Computer Oral History Collection, 1969-1973, 1977

Interviewee: Dr. Josef Kates
Interviewer: Henry S. Tropp
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KATES:

Well, if you take the period from 1945, the post-War period, to about 1950, you know, in those days you know, the computer was mainly a university thing. There were some small industrial starts. The interesting thing was that IBM was definitely going very slowly in those days, and it was, I don't have it first hand, but they. Rumors had it that old man Watson considered the computer something that [?]big computer, and he didn't see the big future that later the young man Watson was the one who saw it. Mind you, IBM followed the policy initially, of sort of putting electronics technology into the, what we call, unit record equipment, at that stage. At IBM in about 1944, there were mainly tabulators and sorters and cards. They came out with mechanical multipliers, and in the late forties, I believe, or the early fifties, they came out with an electronic multiplier. They then had a machine which was called a card programmed calculator they had one. This was a control unit, so they could hook their multiplier to their calculators and tabulators together to make something that looked more like a computer. Then they came out, I remember, with their 604, which was an electronic multiplier that you could do a certain number of programs [?] with. But, to look at it, it was all really a big gradual [?], you know, taking advantage of electronic technology with old equipment. The major push with IBM really didn't start until, it seems to me, well into the early fifties, and was quite definitely, especially the large equipment, preceded by UNIVAC. That itself is a very interesting story because from a business point of view, I think we should sometimes look at this. It looked like IBM had missed the bus, you know, and UNIVAC, particularly, or Remington-Rand had moved ahead sufficiently to buy out two groups, Eckert-Mauchly and I think the other one was called Engineering Research Associates or Electronic Research Associates, I'm not sure. Eckert-Mauchly were in Philadelphia and I visited both places in those days, [?], you know.

TROPP:

That's right, Eckert and Mauchly came out of the Moore School, didn't they?

KATES:

The Moore School, yes. They were originally with ENIAC, you know, and then they set themselves up in business, and they called it Eckert-Mauchly Associates or something like this, and they actually built computers, but they had a hard time and

Remington-Rand bought them out, which was a good move, you know.

TROPP:

So Rand really had the jump on everybody at that particular time. Oh, yes, they had the jump and I believe they sold their first big machine to the Bureau of Census.

TROPP:

The SWAC or the SEAC? Or was that...

KATES:

No, no. I think that was the ... I'd have to check on the names. I thought they had already used UNIVAC then, no? The SEAC was sort of pilot modeled before the one that was sold to the Census. The Census one, I think was already supposed to be UNIVAC. They did a similar thing with a group in Minneapolis-St. Paul. [?] broke away and formed Control Data, you know. The Control Data Group is a break-away from that. But the interesting thing is that what made UNIVAC fall really way behind IBM is that they were never able to marry their [?], they were never able to establish a business strategy. In the early days, they did not relate themselves to the business market in which they were and they were never really able to develop sort of a [?] marketing technical strategy. They had a bunch of longhairs, you know, who were wild, but they did not know how to turn this into a business. There was IBM who moving much slower [?] two or three years there, they [?]. In the early fifties, UNIVAC had a lot more orders than IBM. They were way out ahead, you know, and if they really would have seen it, I think they might have had a chance to stay ahead. It was IBM's marketing power that... That's just a little aside.

TROPP:

Is part of that due to their inability to have the capital to lease...

KATES:

I don't think they had a capital problem, because the capital tie-up in those days wasn't really all that large. There was a fairly latent heavy demand for them, you know, so that if you had a good product, and if you had a good marketing organization, why you could get contracts. I think it was just that the top management felt that moving the computers was a good idea. They said that if you want to move fast, you don't have computer people who buy computer companies. But they didn't follow through. They didn't realize that these fellows who were [?] technical people, both in Minneapolis and in Philadelphia, have to be somehow married in with marketing and other kinds of business people if you want to make it an industrial success. That's what they didn't see, so as a result, IBM was, of course, all marketing and business oriented, you know, so they fitted the computer development into their business perfectly, and they overtook them in two or three years.

TROPP:

What was the impetus behind the machine in Toronto?

KATES:

Well, fundamentally what happened is the history of Toronto thing runs something like this, and Calley Gottlieb may remember it a little better than I. I think around 1946-47, U of T had some IBM machines which they used for statistical work. Some of it for their own research, also for sponsored research, especially Atomic Energy, NRC and DRB, who were the three main sponsors. And Calley was connected with that part, this was sort of the actual computing arm of the thing. The professor who was closely connected with it at that time, was Professor Griffith, who was the Head of, I don't think he was the Head of it, but he was the Head of the Statistics Division in U of T. I believe the University formed the Computer Committee on which I believe Calley was, and Professor Griffith, V.D. Smith in Electrical Engineering, and a few other people. That Committee concluded that U. of T. ought to do some research and development on computers and it started to become an interesting thing. So they began to look around for some people to hire, and for this research and development function, I was hired in 1948. I had just graduated from mathematics and physics, and I was also a professional electrical engineer. So they had me and they also had another chap by the name of Ratz. It was a big joke always, Kates and Ratz. Basically, we were supposed to start doing some research on computers, supposedly under the direction and leadership of Professor V.D. Smith. Specifically, we acquainted ourselves with what was going on. We visited pretty much all the centers. We didn't visit the ones in England, but we had visits from the, so we also had papers, so we knew what was going on in England. Two main developments were the one in Manchester, at both university and [?] there, as well as one in Cambridge. In Cambridge, they had a mercury delay line computer. I think that was called [?]_, I'm not sure.

TROPP:

Right.

KATES:

I forget what the one was called at the University of Manchester. The Frank development took over from that. We visited MIT, Harvard; there was a conference on computers... By the way one piece of material that may be handy for you: I think it was around 1949, probably, maybe in 1950, but anyway around the 1949-50 period, there was a computer conference at Harvard, around the Mark I (Mark III) computer, which they had, which was a magnetic drum computer. I believe that was the first conference, you know, where sort of technical computers touched and so if you could get some papers and a list of them, that would give you...

TROPP:

I've got some of the documents from that conference. I've seen selected papers, I haven't seen all of the documents.

KATES:

Yes. After that there were several more conferences, I remember. There was one in Atlantic City about a year or two later, and I think ACM had been formed thereabouts, you know. So if you go back, to the ACM conferences, you get anything [?]_ Well basically, Al Ratz and I formed a little technical group, which was organizationally shifted around, I think in the early months, it was headed by Professor V.D. Smith. I think then it was shifted into the Physics Department, then sort of combined with Gottlieb's side. Gottlieb was basically on the computing service side and we were on the technical development side. Professor Bullard was here, which was the academic year 1948-49, I believe, if you are interested in it. Then it was shifted back to Engineering Department, and made responsible to Dean Tupper for two or three years. What we decided to do after looking over what everybody else was doing, and there seemed to be two key problems with computers, ...well the key problem with computers, the whole purpose of computers is to get speed, you know, and the computers of the days, generally speaking, were pretty slow, and the reasons they were slow is that they were built for serial computers. In other words, they [?]_ in a number, and these were handled one after another, sort of simultaneously. Well, one way to overcome that was to go to a parallel circuitry where you deal with all forty bits at the same time, and that way, you could get a lot more speed. So we decided that we would try to make developments in the parallel machines, and start working out the circuitry that would be required for that. The other major problem was in the storage area there. Again, the majors of what was then called [?]__ storage was mercury delay lines. That was basically a way of moving, an acoustic way of moving through the mercury, and by being set up _____ of one feeding out of another, because basically, it was numbers moving around, and they could be taken off [?]____ the serial type of circuitry. So, at that time, one of the technologists that was greatly impressed with cathode ray tube technology, they were working on that at Manchester, and they were really, when we started, didn't seem to be too much work being started in North America yet. So we decided that we'd concentrate on those two things. In other words, a cathode ray tube storage development and parallel circuitry development.

TROPP:

The work at Manchester, that's the Williams'...

KATES:

The Williams', right. We got a paper and Williams visited here and explained his work. Basically, what we did is that we decided rather than[?] in the main we were supplied by NRC and DRP, so we decided to build a pilot model of a computer. We called it UTEC,

University of Toronto Electronic Computer, and we decided on a twelve-bit machine. The reason we decided on a twelve-bit machine was that it became clear that you could do everything you really wanted to do with an extremely elementary set of orders, and actually you can show that you can do everything you want to do with the computer if you had only four instructions. Well, we decided on eight instructions. I think there were add, subtract, and things like multiplication, division, and so we were programmed, we could program it because since we were going to have a [?] computer, even at program multiplication and division would be much faster than a serial multiplication in a fully wired computer. And so, seeing that we needed eight instructions, we basically, for the eight instructions. Then we decided that we would have in our memory bank, capacity for 512 words on cathode ray tubes, which were shown basically as a rash of 512 dots. 512 words requires a night beat address, you know, so we decided to build a twelve-bit computer, so that our instructions would actually be twelve-bit numbers, three bits of which would actually be the operation, and nine bits of it would be the address of which it operated. They were what was called a single address type of instruction. In other words, you would give, let's say, instruction number 815. I mean address number 815 and simply take that number and add it to some register, you know, or subtract it from the [?], or take a number out of the register, and put it into a certain address, you know. So, that was the reasoning behind the twelve bits, you know. Basically that was the concept. A twelve-bit parallel machine and corresponding to each bit, we would have a module and of course attached to each bit, you would have basically a cathode ray tube. I wish I had a picture.

TROPP:

You say you do have pictures?

KATES:

Oh, yes, I have pictures at home and I can bring them in.

TROPP:

That's very good. Could I have them copied and return them to you?

KATES:

Oh, yes, definitely. So, the way the machine really looked, it was a series of modules, and the whole thing was, as I recall, only about five or six feet long. It was about this high, and just a bunch of racks on which you could tabulate electronics. Some of it we had twelve _____, you know, and [?]. Down below it, there was all the [?]_____. We decided...there was one _____working with us who was very good, and he left us and went to Los Alamos during the thing.

TROPP:I'm trying to remember his name.

KATES:

Richardson.

TROPP:

Richardson, that's right.

KATES:

Jim Richardson.

TROPP:

I think he told me about him.

KATES:

One of the things we did is, we started working with...you see, in Cambridge, there were the three large [?], because the way the storage looked [?]_. The spots you could have in one or two positions and you could actually see what you were storing, you know, because if you had [?]___ a bright spot, and it was a zero, there would still be a spot, but it would be...it wouldn't be nearly as bright, you know.

TROPP:

This whole thing, then, was filled with...

KATES:

Spots, yes. So you had basically 512 bits on one of these. Actually we also experimented with 1,024 [?]__. But at Cambridge, they had started with very sizeable tubes, and I think the idea was to catch the spots by power, and Jim Richardson started to experiment, because these big tubes presented a lot of problems, you see. It was a very standard piece of equipment, and it had to be well shielded, you had to _____, so he started experimenting with quite small tubes, three-inch tubes only. We found we could store them and they were _____, of course. It made the whole thing very much more compact, and we built a nice little unit, in which we could have these tubes. They were and not these big monsters. So we concentrated on development on _____ small tubes, and we actually built that and, I believe, it became operational. One of the problems was that we were working over in the Physics Building, and then we had to shift our operations back...the whole thing was moved back into the old Manning Building down on College Street. And it got to work, I believe...no, I haven't got my dates right, but I think about a year, after the conference, about 1950 or 1951.

TROPP:

About 1950-1951.

KATES:

About 1950-1951. We naturally had tremendous promise with it. Our main problems very frankly was that it proved to be an extremely sensitive device. Naturally you had high voltages... Do you know anything about electrical engineering? It was basically a high impedence device. In other words, you just store something and flick a light switch in the room and it would upset it. We found that for several months we were doing nothing shielding and hanging capacitors on it and all, but we got it to work. We actually programmed...I have still on my staff, one of the fellows who was programming on that machine.

TROPP:

Who was that?

KATES:

That was (Ken Hill?) Kannhill. He was with the group, and he is on my staff here. I remember we programmed it to play games like Nim and so on. We programmed all the basic operations. That is, multiplication, division, we started writing subroutines for different instructions, but it was naturally being a _____ device, a fairly _____ what to do. As to the contributions we made, I would say in retrospect, looking at computers, we were holding our own with other universities, but they were major, and we made contributions to producing a more effective cathode ray tube storage device. IBM, in their early development, also went to CRT storage, and they sent people up here to look over our shoulders, and they were also picking our brains, but they wouldn't tell us what they were doing. They came out with the, I believe, 701 machine, which was a CRT machine. It was similar, you know. I mean it was a commercially developed machine. I was always envious when I went to the IBM lab. I would find that one little component, one little problem, had a bigger staff to sort that one out than we had for the whole thing. You see, we had to work out the concept of the size of the machine, we built it with our own hands, and we had to de-bug it, and I think there were really only four professional people on our staff, which were myself, Al Ratz, Stein what's his name, he's with Trenton no, but Stein something, I don't know.

TROPP:

That was somebody that Dave Anderson couldn't remember. He knew there were other people.

KATES:

There was Stein and Richardson worked with us for a while, but he was off to Los

Alamos. Oh, Len Kosciato, of course.

TROPP:

Len?

KATES:

Len Kosciato. He was a partner in the firm here for quite a long time, but he left in 1966. Yes, I think there were four key people, you know. I was the most senior one, and Al Ratz and I were practically the same level. Then there was Len Kosciato. Len and I, basically, concentrated on the CRT's, and Ratz and Stein concentrated on the circuitry. Also, I made a development...one of the things that impressed me was ...this was all vacuum-tube technology in those days, and we were just getting off to the transistor technology, circuits, you know. So, one of the things that really bothered me was, for one...the adder, the basic thing you added in the vacuum tube was the adder, and to add one bit, took something like eight or ten tubes. I have pictures of that, you know. So, that really bothered me because I said to myself, "gee, if we ever build a big machine, that is a forty-bit machine with multipliers and everything, that's going to become a monster." So I invented a tube which I called the Addatron, which was a vacuum tube. The idea was that it could perform the addition function. One tube, you know, instead of eight or ten. I gave a paper, and that was my first brush with publicity. I think it was in 1950 or 1951, that I gave a paper about it at the IEE, Electronic Engineers Institute at New York. I was amazed at the amount of interest I got, and I came home, and I had a phone call from a fellow from the Globe and Mail, and I explained it to him as best I could. The next thing, my picture and Al Ratz's picture was all over the front page of the Globe and Mail.

TROPP:

This would be about 1950-51?

KATES:

Yes, I think so.

TROPP:

I'll have to search the Globe and Mail files. That would be an interesting article to read, because reporters tend to...

KATES:

Yes. It says Canadians invent something, and it shows a picture, which is one blackboard with all the circuitry for addition, and then it shows me with that tiny little tube showing the same thing.

TROPP:

Showing the contrast.

KATES:

[?]__. You see, both developments, of course, now don't mean much. The CRT telephone, has been overtaken by magnetic storage, basically, which is far more reliable, and it also doesn't depend on active power, which is extremely important, and the vacuum tube circuitry has been displaced entirely by solid-state circuitry.

TROPP:

You mentioned the early developments, and the parallel, that approached the parallel circuitry, was a major change at that point, wasn't it?

KATES:

Yes, but again, the idea to go parallel was already there. I can't say that we invented parallel circuitry.

TROPP:

I realize that, but this was part of the controversy that was going on in the early days.

KATES:

Well, the main thing, you see, is that parallel circuitry quite obviously was afraid of...you bought speed at the expense of a hell of a lot more circuitry. In those days, circuitry was very cumbersome. If you look at Whirlwind, for instance, that was supposed to be a pilot machine, and I couldn't believe my eyes when I saw it the first time. The damn thing looked like a _____ railroad station, when I saw a picture of it. And they told me that it was a model. These people at MIT had money. So, this was basically the development. So we built UTEC after, really I would say, we built it, I would say that we knew a little bit about computers, and we could really go forward to a proper project. Al Ratz and I drew up plans for a full scale machine, that might be useful and so on. We proposed that to both the NRC and ERP, and finally go turned down, and I think the key man in turning it down was W.B. Lewis. Part of it may be because he may have found me a personally difficult person. I had a lot of people you see... He came down once to the U. of T. to look over a development, and I had developed some theory of what really makes a cathode ray tube storage really take, what is the mechanism, which differed a little bit from the accepted theories. I tried to develop circuitry to prove it. He was quite with me, you know, as I was only a Ph.D. candidate, and I think I had the effrontery to that way. I have a feeling he took a dislike to me personally. Now how much that weighed in that…in other words, he might have felt that we shouldn't give that money to

Kates...how much of that... I think there were several strains of it. The University at that time, was considering buying a computer from Ferranti, bring it over, and he went over to Ferranti, and saw it, and he had fairly close contact with.... Mind you, I don't oppose that decision at all. I think the idea of getting a computer for actual computation quite obviously would help our group of four or five people [?]_. So I think the idea of buying a computer was a good one. The idea of canceling further research and development by the University in computers, if for no other purpose but to develop more ____ know-how than _____ in industry, ____, that in my opinion, was a wrong one. And I think history shows it to be wrong, you know.

TROPP:

Of course, there has been a major shift in the last decade, where universities have gotten more and more of this...

KATES:

Yes, but now it's too late. You see, a university's not the place really, to build any kind of industrial device, and certainly not a university like Toronto. It just can't handle any large organized thing very well. But a university is a good place to do research and development and _____ people with experience stand out in industry, you see. Basically, that project was cancelled around I think 1952=53.

TROPP:

Do you still have the plans or any of the materials of your proposed machine that you were going to build, or would the Computer Science Department perhaps, have them?

KATES:

If anybody has them, I think it would be Gottlieb, except if Al Ratz had some of it. I doubt if Len Kosciato would be...

TROPP:

Professor Gottlieb told me that he does have a whole file drawer full of a lot of correspondence and...

KATES:

[?] and I imagine, you see, because we made proposals on that thing, our sketches, drawings and proposals would be attached to that. I believe I call it right; it was a forty-eight parallel machine, with three-inch [?]_ storage. It would have been a very fast machine, and it was really very similar...you see, Jim Richardson and I worked very close together. I acted as consultant to Los Alamos in those days, and he was building a machine there, a computer, and you know, we had very similar ideas. There was a fair

amount of exchange of information, so that it would have been a similar machine as the one, I forget what they called it, at Los Alamos would have been. Basically, there was a trend in the same direction in four centers at that time: at U. of T.; at Princeton Institute for Advanced Study; Los Alamos; and Illinois. And all of them were going in for high speed ___ machines with CRT storage. In the early fifties, the U.S. _____ financed to far more _____ than we were, and let's say professionals and non-professionals were the differences. We weren't looking at our similarities, frankly, we were making a hell of a big uproar that we were different. Even, for instance, I remember once, visiting Jim Richardson at Los Alamos, and he was mounting his CRT's and we were mounting them on the top in a certain relationship to _____. At Princeton, they were mounting the CRT's, they were fairly large ones over there, [?], like this, you know [?].

TROPP:

[?]

KATES:

[?]___ urinals.

TROPP:

(Laughter) ...Urinals, that's marvelous.

KATES:

_____ we were always enthusiastic about what we were doing.

TROPP:

Where is Jim Richardson today?

KATES:

Gosh, I don't know.

TROPP:

Dave Anderson didn't know either.

KATES:

Well, the last time I saw him, it was many years ago, was when he visited here, was about 1954, when I started in business, or 1955. At that time I believe he was still at Los Alamos. He may still be at Los Alamos. You could check there.

TROPP:

I know I can check to see where he is, but he sounds like a very fascinating gentleman.

KATES:

Well, what's fascinating about him is that he, I don't think he ever finished university, I think he only did one year, but he was an excellent electronic technician. He was very good. One of the big problems was that I think he got along very well with me, you know, the University had their pecking order and if a fellow didn't have a degree, he was considered a technician, and it was extremely lowly paid. I had to put up a hell of a fight to get his decent compensation, and I think he appreciated that very much. There were four sort of university graduates, Ratz, Kosciato, Stein, and myself, who let it, and here was Jim Richardson and practically Jim Richardson was more useful than the other three.

TROPP:

He sounded very talented.

KATES:

Yes, he was a very talented fellow, and a very hard working fellow. He knew his electronics. So the only other little side thing is, well this went on in 1951, I believe, there was the National Exhibition, you know, every summer we have an exhibition here. This Addatron, this special tube that I built, was actually being made by Rodgers Electronics Tubes, they were my employer between 1944 and 1948. I did a full-time job there, full-time while I went to school as well. They were making _____ tubes, and I got them to make those Addatrons. So they said that they wanted to have something to exhibit that tube. Just to show a tube, you know, probably doesn't have any interest. So I agreed to design for them a tic-tac-toe machine. It was an electronic tic-tac-toe machine and we called it [?]_ the Brain, and I still have a little _____ about it. There were already tic-tac-toe machines around, but they were electromechanical, and they weren't very sophisticated, I thought, we'll look fancier. So we built the machine with those Addatrons in it, and we made it _____ because it had eight intelligence levels on it. The machine was fully intelligent, and it played a perfect game. You can't beat a machine and it can't beat you. If you make any mistake at all, the machine will beat you, and then you try to reduce the intelligence level of the machine to [?], let's say. You could be _____, but it might miss beating you while it could, you know. If you pulled another switch, occasionally you might be able to beat it, you know, and if you pulled them all, the machine just played a completely random game.

TROPP:

(Laughter) So you might make a move and it might make the same move.

KATES:

That machine was a fantastic attraction. There was always a huge crowd around it, you couldn't get near it at the National Exhibition. That year, Danny Kaye was up here as the head of the Exhibition, and he came over, and for about an hour, he clowned around with that machine.

TROPP:

Was there publicity on this? What was the brochure that you say was on...

KATES:

I think there was lots of publicity in the dailies here. Actually, Life magazine had photographers photographing Danny Kaye with the machine, you know, but I don't think they published it.

TROPP:

They might have something in their archives of _____.

KATES:

They might have something in the archives. Would they keep them?

TROPP:

This would be the CNE, 1951?

KATES:

I think it would be 1951, yes. I remember photographers took a lot of pictures, and I believe it was for Life. We were disappointed that it actually didn't come out, but I guess it couldn't compete enough with other stuff.

TROPP:

But you do have a brochure that describes...

KATES:

I have a little brochure that describes it. It actually shows you a mock-up, and it shows you what it looked like. It had a little plastic board on which a red cross or a green circle would appear when you press the button, and it was just press buttons, and then the machine answered, you know. We built that thing in summer, and it was a fairly active project because I had barely time for it. [?]_ [?]__, but that machine worked out very well, you know. It was one of the major attractions at the CNE. And we used those

Addatrons and actually it was the only use we ever made of them. **TROPP:** Are any of the Addatrons still around? Are there any still in existence? **KATES:** I think if there are, they would be up at Phillip's. Maybe they've kept one. They were a very small tube, I would like to describe to you how it looked.

TROPP:

But you don't have one in your...

KATES:

I don't think I have one.

TROPP:

Did you keep the original patent on it?

KATES:

There are patents on it. It's patented, but it's a useless patent.

TROPP:

No, I mean in terms of just archival material and descriptive things. Where would the patents be?

KATES:

NRC took a patent out on it, I think. NRC had a patent agency.

TROPP:

I see.

KATES:

And I remember they took the patent out in several countries and as I remember, they put me to a lot of work, checking competing things, as well.

TROPP:

If I were to contact them, what would their descriptive phrase be on the patent? Would it just be called the Addatron?

KATES:

Addatron or adding tube, or something like this. **TROPP:** But if they had this in their archives, it would be an interesting thing to look at. **KATES:** Yes. [?]_____ beam to three targets, I still like to [?]_. Basically, _____ try to do addition _____ vacuum tubes really become complex, because _____ can only do one thing. But I built the tube like this and I had my targets out here and out here. This one went to one bit, and this one to the other bit, and this could be zero-1, and this could be zero-1, and this one could be the [?]_, because you could divide these three bits together. The thing was so arranged that [?]_, the thing could come in here, so this would be 1. If this was 1, this was zero, this was zero, and this was 1, this would have nothing, so it would be zero, And if this was 1, as well...oh, yes, I remember correctly...if any two of those were one, this would become a one, and if all three of them were one, then I think it was arranged that it would be carried out that this would be zero. I still have to reconstruct it, but the whole thing was arranged so that depending on the various combinations, the _____ combinations of these, you could...

TROPP:

Either get zeros or ones here or something here. Now, what were these?

KATES:

There must be the output [?] is only two things: another carry...

TROPP:

Three inputs.

KATES:

There are three inputs? An adder is basically three inputs. This is the addend, and what are the others called? The addend and...

TROPP:

I forget.

KATES:

This would be the carrying, right? And then you had basically the sum, and the carry out, right. And the circuitry to do that in the vacuum tubes is nasty. Now, the way I did this was that my three inputs were _____ three electrodes like this, and my outputs let's see, any _____ ones. Then I wanted to get something from the other pocket. All three of them were ones. Oh, yes, if any two of them were ones, I would want the target to be zero, and I would want to carry. If only one was one, and the other one was zero, then it would...

TROPP:

Then you'd want this one to be a one, the one that you...

KATES:

Yes, _____ like this, and the electrode like this ____. Now, certainly, if one of them is a one, and the other two are zero, then the thing would just sit here.

TROPP:

Right.

KATES:___ so this would be zero _____ _____ in between here.

TROPP:

[?]_.

KATES:

_____. Well, of course, this can be transferred so...

TROPP:

Yes, that's right.

KATES:

Let's say _____ and zero and this is a one. So this is zero and it is basically a carry-out... Yes, I think it must have...

TROPP:

[?]

KATES:

Yes, I think it must have looked like this. I've forgotten already what the [?]

TROPP:

_____ this looks like the problem of three houses and the three hills.

KATES:

This was the carry and this was the sum, and if any...

TROPP:

That's a _____.

KATES:

Well it was solid. This was a type of structure...

TROPP:

This was to replace, as you say, a ____ tube.

KATES:

Oh, yes, this was a tiny little tube, and this _____ here, you see, I used it. You see, I figured it out and it would have shrunk right down. So that was basically the thing I was involved in.

End of Side 1

KATES:

I don't think it was earthshaking, but I would say for the size budget that we had, you see, even the idea of thirty or forty bucks a week in those days, at the U. of T., I was very happy to have it. That was a big fringe benefit that I had so that I could get my Ph.D. at the same time. So we had an extremely small budget, and we had tremendous red tape to contend with whenever we tried to get any piece of hardware. We went to the group. So, considering the limitations, I think we did all right, and I think we were well respected. I was called by the Institute for Advance Studies, and by Los Alamos as a consultant to advise them. Again, when I think of my consulting fees now, you know, in those days consulting fees were thirty dollars a day or something like this. You were happy to get the thirty (thirteen?) dollars a day.

TROPP:

I get the feeling, in that period, that there was a lot more of a sort of a free interchange that everybody was sort of working...

KATES:

Oh, among the universities, yes. There was a ...well, you know, you were in a tough position among the universities. You were grumbling, but if you look at it in retrospect now, if you look at all the computer developments, you were grappling with a lot of problems. You see, one advantage was that you were relatively few centers in the late

forties and early fifties. I think I mentioned basically two centers in England really, and about four centers over here, but the staff are like lightning. And we broadcast. I remember in those days, I gave a lot of talks and I broadcast _____ _____ growth. And yet, what I forecast in growth, I...you know, that is really what happened. We said something like, I don't know, but we made forecast like, let's say, ten years later, fifty or a hundred universities would have computers. Today, you can't think of...well a large university nowadays, would have a number of computers.

TROPP:

Every small university...

KATES:

_____ would be used in business, but again, you know, it was _____ mainly for big business. Soon any business at all will be using them. And yet, I think a lot of people consider, in both business and academic circles, considered us crazy, you know. They thought we had gone stark raving mad, as I remember, putting this program to the sponsors at the University and to the CRC... "This is going to be big stuff, you know. Let's get going." But people didn't see it.

TROPP:

Do you still have copies of some of your early papers, or early talks, or know where any of them might be available?

KATES:

I tell you, I have some old files that I can look through at home. I think the main things I've kept...you see, when we got disappointed at the University, when we lost the sponsorship, the team was taking it hard. I, myself,...Al Ratz went to Westinghouse, he comes from a Westinghouse engineer's family. I was lucky; I know and I taught myself programming as well as the electronic part, so I basically joined the group that was programming _____. And I was happy I did it because I got a lot of things sort of programmed _____ as well. I think Len Kosciato took a job as _____, Stein took a job with Ferranti, Richardson, I mentioned to you, went to Los Alamos. So, we were thinking of maybe setting up a business and making computers, as a buiness venture. We did it like it was a business, but the business world turned out to be different than we had imagined it. We didn't really have any money to start building stuff, so were faced only with consignments and we really became the first software outfit, you could say.

TROPP:

In a sense then, the people, the spin-off from you early work were people going to other industries rather than industries evolving out of them, in terms of hardware.

KATES:

Except my own company.

TROPP:

Except your own company.

KATES:

My own company was the first software/hardware consulting business in computers in Canada, and we did very well. We grew quite a bit. We started with nothing and we now have quite a sizeable firm. I spun most of it off in 1967. It was [?], but we had become a multi-million dollar business by that time. So, from that point of view, there was a spin-off, but the spin-off was really showing people how to use computers rather than making a primary contribution to the computer field.

TROPP:

But conceivably, had this kind of development gone on, and IBM sort of development could have occurred in Canada had...

KATES:

There were some developments like that, you see. Ferranti had a bit of a start and Computing Devices of Canada of Ottawa, were the two main industrial things. I don't think their ideas have developed as I would expect, but if you look at all the development around Cambridge and all sorts of electronic developments, peripherals, other kinds of things. It's hard to say. I've studied economics too and there are two problems. On is, first of all, to create enough people with an interest and an ability to develop something in the field, and certainly the project was stopped short of that happening. There was only four or five people, and they were taken apart so that the little mastery was lost. Secondly, you need a good concrete economic plan for these developments. These developments in the States were mainly...there were two things that really nurtured them along which were the War and space efforts. If you look at where a lot of those companies got their early work, small companies, some of which have grown into giants, that's where they got it, you know. There was a huge demand for electronics, computers, data, systems of all kinds. In Canada, the corresponding demand was very small. The Navy sponsored a little bit of work by Control Data and Ferranti, which really never went anywhere. There wasn't really much, so that _____ there was a fairly good chance that we had developed that system, four or five people, twenty, thirty, or even fifty. Whether that would have started an industry is doubtful. The chances are that they'd have to go where the

market was, and that was south of the border. But from that point of view, it is hard to know whether to fault anybody or not.

TROPP:

Do you know of any other developments like your own that were going on in any other Canadian university?

KATES:

In Canada? U. of T. was way ahead of anybody else.

TROPP:

U. of T. at that time, with the exception of universities in Montreal, was about the only centre then, of major size. Were there any other universities at that point, like British Columbia had not yet grown...

KATES:

No, most other universities in the late forties were still fairly small. As you say, McGill was a good size, Queens was a reasonable size. University of Montreal was all that big, but there were no such developments. These other universities got into computer developments when computers became commercially available, but IBM salesmen knocked at their doors, and they started moving into computers, I would say, by and large, in the late fifties or early sixties. It was about ten years later.

TROPP:

You also said that the Ferranti was purchased here when your other program was scuttled.

KATES:

Yes.

TROPP:

Was one of the first.

KATES:

Yes. It is true. The Ferranti computer at the U. of T. was one of the first computers, let's say, for the actual computer operation rather than just a little toy. In North America, I forget what year it came but I think it was probably 1952 or 1943. You see, the first sort of large-scale commercial computer that became available was the IBM 650, and actually

it is the second IBM 650 in Canada, when I set out in business. Ours was installed in 1956, and I think the first ones came out off the assembly lines around 1954. I played around with the first IBM 650 in Endicott. I went down there to see it, and I was amazed and I said to myself, gee, the University can't compete with that kind of _____. They grew rapidly, and a lot of universities, and I believe the U. of T. had an IBM 650.

TROPP:

Roughly 1956 or 1958, I think or...

KATES:

Oh, a lot later than that.

TROPP:

Was it later?

KATES:

1957-58.

TROPP:

When the University decided to buy the Ferranti, what was their motivation? How did they plan to use it? They were no longer interested in research.

KATES:

Well, not for research on computers, but for research in computer use.

TROPP:

So it was primarily for the people in electrical engineering and physics...

KATES:

For all the Scientifics. For Cancer--there was quite a lot of cancer research that was done and it was quite interesting. We had a chap here, who is now in cancer research, he was very good here also, but he got an M.D. He was from Saskatchewan, and I think we set the first telecommunications link to a computer. It wasn't an on-line link. We had a telecommunications set, you see, the input link into the Ferranti computer was punched tape. So we set up a telecommunications link between the University of Saskatchewan and ourselves. The people there would actually put their programs and data on the tape repeaters of the computer, and we'd repeat the stuff back to them out there. Because the input/output stuff was all teletyped. That was very useful and we had a sizeable group

and ____ was working hard. I was... We were all very proud of the tube, and we had limited storage and how much of it we could squeeze into very limited storage, and I had the fanciest programs written in what I called _____, 64 instructions. And we did a lot of development work on programming and the computer started all the courses that were being given around. The computer was being used by lots of research projects atomic energy, for the various physics people, for other engineering things. I would say there were hundreds, if not thousands, of different applications on there. What also came in handy when the Ferranti computer was installed, it had tremendous hardware problems on it, so it came in very handy that I understood both programming and hardware because I was in there, and I helped the Ferranti people de-bug the computer. I placed the problems, and we were in there working day and night trying to make the bloody thing work. It took months and months to make it work. So what I would do is that when I was working, I was helping the maintenance people repair it.

TROPP:

Well, that Ferranti was used then for quite a long time.

KATES:

Oh, yes, the Ferranti, I think, was used for several years. I think it was displaced by the IBM equipment, but I have the feeling that it was used from about 1953 to about 1958, or so. About four or five years, I think.

TROPP:

Going back to your original, the UTEC machine, Professor E.G. Smith, I understood, actually took your pilot model apart, and sort of saved everything. Do you remember anything about that?

KATES:

No.

TROPP:

Dave Anderson said that he actually took your prototype apart and...

KATES:

I don't know what's happened with it. It's possible you see, because E.G. Smith was one of the sort of professors on it. He may have done that, you know, [?]. Len Kosciato may remember what's happened about it. You could give him a call.

TROPP:

Professor Smith, I understand, is quite ill at the moment.

KATES:

Is he? He's getting old now.

TROPP:

I don't know. I called the Department and they merely said he was ill and I hesitated to call his home.

KATES:

TROPP:

They gave me his home phone number, but I hesitated to call.

KATES:

...but I have been completely out of touch with him.

TROPP: As I say, I hesitated to call until I found out how ill he was.

KATES:

Len Kosciato would be of great interest to you _____, and he may remember what's happened to it.

TROPP:

Is he still here?

KATES:

He's still here in Toronto, yes. I have his phone number here... Yes, the phone number here for him is 633-9364.

TROPP:

How do you spell his last name?

KATES:

C-A-S-C-I-A-T-O. Now he was much more disappointed about the cancellation of the project than I, and he was then a partner in the company with me for many years, because he was sort of ___ on the hardware side while I was flexible, I could switch over to the software side. So he may have been more bitter about the episode than I am.

TROPP:

Well I got that kind of thing that you were talking about with the ...with Mr. Lewis from Ottawa, from a number of people, and I gathered that a lot of it was the typical bureaucratic stubbornness and there was a personal clash, and various..

KATES:

Well Lewis was a great _____ in Canada. I think he had his come-uppance with that ING project. He fought very hard for the ING project, which would have been a hundred fifty million dollar project, and if you ask me, well it was a very interesting project from the point of view of technological and economic importance to the country, I think that out project was more important than this thing, you know. I mean, he dominated the scientific scene, so his word was the decision, you know. He was a very dominant character. I found out subsequently that he made quite some caustic remarks about me. I mean, not about my technical and scientific ability, but along the line that nobody could get along with that fellow, he's headstrong. If you weren't headstrong, you could never get anything done in those days. But I don't know how much that is a factor, you know. I mean the U. of T. would have liked to consider the project and we pushed on for it. I can't say how successful it would be, but at least it was a nucleus, and it was Canada's entry to the computer.

TROPP:

I think it would be interesting, if I get a chance, to look at Professor Gottlieb's correspondence on that period, because it will show the interchange of ideas.

KATES:

That's right. Did you try to summarize any of that? I would like to read it.

TROPP:

I'm hoping to, because...

KATES:

That would make fascinating reading, because these things become very hazy now twenty years later.

TROPP:

Much of the technology has been replaced at such a great extent that I think one of the more interesting things is the interchange of ideas of the people involved. In fact, I've taken considerable time today. One of these, I would like to come back not only to see the pictures and your documents, but I would also like to go back and sort of pick up a personal history of yourself, which I think would be of interest too. Because these things tend to get lost as time goes on. I think in this early history, the atmosphere and the spirit of the times are so important that it is difficult to replace when you merely read a technical history. I sort of have the feeling from talking to Professor Anderson, within your little group, there was a sort of espirt de corps.

KATES:

Oh yes. I'm told that when we stopped, morale was extremely high. We felt that we could do it, and I think we could have done it, yes. The people that we had on the staff were good as elsewhere, and I would say the main limitation naturally would have been budgetary limitation and resources. You know, with computers, there were so many problems to be solved, so many answers to be developed, and extremely difficult to stay completely abreast. Of course, we fought decisions where do you stay vacuum tube or do you stay transistor and so on. Things like this were still controversial in those days.

TROPP:

The transistor, of course was brand new then.

KATES:

Yes. Well, we had a few expenses. We had transistors at fifteen dollars a piece _____ in our budget. So these were major factors when we had to think of that and hundreds of them, you know. They were far more expensive than vacuum tubes. **TROPP:**Sitting here now, that's just very difficult to remember. That at one time, the transistor might have had prohibitive costs. **KATES:**Oh, yes, they were very expensive. I remember we kept them in a special locked thing so that _____ because they were so small. It was little known that they had strange characteristics. We had quite a project going on; I think Stein did that. You see, with that tube, you couldn't get a machine that would give you the characteristic curves. You couldn't get them, you had to get your own and then make sure _____. The ____ _____ depended on this being stable and sensitive to temperature and humidity, so that quite obviously we couldn't start a _____ reliable. So there were a lot of questions. Eventually, I have a feeling that the project would probably have become one of concentrating on other elements. Well here's another element: we had another chap here, and I forgot to mention his name. Bob Johnson was on our team and he also has a lot of _____. He once had an invention for high speed printer. You know, one of the problems was how do you get information passed out, and again, I'd have to reconstruct _____, but it was basically based on an eccentric cylinder, rotating inside another cylinder. I forget what the whole point of it was, but the scheme would have produced a very fast printer. In other words, there were ideas on quite a number of...

TROPP:

Was Johnson part of the physics or electrical engineering?

KATES:

No, he was part of our team, and you see, when the team fell apart, several of us worked for a while for another consulting firm on a Canada project, but that fell apart. We did a good project, and we completed it, and I started in business myself, and Johnson went to the States or something like this.

TROPP:

You have no idea where he is now.

KATES:

Last time I heard of him he was _____. Well, Ken Hill would know, and he's right here. (Kates makes a phone call). No answer.

TROPP:

Well, I could get that at some later date, from you or from him.

KATES:

He was somewhat erratic, so... Bob Johnson was a fellow who often... He worked mainly on the input/output part of the thing, not on the electromechanical parts of the thing. While he had good ideas, he always sort of failed to complete them, to carry them through.

TROPP:

But he did actually get a patent on this high speed...

KATES:

I don't know. No, I don't think he got a patent; that was only a proposal. I don't think he got a patent on it.

TROPP:

What was Professor Bullard's role in this early period?

KATES:

Well, I have a feeling that the main thing is that Bullard was like a breath of fresh wind. The Physics Department, which originally ___ was quite a pioneer, and it tended to ossify a little bit, but Bullard came in here, you know, and he gave it a lot of spark. He took a great interest. He was the bureaucrat, and he loved us by this time. With the fellows doing the research and development, so that he was boosting morale up, and he was encouraging us on all of these projects. He was making some geophysical studies in which he was using the computers himself. Harvey Gellman, who was in the Computing Centre, I'm sure Calley Gottlieb would have mentioned his name to you.

TROPP:

Right.

KATES:

Harvey was on the computing side of the Centre and was doing a lot of computations for Professor Bullard, as well as for Chalk River. That is, atomic energy, you know. So he had a dire interest in the actual computations that were being ground out by the Centre, as well as being _____ sparkplug. I have a feeling that if Bullard had stayed here, he would have been quite a good counterweight to W.B. Lewis.

TROPP:

Was Bullard involved in the original proposal, or was your project already started before he came?

KATES:

I think it was just being organized, you see. He came in the academic year 1948-49, if I recall it right. I forget exactly when he came. Now I was hired, I graduated in the spring of 1948, and almost immediately I saw that the University advertised for the job, and of course I was ideal. I had a math and physics degree, as well as electrical engineering diploma, or whatever you call it. I was examined for this position and I had worked in electronics for four or five years, so the group was starting to be formed, but it was really puttering around and it wasn't doing much yet at the time Bullard arrived. We explained our ideas to Bullard and Bullard encouraged us tremendously.

TROPP:

He was succeeded by...

KATES:

Watson.

TROPP:

Watson, yes.

KATES:

You see, Bullard...I have a feeling that Bullard only came here planning to stay only four or five years or so, but he was here only one year.

TROPP:

Just one year?

KATES:

He was here just one year.

TROPP:

Dave Anderson couldn't remember, but he thought he stayed as late as 1952, but that doesn't seem right, because I'm sure he was at the National Physical Laboratories before that.

KATES:

Oh, yes, I have the feeling that Bullard was no more than one year here. I think it was one academic year. Maybe two, but it doesn't look to me like it.

TROPP:

The only other name that came up was that of McKay. Now was he involved in...

KATES:

Very peripherally. I think he was one of the members of this computer committee. He was a physics professor, and his particular specialty was electrical. He took an interest, but frankly, I think our biggest problem was that none of the professors...we lacked leadership. We had to do our own thing, and that's fine, but you know, but I wasn't experienced in conducting projects and leading them. Also, without any formal leadership from above, an atmosphere could grow up within your project. In fact, I think simply by force of personality, I took leadership, but I don't think I was really pointed to lead.

TROPP:

Had Professor Bullard stayed longer, things, with that kind of leadership, things might have been smoother.

KATES:

Well, he was really too far away. You see, he was head of the Physics Department. What I was disappointed in was that the logical man that should have served, and taken more of the leadership might have been V.D. Smith or someone like that.

TROPP:

Where does the Mathematics Department fit in at this early point? Was there any interest on their part, or were they still split into two.

KATES:

Well, Professor Griffith represented the Math Department.

TROPP:

He was in the Applied Mathematics section. They were still two separate...

KATES:

Yes, in the Math Department. I don't think there was...

TROPP:

There was an early history of a separation, but...

KATES: I think applied math was actually part of math, but I can't be sure of that. I think it was a section or division within it, I believe, and Griffith represented them. Griffith took a great interest, but naturally, his interest was concentrated on the applications and usage side. He started courses in numerical analysis, and so on. Griffith was one of the professors who did participate in the project. The main problem, as I see it, was that here was a young crowd, Calley Gottlieb and a few people who sat on the computing side, and the technical crowd with four or five people on my side, where really the structure above was taking very little interest. I have a feeling almost taking an attitude _____. It wasn't so much that we couldn't solve the technically...good enough...we were enthusiastic and hard working, but I think the problems of how do we organize ourselves, this project means distributing the responsibilities and so on. I had to sort of, how do you say...you know, in a puritan way, set things up without really having an authority to do it. That was very difficult, because unfortunately, the poor fact was I think, from what I recall, we were together, there wasn't much bickering _____.

TROPP:

This was the impression that Professor Anderson had. He said that the only bickering came via Mr. Lewis. It was nothing internal.

KATES:

Yes. In those days, I remember often working day and night, literally right through. I just wouldn't go home, I was working on the damn thing. My wife didn't see me. I remember sometimes being weekends down at the University, trying to make the bloody thing work.

TROPP:

Did, in the early years, in this 1948, '49, '50 period, were there any young students who were attracted to your project that later... Again, this is one of the spin-offs of the University...

KATES:

Yes, there were quite a few. Most of them now, I think, are in the States in some various positions, you know. Especially in summer, you see, we used them. I remember a couple of them in particular, and they were very bright, but I can't remember their names. But quite a few young students went through the project, were attached to it. The main problem, I remember, is they all ended up in the States afterwards.

TROPP:

Then, this is, in a sense, one of the more important spin-offs of the early projects. Some

of these people who got their impetus, who never would have had access to it if you hadn't had such a project.

KATES:

Oh yes. Quite definitely, we had a succession in the early years. Let's say, in the summer of 1948, there wasn't too much, but by the summer of 1949 and 1950, especially once the machine got working, we had three or four students programming, and they loved it. Also, after the first program, ___ actually was one of the first fellows to program, so...

TROPP:

By 1949, you did have the prototype?

KATES:

No, the prototype did not operate until 1950 or 51.

TROPP:

1950 or 51.

KATES:

I believe it was about that time.

TROPP:

And it was about that 1951-52 period when you lost the funding for the continuation of your project and...

KATES:

That's right. We got the prototype to work, and it worked for a few months, and we showed it to people, demonstrated it, and then we lost the funding. It's hard to remember, but it must have been quite a blow, because I had worked tremendously hard to make the bloody thing work. You had very little help to do it. You had to do everything on started drawing on the other side. _____ because most of the _____ were intermittent things. If there was the sort of thing, I could fix it right away, but the trouble would happen once every ten minutes, that's an extremely hard thing to find in a computer. Our only diagnostic were really CRT's, you know. So, it was very hard to get the thing to work. It was a very hard effort, and it certainly was an anti-climax when you realized that you hadn't got [?].

TROPP:

I think this was probably typical of all the early university projects. The stories are told of von Neumann coming to visit his machine on a Saturday afternoon and finding a man working on it, and asking for von Neumann, and discovering that that was von Neumann. He was there trying to get the thing going or to solve a problem...

KATES:

It's funny. It was, for those days, just about the most complicated profession. It didn't have the benefit of industry of the _____ department or the engineering department and this and that. You had to use chewing gum and scotch tape.

TROPP:

And the fact that so much has happened in less than twenty-five years, that it's really incredible.

KATES:

Oh, yes.

TROPP:

Well, I really thank you very much. I've taken an awful lot of your time, and I would like to come back.

[End of tape]