH:

It comes out--all the checks can come out in the reject pocket if they are coded by a bad coder. And then they have to be hand-sorted out ... messy things.

MAPSTONE:

So GE did get the contract. And do you have any idea what quantity of machines were delivered?

TORFEH:

Quantity of machines? To Bank of America, as far as I remember, [it] was [in] thirty-two centers that Bank of America needed those systems. No, thirty-two computer systems they needed for something like twenty centers, or something. You know, across California.

MAPSTONE:

Yeah.

TORFEH:

I heard later on that they ordered some more as their accounts went up. I'm not too sure

of that. However, the machine that we designed was designed for given specifications of processing so many accounts per day. But we put so much speed and super capability in, it was really capable of doing more. So that when it processed its job they would have some time left over, so they rented time to other, smaller banks, banks and savings and loan companies to run their--they were renting out time. And I think they got put in the courts for that because they were not really in the computer leasing business. BOTH [laughter].

MAPSTONE:

Oh.

TORFEH:

And then subsequently they changed it. Of course, that gave GE another opportunity which was unique and GE blew it. And that gave GE an opportunity to get into banking business that no other computer company had, including IBM. The idea was rejected by the Bank of America, because IBM people didn't believe in doing the MICR work and check coding--they wanted to do it on punched cards. And bank through those.

MAPSTONE:

IBM has made a lot of those slips.

TORFEH:

Yes, but the thing is that afterwards, they did it anyway.

MAPSTONE:

That's right.

TORFEH:

Their sorters actually were better than the sorters that GE was using. GE originally wanted sorters ...[?] NCR. And subsequently they built their own check sorters for checking. But as far as I know IBM came out with a better one, something like fifties. I saw one at a computer conference.

MAPSTONE:

You said that you felt that GE blew their opportunity of being in the banking business. In what sense did they blow it?

TORFEH:

Well, after Bank of America, for instance, they got a contract for Security Pacific Bank for twelve or so systems, they got a contract from Marine Midland. And, of course, there was an agreement with the Bank of America that they will not copy exactly the same machines for other banks unless they pay royalties to the bank. So that agreement, I think was met. GE was paid some royalties for the Bank of America. The Bank of America paid SRI to do some investigation. And they were entitled to some royalties. So when the other banks wanted it, we went ahead and built them for the other banks, with some modifications. Because some of the banks, for instance, they wanted a card capable of recording, but not capable of repro type, they wanted different printer type, modified quality of the cards. But generally speaking they are the same machines. And, as I say, big banks like Security Pacific, Marine Midland and several other banks on the east coast, I can't remember names, did contract, did give a contract to GE to develop these machines. And they could have at least stayed in that market, instead of letting it go. When the 1960s came about, they wanted to get in the wide open business data processing market without really having very much interest to keep the banking market. That's where I say they blew the capability.

MAPSTONE:

Right. When they actually had an urge ...

TORFEH:

Because at that time, I remember, I used to travel to different sites where they had problems. I was transferred from Palo Alto to Phoenix to head the modification project from ERMA to what they called the GE-100, which was a general purpose banking machine. It was the same thing as ERMA with small modifications; a card capability [was one of them]. I was heading that project and as a result I had to tour the country sometimes when they had trouble in the field or customers had some questions. Invariably I heard from the users, "when are you going to upgrade your machine to process more accounts"? The reason was obvious. They were growing in their banking and they wanted machines with higher capability. They were running these machines for twenty-four hours around the clock. Security Pacific, for instance, was running twenty-four hours around the clock, even though we had asked them to give us the machine for eight hours preventive maintenance. They would effectively come and beg our field service people to keep the machine going.

MAPSTONE:

So what they didn't do is develop a follow-on machine.

TORFEH:

With higher capability to continue that market. Yes.

MAPSTONE:

Computer Oral History Collection, 1969-1973, 1977

Mark Torfeh Interview, March 8, 1973, Archives Center, National Museum of American History

And somewhere along the line IBM did.

TORFEH:

That's right. IBM by that time--by the 1960s--IBM was already

in the banking business. They had their own check sorters. And the MICR character readers. They rented--no, I better change that. People on the East Coast had [?] the IBM machine, but GE definitely had the lead.

MAPSTONE:

I just thought about something. IBM, back in, oh, now we're going back into the forties, had a thing called the bank proof machine. This is before. Now, I'm not talking about stored program computer, by any means. But it was some kind of a big clunking device. But it was a bank proof machine, where, I don't know, some way or another, they proofed the checks against their records of some kind or another. It's just an interesting thought that they--back as early--and this was the forties--they were actually building a sort of clunking card punching type machine for banking services. It took them awhile before they got back into the market.

TORFEH:

Yes, but you know, during the same time the Bank of America had the ERMA system, the printing process they--you remember they came up with the BANKAMERICard system. That was originally an IBM machine.

MAPSTONE:

Oh.

TORFEH:

So when you went to their place in San Francisco, our ERMA installation, the upstairs was all IBM systems and the downstairs was all GE systems. [laughter].

MAPSTONE:

Yes, I see what you mean where--about GE just not getting what it should have.

TORFEH:

Right.

MAPSTONE:

They really were sitting there--sitting with it all in their hands.

TORFEH:

Right. It was a terrific opportunity. You see my opinion is that once you get into the banks, then you can easily get into other big businesses such as insurance companies,

mortgage companies, savings and loan companies. In all business areas you can get involved, especially with now optical character readers instead of MICR. But you just have to have a reputation and a lead on the market. And you have got to develop your systems around these markets instead of saying "Hey, you know, I would much rather get into IBM business and instead of doing that changing orientation, changing direction. There are a lot of unknowns in the other direction. It's alright to go other directions if you maintain your existing banks. But--no interest.

MAPSTONE:

You worked on the logic of the—

TORFEH:

ERMA system.

MAPSTONE:

ERMA system, and I thought you said you went to Phoenix. And now were you still involved with logic or did you get into other areas?

TORFEH:

At first I got involved in the logic design of the GE 100 modifications that I mentioned. And then later on I got involved in the systems group for the large computer systems which was--its main function was the system architecture. And what do you call the original planning of the logic? How it operates, and the feasibility studies on the feasibility of the technology, how far you can stretch it, how far you can go. The particular system I got involved with was interesting in that, if you recall in the early 1960s and '59, after the SAGE system, the STRETCH system and the ATLAS system was developed everybody wanted to go multiprocessor. But the semiconductor industry wasn't really ready for a large computer, multiprocessing system. Even though a lot of people were tempted, and I think CDC and Burroughs, for instance, did pretty good jobs with it. But many manufacturers, I think, shied away from that stuff because of the sheer size, physical size of the machine. That was kind of scary. Particularly, when you started thinking about the software available at that period, the monetary control of the system. It was way out. Surely you could build semiconductors together and do something. And you could go, you know, way out of hand, if you didn't really know how to manipulate the information flow. And, of course, what we call monitors in our systems now are these operating systems. It was quite difficult to conceive how far you can go to take advantage of a multiprocessing capability. You know, software people were just developing their concepts about multiple processing. And hardware people were trying to see how they could do it. So it didn't really look feasible. In the laboratory environment it did look feasible, but it was not a proven method yet, you know. And I think further down the line, when IBM announced the 360s in '64, it was the latter part of '63 and '64 I guess. They did

announce a large system. This was, I think, system /90. But they never really delivered that system. That was one of the problems. I think it could--they must have run into other problems. The sheer size of the machines--whereas, you know, CDC, for instance, at that very time, they announced their 6600. They made it; but that was a different market. It was typically a scientific market. In Livermore, for instance, AEC bought one of those. Has high computing capability, capacity, but scientists--cannot be manipulated very much--I don't really know. All the big machines go to Livermore [laughter] I don't know what they do.

MAPSTONE:

It's behind closed doors.

TORFEH:

Right. Yes, all the first CDC--the 6600, the 7600, the STAR system and all that. Their first machines always find their way to Livermore. I guess they probably send them to AEC and New Mexico.

MAPSTONE:

Los Alamos. So how far along did you get with the GE machine?

TORFEH:

The large system?

MAPSTONE:

The large system, yeah.

TORFEH:

That was when I really realized that GE is going to crumble and miss staying in the business. This project, we had spent about two and a half years in development of design, and some substantial money, over twenty million dollars, was spent on it; and they cancelled the project. And the cancellation was, I think, because of, probably, a change in corporate decision making process. Corporate organization decision making process, that brought about a comparison of a multi-processing machine that we were doing to the one that was developed in the military, in Syracuse. And, I guess, the top of the Corporation decided to get the Syracuse machine, instead of the one we were developing. And maybe incorporate some of the features we had developed in Phoenix on that machine and sell it as what was developed later on as the GE 640 or 635 or 640. That was really--the machine never compared to the machine we were developing. Besides that, there were a generation of machines that I guess we called middle--medium-size, they were the GE 400 series was the smallest of those, the GE 425,

and following that was supposed to be the machines that we called--what did we call them? G1, G2, G3, something like that, but eventually the G1 came out. I don't remember if it was the GE 425 but nothing followed. I did get involved in a project for a short period of time to look into a machine that would be competitive with the 1401 market, because that was the peak of the 1401 market, and GE, at least Johnson, who was head of engineering, thought that we should get into that market, but we were kind of three years after IBM and, of course, the 1401 machine was a successful machine only and only because it was an IBM machine. The reason I say that is because it had IBM peripherals on it, and nobody else could touch that kind of a system and make money in it unless they had their own highly reliable peripheral systems with the IBM type marketing services. And GE didn't have that. We had at that time, I remember, another section of GE engineering and design, a machine we called the GE 235, which as I recall we used to call the bastard machine because it was a nineteen bit word machine.

MAPSTONE:

[Laugh]

TORFEH:

Could never figure out how that developed.

MAPSTONE:

That would have been my next question.

TORFEH:

But it, you know, they developed that machine and used it as a general purpose machine. There was some interesting functions in that. For instance, if you wanted to do high speed arithmetic functions, there was a box that was designed--it's what they called an arithmetic unit--that was connected to the machine as an I/O device, that was working on the interim basis, the arithmetic unit inside the machine only had a certain amount of capability but if somebody wanted to have some extra mathematical, arithmetic capability he could buy this box. I thought that was a nice feature, because you don't slave across the entire machine for high speed mathematics.

MAPSTONE:

Yeah, that makes good sense.

TORFEH:

And that actually, that is the machine that got GE into the time-sharing business. They put a front end on it, they called it Datanet 30. That was the front-end of the GE 235 and that was the first timesharing machine, I think, that was designed commercially. That

was the beginning of GE's entry into timesharing systems. Later on, after they cancelled the large multiprocessing system project, the corporate management decided to have an upgrade version of the 225, a high-speed version of the 225, so with newer technology they developed a GE 235, and that 235 was exactly the same, but compatible with 225s, and a higher speed...

MAPSTONE:

Which is a follow-on.

TORFEH:

A follow-on, yes.

MAPSTONE:

Was--I thought SDS was one of the first companies to get into the time-sharing.

TORFEH:

Yes, but--well, it was after GE. GE had the machine; it didn't have very many installed bases. In fact, the man who got SDS interested in time sharing business was a man who used to be a marketing man at GE, and he established his own company which was called Tymeshare Corporation. It's a company--it's a different company, it's called Tymesharing; it's spelled T-Y.

MAPSTONE:

Is that a West Coast based?

TORFEH:

West Coast, yes.

MAPSTONE:

Who was the man who started it?

TORFEH:

The man's name is O'Roarke.

MAPSTONE:

O'Roarke?

TORFEH:

Yes. I think his headquarters is in San Francisco.

MAPSTONE:

And he was originally with GE?

TORFEH:

That's right. He was one of the district--regional managers at GE.

MAPSTONE:

And then went to SDS?

TORFEH:

No, he didn't come to SDS.

MAPSTONE:

Oh.

TORFEH:

He wanted to start this Tymeshare Corporation, and he did start that, and then, at that time, he got interested in the Berkeley machine.

MAPSTONE:

Aha.

TORFEH:

And Berkeley had bought a 930, SDS 930 from us, and they were modifying [it] to a timesharing system; it was really a research project for the Berkeley people. And O'Roarke had liked that machine, and he negotiated with our salespeople for it, and encouraged Max and the marketing people to grab the Berkeley concept and actually make a commercial development. And that's what they did.

MAPSTONE:

I see. OK. So Berkeley did the research, using an SDS machine and then, in turn, SDS came back and built the machine. But GE had a machine, too. Right?

TORFEH:

Yes. GE had that machine before, way before that.

MAPSTONE:

But it didn't get, it didn't get the--

TORFEH:

Well, they had some basis. I think they had five or six installations before we started. O'Roarke would be the guy to talk to, because he would know. He placed all those orders.

MAPSTONE:

Yeah. That sounds like a very good man to talk to.

TORFEH:

They have a branch down here. ...

MAPSTONE:

Just to get my GE genealogy somewhat straight. What would you say were the successful GE machines, starting with ERMA that got produced?

TORFEH:

Yes, well, I think their first success--I might be biased--but I think their first success with machines that GE had was the GE 100, or the ERMA system, they're almost parallel. And the next one, I can say easily, was the NCR 304. What I'm saying is that those machines didn't lose money. They at least broke even. The machine that, that may have cost as a computer something to GE, but one doesn't really know because they ... was control or power control or process control devices was what we called the GE 213, which was a drum machine, developed by another group of engineers, a GE computer, for process control and applications. Later on, in 1959--1960, GE divided the two organizations. They, they organized the GE computer control processing--process control computer activity and put them in a different building, in Phoenix, in a different building than the other faction [which] was to be general data processing. However, the development--I know that much about control climate--the team that did the 215 was the same team that did the 225, the 225 was an outgrowth of that 215 drum machine.

MAPSTONE:

But it was—

TORFEH:

It was an upgrade.

MAPSTONE:

An upgrade with--what, core?

TORFEH:

With core memory, right. And I think the 215, had a fifteen bit word,

MAPSTONE:

[laugh]

TORFEH:

because they wanted to do some other things, they finally added on these core bits, to do other functions, this is why it came on so hot.

MAPSTONE:

What was--ok, the 215 and the 225.

TORFEH:

Let's see, the GE 215--I can't really say it was money making, because GE generally sold to power companies like Edison and other, you know, PG&E, and GE would sell them a big control system for their power, and, as part of that, they would sell them a computer. So, if you look at the books it looks as if those computers made money, because they always were instrumental in selling the sixty million dollar system. But you can't really tell. Later on, for instance, I know the process control people came over to us, to SDS, they proposed to Max, they wanted to buy Max out, because he had a 930 and a 920 that would beautifully fit into their type of control system. I think that was one of the--I think that was the first company to propose buying SDS. [laugh].

MAPSTONE:

I wonder what they offered. [laugh].

TORFEH:

Well, Max, from what I heard, didn't give in; because he had just started, you know. The miraculous thing about SDS was that ten months after the company started they delivered

a machine.

MAPSTONE:

And within a year, they were in the blue.

TORFEH:

That's right. Yeah, within a year and a half, eighteen months, they were in the blue. Right. And that was really the miraculous part of it, and I don't think Max, at that time, would have been willing to give up.

MAPSTONE:

That's a fascinating development; it really is. Something I wanted to ask you was: Did you have any consultants, and the type of people who come to my mind are--well, Frankel, who was a consultant on character recognition, but, you know, like the Huskeys and the people who were really big names in the computing field? Did GE use any of these people?

TORFEH:

GE--I know that GE, when we were in Palo Alto, we used Frankel quite a bit. Frankel was actually instrumental in designing a paper processor that we called as a front end for the ERMA system. Originally, GE had agreed with Bank of America to make a paper processor that would sort out the checks and list them before they processed them on the computer; a sort of preprocessor.

MAPSTONE:

Mhm.

TORFEH:

And Frankel designed a drum machine to do it, to do that particular thing, and designed it particularly on paper and logic designers implemented the design. However, that design never worked out. I think Frankel was--sort of should stand somewhat guilty for that, because he broke all the circuit rules within the thing. He wanted to really play the type of sports he played with the LGP 30; but with the semiconductor, that thing wouldn't play. You had a completely different discipline and different value system in designing a semiconductor machine as is a vacuum tube. For instance, in vacuum tube, you require higher voltages. In vacuum tube, you had more heat to dissipate; the less tubes you used, definitely, you would save more money. Transistors is the bargaining thing that goes in there, you have to say, for instance, from this stage to that stage in a medial [?] path I can only put this many levels because this stage and that stage are only one plot apart; so you do a worst case analysis of the circuits, and you don't want to exceed those levels, the

levels of those numbers, because if you do, the worst case delays, if the components age or something, you may not have compared the next stage of switching before that next stage switches. But Frankel's model for computer design is to save flip-flops, [laugh] and he tried to practice that on that machine and it didn't work. It was very marginal. I was--a friend of mine and myself were assigned to do an analysis of the design of that for several months and the best we could do, really, was to bring that machine up and make it operate for fifteen minutes. Then it would fail again.

MAPSTONE:

On paper.

TORFEH:

Well no, it was, it was actually done.

MAPSTONE:

Oh, it was actually done.

TORFEH:

It was done, yes. It was a machine that--but didn't really do the job.

MAPSTONE:

Did any--did Frankel do anything else with GE?

TORFEH:

Oh, yeah. Frankel participated in developing the architecture of the future machines at the same time that, I think, yeah, at the same time that Herb Grosch got involved as a consultant.

MAPSTONE:

Oh yes, that's right. You mentioned that, I think. What was his?

TORFEH:

Herb?

MAPSTONE:

Yes.

TORFEH:

There was a series of machines that we called--if you talk to Joe Weizenbaum he'll probably remember it a lot better than I do--X,Y,Z series, these were supposed to be the GE second generation systems. X was supposed to be the smallest one; Y the next one, Z was to be a very large system. Joe was assigned to develop a team to do the architecture of that system. And he was the one who hired Herb as a consultant.

MAPSTONE:

Did von Neumann ever get into the picture? He died in '56.

TORFEH:

I don't think so.

MAPSTONE:

I keep forgetting that--that's really incredible, that he died—

TORFEH:

Just before GE got into the business.

MAPSTONE:

Yeah. And before so many of the computer developments really got underway.

TORFEH:

Right. In fact, I think he was--

MAPSTONE:

He died before the first generation finished, actually.

TORFEH:

Right. Even though we went from vacuum tubes to semiconductors, the first generation was still a sequential von Neumann machine. I think we still follow a lot of von Neumann's concepts. In other words, I think, most of our machines are still sequential processing. We have only limited parallel processing, even though we have all the processors. Basically, because the design on the operating system to do a true, honest, multiprocessing design is very complex. Nobody has really done a decent job yet.

MAPSTONE:

Right. Just hoped, I guess. Oh, yeah: One of the great issues that seems always to be coming up is the East Coast design, logical design, versus the West Coast logical design.

TORFEH:

Yes, yes. I thought you'd ask that question.

MAPSTONE:

[laugh].

TORFEH:

There are certain traditions that had developed on the West Coast and somehow didn't go to the East Coast, and vice versa. Of course, nowadays, it's pretty well mixed because of the infiltration of eastern engineers and western engineers. One of the major differences that I know is that we on the West Coast got used to developing machines in equations and actually documenting machines with logic equations. We had to teach our circuit people to write logic equations and debug the machines with logic equations, all our systems were developed out of that; whereas on the East Coast they went the schematic, the logic-schematic route, which was a further extension of electronics schematics. There are pros and cons on both sides, and almost fifty-fifty. Anybody can win the debate.

MAPSTONE:

[laugh].

TORFEH:

I think, it somewhat varies, varies with the different generations of machines. Right now, with medium size computing circuits, and large size computing circuits, I think schematics to the level of MSI and LSI, would pay off, probably, a lot better than equations; but if you go further down into the chips, into the LSI, let's say chips, and try to schematically represent them, then you're asking for a big roll of documentation just as awkward as equations. For design automation purposes, which is the technique that all of the industry uses now, equations are a lot simpler than schematics. The other pros and cons. I don't really know. Generally speaking, the East Coast people got into more of a sophisticated electronics, I mean, complex electronics, maybe our concepts about design of computers were simpler to some extent, or maybe they, because I was accustomed to it, looked simpler to me.

MAPSTONE:

Yeah. So, the GE machines were pretty much West Coast?

TORFEH:

Yes.

MAPSTONE:

I mean West Coast, with equations as opposed to schematic drawings.

TORFEH:

Yes, that's right. The logic team that did the first machines was typically, on the West Coast,

MAPSTONE:

Boolean algebra.

TORFEH:

That's right. Boolean algebra.

MAPSTONE:

Right.

TORFEH:

And, for instance, the people who designed the 304 for NCR were also the people who've developed the design automation for GE.

MAPSTONE:

Oh, that's interesting because--the 304 people were really the people who started the whole Boolean algebra,

TORFEH:

method.

MAPSTONE:

approach, anyway.

TORFEH:

Yes.

MAPSTONE:

Which was Floyd Steele and the group that came out of Northrop, so there really is a whole tie-in there between that genealogy.

TORFEH:

That's right. Very much so; very much, indeed. It is amazing how much that Northrop influenced the West Coast.

MAPSTONE:

It really is. I feel, I think, on the West Coast that's where it started.

TORFEH:

Yes. [laugh]. Well, of course, you know the scientific and real-time machines that were developed on the West Coast were generally tied to the aerospace industry. On the West Coast you have a lot more of that than on the East Coast. The only machines that I can think of that were commercially developed on the East Coast in the old days were the RCA BIZMAC and, following that, I guess, the RCA 601, that didn't get--that was another multiprocessor, that sort of thing. They actually made six of them, or eight or something. I've forgotten. The original B5000, I think, was a system that was designed by the Burroughs people in Philadelphia for a government application; I think it was for a communication system of some kind, I think they called it Burroughs 825 perhaps.

MAPSTONE:

OK. I think the 5000 was really a data processor.

[End of Tape]