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Computer Oral History Collection, 1969-1973, 1977

Interviewee: John M. Salzer

Interviewer: Richard R. Mertz

Date: February 17, 1971

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MERTZ:

The following is an interview conducted with Dr. John M. Salzer, S-A-L-Z-E-R, in his home: 909 Berkeley Street, Santa Monica, California, on the evening of the seventeenth of February, 1971, Richard Mertz is the interviewer.

[Recorder off]

SALZER:

Well, I thought it might be interesting to mention that my career in the United States, where I arrived in 1940, started as an upholsterer, and then I went to night school at Case Institute of Technology. I took a few courses before I was drafted. I was very fortunate in the Army because I did a lot of technical work there in anti-aircraft computers, both in the Ordnance and later in the Signal Corps on radar and related areas. I also had some Army training. Which they called the Army Specialized Training Program. So I gathered credits from about five different schools while in the Army, both correspondence courses and otherwise. When I got out of the Army, I went back and cleaned up my credits at Case, which turned out to be mostly the missing freshman humanities, and sophomore year and some junior. I had all my senior credits almost. I then went on for my master's degree. By that time I was supporting a family. And when I got my master's degree in 1947, '48, I decided to go on for a doctorate after having taken a number of tests that would indicate that I should be able to do it. I chose MIT simply because I was in electrical engineering already, and I wanted to go to the best school. At MIT I was offered a research assistant and later a research associate position at the Digital Computer Lab, which, at that time, was part of the Servomechanism Department--or Laboratory, under M. S. Gordon Brown, who is now dean, Professor Brown at the time.

MERTZ:

M. S. Gordon Brown, and Campbell was still alive and there.

SALZER:

Mhm. And the Digital Computer Laboratory was under the direction of Jay Forrester and Bob Everett. I worked directly with Bob Everett, and I was allowed to take credits about forty to fifty percent level compared to full time. And otherwise I worked full time at the

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Laboratory. My work there first was to learn about digital computers, which I considered extremely interesting. It was a new field for me because in the Army I prepared electromechanical analog computers and radar sets. And, however, my mathematical background and numerical interest was very great, and so I enjoyed this.

MERTZ:

Had you had, prior to 1940, any special training in mathematics and the sciences?

SALZER:

Prior to 1940, I only had high school. However, the high school level in Budapest

MERTZ:

Mhm.

SALZER:

was far greater than the high school level here.

MERTZ:

This was gymnasium?

SALZER:

It was Real gymnasium, essentially.

MERTZ:

And did you have--ah, oh, and then you specialized in science and technology at the—

SALZER:

My interests were always in the direction of physics and mathematics

MERTZ:

Mhm.

SALZER:

Although I liked humanities, too, but languages and all that. Does that answer your question?

MERTZ:

Yes.

SALZER:

Actually, I spent several years in Hungary before, after my graduation from high school, without going to college.

MERTZ:

Mhm.

SALZER:

Just supporting myself. So, I--where were we? So, excuse me, we come back now.

MERTZ:

When did you first appear on the scene at the Digital Computer Laboratory?

SALZER:

1948.

MERTZ:

'48, I see.

SALZER:

I started in September, 1948, and on the--what was called the Whirlwind project, which was, of course, the big--one of the first large-scale computers built along the von Neumann principle. The conceptual design of the machine was, of course, Jay Forrester, and his group, and the logical design was done by Bob Everett. I, as I spent my time there, I took over the block diagram responsibility for the computer,

MERTZ:

I see, mhm.

SALZER:

Which is really the logical design responsibility. And I enjoyed that very much.

MERTZ:

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Now, excuse me, in 1948, the several important decisions had already been made, hadn't they, about the kind of machine that the Whirlwind computer was to be? That is, they had decided,

SALZER:

Yes.

MERTZ:

I believe, it was to be a parallel synchronous machine rather than a serial machine, is that correct?

SALZER:

That's right, that's correct. Sixteen bits. At that time, of course, it was a storage tube

MERTZ:

Yes.

SALZER:

Memory, which we had a lot of difficulty with to make reliable. It was, the basic block diagram has been completely defined by Bob Everett and many others.

MERTZ:

Mhm.

SALZER:

However, the input-output part was not yet defined, and I had contributed very heavily to the design of that part.

MERTZ:

I see.

SALZER:

But the basic machine was defined, and I only took over to make sure that everything was kept in shape, so to day, like a project manager, not in responsibility but in staff effect.

MERTZ:

Well, now, there was, I imagine, some number of minor changes perhaps that went on in the block diagram as time went on.

SALZER:

Yes, and particularly in the input-output area, because at that time, we didn't even know what the input/output was going to be. We worked on the Eastman Kodak film output, which, of course, never became reliable.

MERTZ:

Were they working on it at that time when you were there?

SALZER:

Oh, yes. Exclusively.

MERTZ:

I see.

SALZER:

And there was some activity on magnetic recording, but that was in the very early stages of magnetic recording. And I voted for magnetic recording. But the investment, I guess, the thinking was very strongly in the film area until they had to give it up and go into other types of input-outputs. Before the storage tubes worked there we had only toggle switch registers. There were thirty-two sixteen-bit registers. I remember very well, because I had branched out from logical design into programming a little bit, and this was, of course, machine language programming. And it was quite an art to squeeze the most into thirty-two bits, thirty-two registers, and that really was very educational. We had sort of a contest on trigonometric routines particularly when, because coordinate conversion was very important, and I won that contest with a single twelve address instruction sine program which, I think, is still the basis of--maybe modified form--of the SAGE system.

MERTZ:

I see.

SALZER:

It was sine-cosine. And that was Professor Franklin, a very great mathematician who wrote a lot of books, was there, and he evaluated these results. It wasn't a formal contest, but it was just the pioneering spirit, and that was very, very educational. Later on, I got

into input-output programming only in the general conceptual sense. I did not write programs in great detail or very many of them. I also got into the testing programs, and we worked on, we had quite a project on how to test that computer. Of course, Norm Taylor's contributions there were on the marginal testing. And there was a lot of people there who had to write little routines to exercise various parts of the computer, and I was tied into that program, and my contributions were just incidental here. What I finally ended up in doing is getting to the real time application of computers, and then write my thesis on that topic. And this was really--the concept was a little funny at first, but once you really do it, it's so simple that it does not even appear like a contribution. But it was basically the representation of digital computer in the frequency domain, which is nothing else but application of...--plus transforms, or z transforms to difference equations, when you come right down to it, but in a real time sense, of course.

MERTZ:

This wasn't related in any way to the project they had for assigning television frequency bands—

SALZER:

None whatsoever.

MERTZ:

I was trying to think—

SALZER:

It was more in the sense of how you control; it was a control system problem. When you control, say, air traffic, or a body of some sort like a missile, or track-while-scan radars and things of that sort. Sample data systems, where the computer has to interact where the sampling time between control signals, command signals, is long enough to be comparable to the critical frequencies or time constants of the system. You find some very strange instabilities occurring. The RadLab series had a chapter in this direction by Horowitz, I think it was volume 5, but I don't remember anymore. And that gave sort of an impetus to go into this much more deeply. And I had a successful thesis in this area which gave me my doctor's degree.

MERTZ:

I see. Who--was Franklin involved in this at all, or was this—

SALZER:

No, it was--Bill Lidvall was my thesis supervisor. Franklin was a mathematician, whereas this was a control problem, and just incidentally a programming problem. And,

as a matter of fact, the strangest things happened. We tried to solve a second order equation on the computer using a display, a cathode ray tube display, and the solution which was completely stable, it was an over damp system, so to say, flew off the cathode ray tube, and nobody at that time could figure it out readily why it didn't display itself, whereas an unstable solution for the system for the differential equation displayed itself very well. And this was another, let's say, motivation or forcing function in my investigation. My thesis directly applied to that, and showed that the stability of the system and the stability of the computation are two independent things. And I was able to also find the degree of damping that would make the solution also stable by that particular difference equation which we used, and then we could demonstrate that. And this was a very exciting thing at that time in its way of my thesis: because that was my thesis topic of stability of complete systems where a program is just part of the system, and the stability of the program, of course, is part of the stability of the system, and vice versa. It could be a stable program, unstable system. And this basically is the topic of my thesis, which later on became a rather well-known topic in the field. When I came out here in 1951, I was fortunate to work in this field directly, and I also established a course in central data systems at UCLA which was at the time a brand new topic as a school thing. I wouldn't say any topic is really new. It seems to be Laplace invented everything. But we introduced—

MERTZ:

Some people think Gauss [laugh].

SALZER:

Gauss? Well, one or the other. Actually, in this area Laplace did do things and I also worked at Hughes on one of the first airborne computers used in fire control, airborne digital computers. Which, of course, also had control problems in it.

MERTZ:

Was this computer, in any sense, related to, in terms of its logical design or circuitry or the like, to Whirlwind or Sage computers?

SALZER:

Not in the least, of course. But the stability of the system was related to my thesis. As a matter of fact, the whole topic of a digital computer in a control system was a very unusual topic, and there were really no experts in that topic as such. And I can't go into my contributions here. Because, of course, it is a classified project. But some of the things we were able to make presentations on, and this was--we were designing then programs to compensate the system, which was another step in development. And we tested these programs at, on a simulator, and some of these simulations we were able to give speeches on because not all of them were classified.

MERTZ:

Did who else was on your committee that you did your—

SALZER:

thesis on?

MERTZ:

thesis on?

SALZER:

Well, I had quite a dignified committee. I had Forrester on it, of course, Bill Lindville, oh God, Morse.

MERTZ:

Oh yes?

SALZER:

Morse was on it. I'm not sure if Franklin was there--I think he was. And Campbell was there. And I think I left somebody out from the physics department; but I can't--oh, Kopal was there, who was in numerical analysis. And, incidentally, I was a very avid student of Kopal's. Zdenek Kopal.

MERTZ:

Mhm.

SALZER:

Who is an astronomer as well as a numerical analyst. And I edited his book; really, he gave me credit in his book. And this, of course, for me was an educational exercise. And so I had a very distinguished committee. I was--[laugh]

MERTZ:

I was going to say, did Morse have any particular influence on--on your-- Well, then, when you left MIT, you went to Hughes.

SALZER:

Yeah.

MERTZ:

Was--did this grow out of your work there, or did you know people at Hughes?

SALZER:

No, it was purely a matter of responding to interviewers and getting a good offer, and also finding that I would work in my field. At very few places could you work that close to the control problem of the digital computer at that time.

MERTZ:

Well, in 1951 Project Charles was--this was about the beginning of the—

SALZER:

Yeah.

MERTZ:

Lincoln Lab, and there was going to be a division.

SALZER:

I know. But, you know, I don't think this is very difficult to explain, but an airborne digital computer controlling a very fast moving plane and various firing equipment, missiles, and other things, guns, etcetera, is a much more difficult control problem in the dynamic sense.

MERTZ:

Yes, than in the—

SALZER:

In the dynamic sense, not in the complexity sense. The Lincoln project, the air traffic air control, and air traffic control, a very complex computational and a very complex problem because a lot of things are happening.

MERTZ:

Data

SALZER:

But my thesis was not as applicable to that as it was to these tight special purpose digital loops, so to say, closed loop systems. So to me, at that time, it appeared to be more challenging. I had, I was asked to stay with the project, and, well, I really can't tell you how I, how we reached decisions, but I think it was a little bit of the pioneering spirit to "go west young man," and that sort of thing.

MERTZ:

Well, did you, when you were involved at UCLA, have much contact with the Institute for Numerical Analysis?

SALZER:

No, only some contact. It's at, I knew about it. Again, that is not a control, not even an engineering project that was a mathematical project. As a matter of fact, it's a strange thing because after I left Hughes I joined the Magnavox Laboratory out here, which was constituted from people who were on that project and built the SWAC.

MERTZ:

Mhm.

SALZER:

So I--my association was after the SWAC, was more or less--that was the name of the computer, as you recall.

MERTZ:

Yes.

SALZER:

Which had a successful storage tube.

MERTZ:

It was Charles Tompkins.

SALZER:

Tompkins I knew, but, of course, he stayed at UCLA, but all the people who worked on the equipment there were the core of the Magnavox Laboratory out here, and I joined them. Dr. Thorensen.

MERTZ:

Was Willis Ware—

SALZER:

No, Willis Ware was, Willis Ware came from Princeton.

MERTZ:

Huskey, I was thinking of. Isn't he involved with—

SALZER:

Huskey was involved. Harry Huskey; but he did not join Magnavox. He stayed a consultant and I don't know exactly where he was, and also he was not so much involved with the equipment. The group that started Magnavox was mainly the equipment group.

MERTZ:

I see. And who—

SALZER:

The project probably went on as a project in programming or applications.

MERTZ:

And who, you were starting to mention, excuse me, before I interrupted, some of the people who—

SALZER:

Well, Dr. Thorensen was heading that project. He is still with Magnavox.

MERTZ:

I see.

SALZER:

And second in command, or the second man there was Mr. Ambrosio. Bennie Ambrosio. And there were a number of very capable engineers. It was a very small group, about ten people.

MERTZ:

What was their primary task?

SALZER:

Well, at that time, you know, it wasn't very clear which direction they would go. Magnavox wanted to get into this field. We actually had a very ambitious program when I got in there. We wanted to become "the computer designer for the Atlas project," which was a precursor--and we had very good relations with General Dynamics--but it was decided that that's going to be a little bigger project, and that's how STL was born, you know [laugh]. We didn't quite make it. No, our resources weren't such that we could. But we were seriously considered for it. At that time, it just looked like a computer design and not as a total system project.

MERTZ:

Now, let's see. We're getting a little bit ahead of the chronology. This was after—

SALZER:

This is '54.

MERTZ:

'54, I see,

SALZER:

so you're still [within] your limits [laugh].

MERTZ:

Yes, but we're several years after Hughes.

SALZER:

Well, I was at Hughes from '51 to '54.

MERTZ:

Mhm.

SALZER:

I left during the time that most people left, but I went in a novel direction. Magnavox.

MERTZ:

Mhm. Of the..of the people that you knew back at MIT during the period from '48 to '51

SALZER:

Yes.

MERTZ:

do you recall if any of them came West? Do you know?

SALZER:

I'm thinking. Most of them were very happy in the Boston area.

MERTZ:

I only know of one person at the moment who went west and that was... who went to St. Louis.

SALZER:

Yes, but not out here. Is he there now?

MERTZ:

I believe he's still there, although he's at Washington University.

SALZER:

Well, there was--yeah, there was a fellow named, I think, Bill Morrison; anyhow, Morrison who--but he was not one of the pioneers. He was, and I know he was out here at SDC, I guess. But I don't remember any of the major figures getting out here.

MERTZ:

Mhm. Do you happen to recall any visits that were made by John von Neumann to the Whirlwind project while you were there?

SALZER:

No, I--well, I shouldn't say that. Yes, but I remember von Neumann being out here giving some lectures on redundant systems, reliable systems made of unreliable components by redundancy. And I know he was, he was out there once while I was there, but I don't think I had much to do with that visit. We had some very interesting visitors there, of course. Dr. Rajchman of RCA, and we had, of course, C. V. L. Smith of

the Navy, who was project engineer at the start with the Navy Training Devices Center. And Aiken was out, of course.

MERTZ:

I think Wilkes came by there on his way from—

SALZER:

Yes. And I don't, I don't recall Wilkes, and it's quite possible that I was involved then, but—

MERTZ:

Charles Adams spent some time, quite a bit of time, with him because, as you may recall, Wilkes, Wheeler and Gill was the first textbook on computer programming--a number of Englishmen spent time at Illinois and then part of the time in the summer at MIT, and went back to Manchester and Cambridge.

SALZER:

This was under Meager or was it before Meager?

MERTZ:

I think it was under him

SALZER:

Mhm.

MERTZ:

Because he had spent a year or so at Princeton.

SALZER:

Well, Meager got started in '50, I guess; very close to the end of my stay at MIT.

MERTZ:

Of the people that you know who did go west, who followed Horace Greeley's advice, in the Los Angeles area, or, for that matter, elsewhere, who do you think, would you feel, are important people to talk to or visiting, interviews?

SALZER:

You mean from MIT?

MERTZ:

Well, just to your knowledge, who've come out West.

SALZER:

Well—

MERTZ:

We've been accused of being a little bit parochial back in the East because we don't—

SALZER:

Well, I think Willis Ware, of course, who came from Princeton and made important contributions. And Milt Rosenberg, also from Princeton, although I don't know how he was connected with Ware there. He certainly made contributions here. In fact, he built the JOHNNIAC, or helped build the JOHNNIAC memory.

MERTZ:

Where is he now?

SALZER:

He's with Electronic Memories and Magnetics, which is a company he established. He was one of the founders.

MERTZ:

Is that in the Los Angeles area?

SALZER:

Oh yeah. His office is on Wilshire, I think it's 35, 3435.

MERTZ:

Milton?

SALZER:

Milt Rosenberg. 3435, I think. It's a big building. Electronic Memories. The telephone

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is 380-1111. I remember numbers but forget--I think its Equitable Building. Yes, it's the Equitable Building. It's right across from IBM.

MERTZ:

And he is certainly one of the ...

SALZER:

Yes. He has accomplished a lot, and he's shifted from, I think, more of the outer field. He was really scientific instrumentation as far as electronics is concerned. I forgot exactly what, but--and he branched into this. A very capable person. Achieved a lot. I hate, I hate, to, you know, just be so haphazard, but, of course, there are a lot of people who started here, you know. Didn't know even when they were east. Like Eldred Nelson.

MERTZ:

Mhm.

SALZER:

who's

MERTZ:

Dr. Nelson, Eldred?

SALZER:

Yes.

SALZER:

who is now with TRW, and he, he was, during very early for the airborne computer project at Hughes he did some of the early logical design work. And, he's more mathematically and programming-wise oriented. But he was a good one. He did a lot of contributions. He did not publish much, but he made contributions which were significant. I--way back, you want to keep this before '55, you know, it's very difficult to just grab things out of the air. So I--probably as I go on, things will come to me.

MERTZ:

Come to mind, sure.

SALZER:

At Cal Tech, of course, there was McCann who is now in the simulation of the brain, that area.

MERTZ:

Artificial intelligence?

SALZER:

Artificial intelligence.

MERTZ:

Same with Kirsch, who was with the SEAC project.

SALZER:

Yes, SEAC. Now, Bill Martin was also with SEAC, right? And he's out here now. He's a man who came out and did a lot--we did a lot initially in the committee work, in the sense of establishing a computer community here under the aegis of IRE at that time. We organized one of the first Joint Computer Conferences, which we called Western Computer Conference at that time.

MERTZ:

Mhm.

SALZER:

And Bill Martin was very active then. He's up north in San Francisco.

MERTZ:

Where is McCann?

SALZER:

As far as I know he is still at Cal Tech.

MERTZ:

He is? Well, and then there are some others who are, I think u, up--fine, at Stanford.

SALZER:

Of course, Bill Lindville is out here at Stanford.

MERTZ:

Yeah.

SALZER:

But he has to do, he is a systems man, he is a systems man. You know, computers are a component in his thinking, but he's a very capable person. Central [?] data systems, of course, he did definite pioneer work, but not so much with computer orientation. That is, up to '55 he was more a control systems man, but he did some fundamental work in this area of computer applications, control systems.

MERTZ:

You mentioned, just to skip back a little bit, during World War II you were active in work on fire control with the M-4, M-5 gun directors. Was this as an employee of the Army Ordnance?

SALZER:

As a recruit of the Army Ordnance.

MERTZ:

Oh, I see. You were in the service.

SALZER:

I was in the service,

MERTZ:

Mhm.

SALZER:

I came out as a staff sergeant, Technical Staff Sergeant.

MERTZ:

Mhm. Now were there any people with whom you were associated at that time who later wound up in—

SALZER:

No, this was down-to-earth repair work out in the field.

MERTZ:

Mhm.

SALZER:

If things went wrong we went there and tried to fix it. Probably we plugged in the computer or something like that.

MERTZ:

There, Forrester had to do that with a radar mount too, on this project he had before he got started on—

SALZER:

Yes, as a matter of fact, the radar, the track-while-scan radar had a lot to do with the motivation in this whole Lincoln and ...project, I'm sure. But I didn't do this from the theoretical point of view. I...well, it was purely repairing and I understood the, I learned a lot about analog computers in this process and, of course, I knew intimately some of the electrical circuits and remote control systems, etc.

MERTZ:

And I take it there was some ASOP training that went along with it?

SALZER:

No, it wasn't along with it. It was one followed the other.

MERTZ:

Oh. The ASOP training preceded the—

SALZER:

No.

MERTZ:

Followed?

SALZER:

I first got my basic training, then I got my technical training in the Ordnance

MERTZ:

Mhm.

SALZER:

at Aberdeen. Then I was shipped overseas after Pearl Harbor, and I was in Hawaii for a year running around repairing installations.

MERTZ:

Mhm.

SALZER:

When I came back, I joined the ASOP program. They wanted me to become a linguist, but I fought with tooth and nail and was able to get into engineering. And so I had won four terms of engineering in three different schools.

MERTZ:

I see.

SALZER:

While I did this, I also took correspondence courses to clean up some of my prerequisites in order to be accepted. So—

MERTZ:

This is back at Case, or was this—

SALZER:

No, Louisiana State, Texas Tech, University of Maryland, University of Michigan. And I took additional correspondence courses from Louisiana State and from Wisconsin. So I, I scraped up everything I could. Then they put me in the Signal Corps. I couldn't finish because it looked like they didn't need so many people. They put me in the Signal Corps where I learned a lot about radar, communications, and pulse communications systems, some of the first pulse communications systems.

MERTZ:

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Did you go to the radar school

SALZER:

Yes.

MERTZ:

at MIT or Harvard?

SALZER:

At Fort Monmouth, Fort Monmouth,

MERTZ:

Fort Monmouth, mhm.

SALZER:

and also communications school. The TRC-7, I think, was the set. It was a pulse position modulation system.

MERTZ:

Mhm. And so that was very good training. Then they sent me out to Camp Crowder where I didn't do anything except wait to be discharged.

MERTZ:

And then returned—

SALZER:

I returned straight to Case.

MERTZ:

Case.

SALZER:

I was married by that time. I got married

MERTZ:

1944, is it?

SALZER:

Yeah. You looked it up?

MERTZ:

Huh?

SALZER:

You looked it up.

MERTZ:

You're married and you have four children.

SALZER:

Four children. And I went back to Case and I studied furiously to make up everything. I took eight courses, eight full courses in a three month's term. I remember that very well. All humanities, so it was really hard work. But I wanted to get through; I did, post haste. And then I got, I took my master's. By that time I had a child. And I held down a few jobs.

MERTZ:

You had some GI Bill—

SALZER:

Oh, yeah. I couldn't do it without it. It was difficult enough this way.

MERTZ:

At MIT then you also had this teaching assistant—

SALZER:

Research assistant, research associate.

MERTZ:

Research associate, which was directly with the Whirlwind project?

SALZER:

Yes.

MERTZ:

Did they worked a--I don't know whether it was just a sort of rigged thing for display purposes, but they had a bouncing ball problem that they showed. In terms of graphic display in the Whirlwind fairly early when it was--now, I don't know whether this was just simply—

SALZER:

Well, I don't know the bouncing ball necessarily. We had a display. I won't say that was fairly early, I think that was fairly late. Because the input-output, you know, as all computers, they had the arithmetic unit chunking and multiplying thing and somebody said, "Well, gee, maybe we should show something for the visiting firemen." But I think that was one of the first cathode ray display systems ever connected to a digital computer. And I think that we had various demonstrations, I wouldn't doubt that there was a bouncing ball. I mean, it's quite possible; I don't recall exactly that. But that was exactly the time when I also put on these problems in stability.

MERTZ:

I see.

SALZER:

So the bouncing ball, I'm sure, we had various things there like simulating shooting down airplanes and this sort of thing. And so that's quite possible. In fact, I think that some of the air traffic projects utilized this display, too.

MERTZ:

They had a device known as a light gun, which—

SALZER:

Also was one of the first.

MERTZ:

Which was considered, I believe, top be, early one. It became quite interesting and an application many years later, although it was, I believe, in connection with reservations of airlines and the like. But there was no real...between the two developments, but they did have—

SALZER:

I think there is.

MERTZ:

Well, in the sense that it was many years before the idea was—

SALZER:

Was actually

MERTZ:

Picked up on. Conceivably

SALZER:

Yes. It was many years before sample data systems became actually used. In fact, I was called in on a patent case, you know, in this area, many years later. No, but that was the first. I think they are direct descendants. The basic idea came from there. So I'm sure that had an effect on the Whirlwind. The idea is very straightforward and simple.

MERTZ:

The...did you get at all involved, or was this a little bit after your--with the so-called Cape Cod system?

SALZER:

I was not involved with the Cape Cod system. I was familiar. I think the Cape Cod system was already either in the planning stage or actually done. But I was not directly involved. Dave Israel was, I believe. Ed Rich, I think, was involved, but I was not.

MERTZ:

And Weiser. MS:Yes. Bob Weiser.

MERTZ:

There were...And that came along at a very, excuse me, important moment when the, for the future of the Whirlwind project, since it did, in fact, I believe, demonstrate capability for tracking and guiding and intercepting.

SALZER:

Yeah, Well, I think it was already in process then, because I wouldn't have that much; I seem to have more knowledge of it than I would have if I had left already. But I was not involved. At that time I was, must have been avidly writing upon my thesis.

MERTZ:

Mhm. Right. Well, I was going to say, it was about that time, if not just a little later that a completely new--well, not completely new, but a new approach was being taken to designing, drawing up the logical design for the SAGE computer with a view toward making it sort of Whirlwind II. If there had been a Whirlwind II computer it would have been the AN/FSQ 7 SAGE

SALZER:

Yeah.

MERTZ:

machine which was a completely double dual

SALZER:

Yeah.

MERTZ:

Computer. And, and those logic diagrams were being f drawn up perhaps as early as '52, but I don't believe '51.

SALZER:

Well, Whirlwind II, of course, was described sketchily already in '48. But it never was created in that, in that same vein. And the AN/FSQ 7, well, you can call it a derivative of Whirlwind, but it's not the Whirlwind II as it was described.

MERTZ:

What, what do you feel are the most significant or substantial contributions that you have made to, to computer technology, looking back in retrospect?

SALZER:

I think it, it was the...application of computers in control systems.

MERTZ:

Which grew to some extent out of your doctoral

SALZER:

Oh, yeah.

MERTZ:

work, and directly—

SALZER:

Directly related to it. And then, of course, the very unusual thing of many people who can continue in the field of their thesis. It was fortuitous, or maybe the thesis was oriented toward problems that really arose, but my...at least three years at Hughes I was able to directly relate to that thesis in my work.

MERTZ:

During those three years, whom would you, could you single out any individuals who you felt were doing the most significant work or consequential work? I realize that they, that they didn't...well, that it was highly directed research work...

SALZER:

Well, I, I must say, that there were a lot of people--you mean in my field or in the project in general?

MERTZ:

In the project in general.

SALZER:

The project was [laugh] well, Rube Mettler, who is now President of TRW. He certainly was conceiving the whole system. And Bill Jacoby, who wrote one of the basic documents of the system. This is all classified, of course.

MERTZ:

I don't know whether, you know whether it still is. Or whether it's been—

SALZER:

I don't know.

MERTZ:

Because all of the SAGE materials up through 1958 have been declassified.

SALZER:

Yeah. I don't--I can tell you it was called the MX1179 system, and you can find out.

MERTZ:

Oh. The MX11

SALZER:

79

MERTZ:

dash 79, or 1179?

SALZER:

1179.

SALZER:

And then a fellow who worked for me is Hal Gruen, who came from the Institute for Numerical Analysis, actually.

MERTZ:

Gruen, G-R-U-E-N?

SALZER:

Yeah. Who worked with me. We wrote off the first complete set of equations for that system. And he did make contributions.

MERTZ:

Right. This is the end of this side.

[End of Side One]

SALZER:

And systems was, of course, a lot of people like Al Jones who did a lot with the radar system; Paul Gates who did a lot with the communication part and also the whole system. In the particular area I worked in I had two people working with me, one was Tom Burns, the other was Jim Cloud, who made some significant contributions in detail to programming and how the programming interacts with the system.

MERTZ:

Are they all out here in California?

SALZER:

Jim Cloud is still with Hughes, and he had a very major role in Surveyor since that time. And Tom Burns, I don't know if he's still at Hughes. Hal Gruen is now with Litton Data Systems. All these contributions were in specific areas let's say. I'm trying to think because I know I leave out people in this thing.

MERTZ:

Well, you mentioned, if I might just go back a little bit and jog your memory; you mentioned that you were active in helping organize the joint Western Conference, computer

SALZER:

The last time that it was called not joint computer conference.

MERTZ:

Right. That might have brought some of the people who were active in organizing it and getting things together might still be active...

SALZER:

Well, you know, again this was.. I think it was in '54. I know I mentioned one name, Thorenson, who was active in that particular conference. I think that Jim Wiener who was with UNIVAC--I don't know why he was out here, but he was there--Wiener was the third, well, had important contribution in Eckert-Mauchly's operation then of course he was with UNIVAC. Since that time, well, I think he is in Europe now, but I'm not sure. He was with North American as a European man... I don't know where he is at the moment. He might be back here

MERTZ:

Did you ever run across a fellow named Mitchell, Herbert Mitchell?

SALZER:

Mitchell or Herbert?

MERTZ:

Mitchell, but I'm not sure of... Dr. Thorenson...

SALZER:

On that conference I forgot what his role was and my role was but we worked on it. I still have somewhere one of these parabolic (?) pictures of the hat table (?) People showing. I think Bill Martin is on it, but I can't recall. I think it was the hat table. Maybe that is why Jim Wiener is on it, he was visiting...

MERTZ:

Was Huskey involved in it at all?

SALZER:

I don't know, but Huskey was involved at that time with... Of course, he consulted for Bendix from the G-15 computer, if I recall. And he might have done some consulting for Magnavox too.

MERTZ:

Did you ever run into a man named Al Leiner? (unclear) Then there's Sorokin (?)

SALZER:

I didn't know him. I know, well there was Bill Gunning. We had a very nice group operating out here.

MERTZ:

Is he in the Los Angeles area?

SALZER:

I don't know where he is now. Last time he was with Astrodata...that exploded. He used to be with Rand, but that was quite a while ago--mid-fifties.

MERTZ:

Willis Ware has been with Rand consistently all the way... Murray Geisler

SALZER:

I don't know him. Keith _____ Juncosa (?) I know of Juncosa but I don't really know what role he played with computers. I don't know what you're trying to...

MERTZ:

The general thing is I'm trying to jog your memory if there are people who you know who might... One other area that I'm interested in, and this is something that you might want to think about, if you can't think of anything right off hand it might come in the shower or some other time, and that is some people have what has been called rather ungraciously a packrat mentality. That is they like to collect and save things. They are for historians very useful to meet and to identify. And sometimes they are not the individuals who necessarily played a very prominent role in a particular thing, but they...to give you an example of the kind of thing I'm thinking of, Patrick Eutes, in 1947 and part of late 1946 kept a daily diary of all the people who came to the Whirlwind project and discussed different things. There is no other record of who was there and what was talked about at that time except for his daily diary. Now he wasn't Forrester, the head of the project, of Gordon Brown, the head of the Laboratory, but still he produced some very useful and important material.

SALZER:

Well, I can do some digging, but I'm not that kind of collector.

MERTZ:

Well, I wasn't thinking of you necessarily yourself, but you might know of people around who might do this, have this sort of thing, and have an antiquarian's interest in computers. You are more apt to find this to some extent among people who were involved in the hardware than in the purely mathematics. Were there fairly good records kept of the West Coast activities, organization...

SALZER:

Probably not. I imagine we had minutes and the like, but I don't know where this became a repository. The whole thing started as a computer chapter of the professional group formations of IRE.

MERTZ:

How about ACM?

SALZER:

ACM, you know, I was always connected with ACM but never very active in it, and in the early times ACM was not doing much out here as far as I can recall. It was really the IRE group that created the professional atmosphere. Also I don't remember what...I think the first computer conference that we organized ACM might have been involved, and particularly AIEE might have been involved. I really don't know who the sponsors were. But it was the IRE activity really that created the core, and it always had well attended meetings here. An interesting development in computers and it might start passing the...I think it was probably...oh, you know who you should talk to is Dr. Frankel. He designed I don't know which computer. He's a logical designer who has excellent capability. He designed Librascopes for the AL 30 computer which was one of the early machines. Now the only thing I don't know whether this happened before '55 or not.

MERTZ:

Do you know where he is now?

SALZER:

He is around. I think he is still but I couldn't swear to it. He is economically located...He designed since that time a number of other computers always for other people, but he is certainly one of the early computer capable people. Palevsky, of course, you know about. He's getting in the movies now. There's quite a write up on him. You know, he starts something new now, I suppose.

MERTZ:

No, I didn't see that.

SALZER:

California Business brought an article on it. Why not. But he certainly did some very early work.

MERTZ:

Was he active in this group?

SALZER:

No. No. He was never gunning down to that, but I think again his contributions may have been later out here, but he was with Huntsville and other places where he did design some of the early let's say digital differential analyzer type computers and was always able to select the people to work for him--I don't mean that in a disparaging sense--but he was always able to select

MERTZ:

He had a good eye for talent, huh

SALZER:

A good eye for right talent and he could put this all into something to bring out a successful project. Which is an unusual capability.

MERTZ:

What was he mostly associated with at the time...

SALZER:

Well, I don't think he was out here at that time. I think he came in the late fifties. He moved out here. I think he went to Packard-Bell and headed their computer project. I know he was there, but whether that's when he came out... Now one person who did connect with the computer field before '55 is probably Les Kilpatrick, who is President of CalComp. Les had an administrative role, but really he had very close interaction with--well, he was active in the computer group at that time, and he had an important role at Automatics (?) or whatever it was called then. Although it seemed to be more or less managerial role, nevertheless he knew--it was a technical managerial role, he understood the computer field and he still does. These are some of the very successful people here. Offhand I don't...

MERTZ:

Do you know of any who sort of got their start out here and went East? We were talking of people going West.

SALZER:

There are fewer of those. No I really don't. Offhand I can't think of any

MERTZ:

There might be some people with IBM or something. I don't know of any. Who do you think would know or who might be able to come up with some leads as to.

SALZER:

For instance, Gerry Estrin is out here. Dr. Estrin. He came from the Moore School which produced the...He certainly is one of the old-timers. And Max Maurice Rubin. And Herb Grosch came out here and went back. You asked for somebody to go back. He was out here for quite a while, before he went to the National Bureau of Standards he was out

here.

MERTZ:

I think it was after '55.

SALZER:

Oh, yes. But he was a factor before '55.

MERTZ:

Oh, yes, That's right. ... Watson Computing Laboratory (?). He was even an associate with the Whirlwind project for six months.

SALZER:

Not while I was there.

MERTZ:

Did he get involved with General Electric--my recollection is a bit hazy...

SALZER:

Of course, we had Rideman(?) out here.

MERTZ:

How active was he...

SALZER:

You know, he was a very big man at Rand Lab (?). Obviously did an outstanding job. When he came out here he decided to establish a small company, and you know, you're fighting on a different level. But he did establish this Telemeter Magnetics it was called, and that was before '55. And Milt Rosenberg worked for him. And Erwin Tomash who is now President of Data Products worked there. Sh is not Hungarian.

MERTZ:

But a pronounced sh and Anglicized to sh---

SALZER:

It could be Hungarian. I know him very well, I never asked him that. You know another

person who really pioneered here just at the ragged edge of your '55 deadline here was Walt Bauer who had a lot to do with establishing one of the first large computing centers. He is now President of Infomatics. Walt Bauer. He worked for me at TRW.

MERTZ:

How about people at TRW...

SALZER:

Well, of course, people at TRW most of them, well, TRW was formed in '54.

MERTZ:

But I thought maybe there might be some people who are today still with them who were active before that time.

SALZER:

Well, I mentioned a number already like Eldred Nelson. Then there's Eugene Grabbe, who had a lot to do with airborne computer. From the equipment point of view there were some very capable people. Everybody did contributions there because particularly there were people like Pete Retsinger. There is a very basic patent by Scarborough and Exner which is a huge patent. The reason I know about it is because I was there. I don't know where Exner is. Scarborough is with _____ Ramo. Probably Pete Bolles and Don Burbeck. Bolles is with ____ Ramo. Don Burbeck who is with now I guess Honeywell Information Systems. They all did some rather fundamental work. Pete Bolles and Don Burbeck worked on the airborne computer prior to the one I worked on, but it was a simpler, it was a prototype one, it didn't go into production. But still they did some of the first navigation experiments. And of course Grabbe and Eldred Nelson were all involved in some fashion.

MERTZ:

Do you recall when this was first organized as a computer group, was this in '54, '55. The group to hold the first...Chairman oror was there a Chairman?

SALZER:

I branch in to the national thing. I'm trying to think whether I was Chairman of the local chapter. I think I was. But it's very hazy and then I started work on national... And Gene Grabbe was in that and me. I got into the control systems group nationally, not the computer. Locally also I was not chairman of the computer group. The controls group. I worked in both groups. Originally I was more active in the computer group. I would say that the thing started in '52. In fact I was asked to give a talk on my thesis and I know it was very early. It was in '52 that Willis Ware came from the East. And I know we asked

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him to do something. I know I participated in a program; I might have been program committee chairman or something. I don't think I was chairman of the group. It bothers me because I should know, but I cannot

MERTZ:

How about people who were involved in more traditional kinds of numerical analysis and computer programming. I'm thinking of people like _____.

SALZER:

Kalusch. I'm sure I'll misspell it. He did some very interesting work at that time but frankly I can't recall anymore. Strictly a mathematician but very application oriented. Gene Grabbe would know his name. And I don't know where he is now, but... And of course at the Numerical Analysis there was Bob Hayes. Do you know him? He worked for me at Hughes on the Hughes navigation system and then later worked for me at Magnavox, but he branched out into--he is now director of library sciences at UCLA, something like that. He branched out into this whole area of data dissemination, not data processing, not that he couldn't do that...Information storage and retrieval, that's the right word. He's quite a specialist and extremely capable. He was here in that period.

MERTZ:

Do you recall anyone who was particularly interested in or active in the problem of languages and computers, translation

SALZER:

Yes. Don Swanson worked for me at TRW. He certainly did some of the very basic things, but I don't when he started. That was in '59. Now he started much before that, but I cannot swear it was before '55. I think he is at the University of Chicago now as head of library sciences or something like that. But he is a _____ involved in that period. But now you see I'm getting away from that period and I don't want to do that. Prior to that I didn't know anybody that...

MERTZ:

Did the group out on the West Coast seem to meet fairly regularly and often?

SALZER:

Well, I have not been that active recently.

MERTZ:

I don't mean recently. I'm thinking of the early, the period in the fifties.

SALZER:

Yes, it was a real pioneering spirit, you know, people wanted to find out what goes on. The meetings were, you know, not that huge, say between twenty and fifty, it wasn't huge in that sense, but it was very intense. Those who were there really were there to participate and to interact.

MERTZ:

You don't recall offhand who might have kept track of the minutes.... Well, Bill Martin certainly was one of the absolute first out here. So he might.

MERTZ:

He would be a possible source of information.

SALZER:

I think Bill Gunning was too, but I doubt that he kept records.

MERTZ:

I've forgotten now where Bill Martin is.

SALZER:

Bill Martin is with Zehnteo which is an affiliate of Electronic Memories. I have his card at my office, but I don't know, I can't even tell you whether he is in Concord, California. It is up in the Bay area somewhere, or whether it's Oakland or Berkeley. I think it's either Oakland or Berkeley.

MERTZ:

He might be a good...

SALZER:

He certainly would be. And of course Huskey... Yes, Huskey was very active. Of course, Tompkins just died.

MERTZ:

Tompkins died just a few weeks ago. He was one of the..

SALZER:

He certainly was, particularly ACM history we would have been able to shed light on
MERTZ:

Do you know of anyone who is very old or very ailing who should be talked to for those reasons? How about Wooldridge?

SALZER:

Well, Wooldridge, in that period I don't consider him a computer man at all.

MERTZ:

Well, in the 1940s he was active in Bell Laboratory.

SALZER:

In computers?

MERTZ:

Gun director, fire control. Wooldridge holds with Ox, MAG Ox a couple of very basic patents in the field of DC drift compensators.

SALZER:

I did not know that. But in any case out here he did not particularly... Of course, he has supervised so many projects that contained that element that... and now of course his work is he is writing books about brain and thinking processes, simulation, artificial intelligence. Similarly I don't feel that Ramo's contribution is in that area, at least not as a person. Indirectly, of course. I'm thinking of other companies, now. Of course NCR out here was formed by absorbing some... Well, of course, the MADDIDA, the digital differential analyzer, drum base, Floyd Steele was active in that and a number of other people. Who, some of them are with NCR, some of them at other places. Sarkissian, for instance, Sarkissian is a significant, I knew him at Ft. Monmouth.

MERTZ:

Is he out here?

SALZER:

Yes. They just changed names. His company changed names. It used to be S, S and S; Sarkissian, Saylor, and Spear, Bill Spear. I think they were bought up by... I think the name Monitor is in it. It starts with an M. But if you call, and it's in Costa Mesa, so if you call. Again I have the address. I was just notified recently that they had changed

names.

MERTZ:

Well, in the last couple of years in the field...

SALZER:

But Sarkissian would be a good one.

MERTZ:

And he was at Ft. Monmouth?

SALZER:

I met him at Ft. Monmouth, which was very strange. I think he was an instructor there just incidentally. And then I saw him out here with what was called Computer Research Corporation, which had one of the first little computers, you know. It was bought up by NCR, I think, or was it Northrop first and then NCR... But he would have some historical inputs to make, and being up some other names that I could not somehow mention. (Unclear) Hectol (?) But I really can't put them in the right perspective.

MERTZ:

Do you think there is anything in particular that the West Coast is going to be (?) observed so far as the future development of computer research and development is concerned, that they'll be making in the regional sense any contribution...

SALZER:

Well, I don't think this is really possible. Let's say they are bolder out here, less conservative, but today anything that can easily be done by boldness is usually also done in the East Coast or other places, and anything that takes a very major investment is not done...requires now the kind of support that only large companies can provide. The nature of the companies out here is somewhat different, but not sufficiently different to say they are certain things. I don't really see the large contributions, unusual contributions naturally coming to the West Coast. I think the most unusual contributions will have to do with microelectronic capabilities that, whereas we have microelectronic companies here, maybe Fairchild is the strongest in this area, of course, now North American, too, and some others, that kind of capability, as a matter of fact North American might at some time contribute rather radical things to the computer field. So then the input-output of the peripheral stuff has possibilities, but I don't see anything that could be typically West Coast. It might grow out of here. Now for instance there is an activity up north which has to do with optical storage. It's too early to say whether it's going to be that significant, but it is unique and it is proprietary, and the work is being done here, but it is

not peculiar to the West--it just...

MERTZ:

I was thinking perhaps historically there was one thing this area had which makes it a little bit different from other areas was the interest in the development of aircraft companies in computers.

SALZER:

And this led to one of the first digital control computers. But already at that time IBM was doing the bombing system. In fact, I was interviewed for that, too. Their airborne computers also made a contribution of sorts. Yes, there certainly are these factors.

MERTZ:

Would you say the general economic situation that obtains elsewhere in the computer field, particularly in the software area with small companies is also true in the West in 1971.

SALZER:

Yes. The West soft...and software field probably even more because again there is... you see whenever you can catapult yourself in a strong position during a boom time on the West Coast it's more likely to happen because at least last ten years people experimented here more readily, but when the bust comes then the West also suffers more heavily. So some of the worst failures in software, and I don't like to just use that word, and I don't like to use that word because to me it has about twelve different shadings, but they happened out here, at least as much as in the East or in other places. So that might be the optimism of broad based usage of time sharing just cannot carry. I think the educational process is completely underestimated. The educational process is bound to be of people and not just training in the definite sense. So it just won't put a computer in the home, say, until housewives start thinking that way and start having control panels for other things... One day there will be a cockpit in the house, but I don't like to call those computers really because, I think the biggest thing that will happen for the home is more in information retrieval, storage and retrieval and probably some programming and scheduling. The computational problem would be very minor, the computational usage. But it would be nice to be able to retrieve the recipe according to associative search rather than go through the mess of old books here and there.

MERTZ:

There's no particular reason why that can't be done.

SALZER:

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No, it's just a matter of cost and education. You couldn't introduce it today even if you did it cost _____.

MERTZ:

Well, thank you very much.

SALZER:

Well, I appreciate your interest, and I feel honored to participate in this. I hope it helped you.

MERTZ:

Yes, I'm sure you have. Thank you.

[End of Interview]