Computer Oral History Collection, 1969-1973, 1977

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Interview: Robina Mapstone
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MAPSTONE:

This is Bobbi Mapstone, and I'm talking with Roger Mills at TRW. The date is May 14th 1973, and this is an interview for the Smithsonian Computer History Project. Let's start by setting up the early history of how you got into computers. Where did you go to school?

MILLS:

I went to school at Southern Methodist University, and I came out here in 1950 to work at UCLA for my doctorate in mathematics. In January of 1951, my wife couldn't support me in the manner I would like to have become accustomed, so I had to get a job. I went down to the aircraft industry, not knowing what a mathematician did, and I finally got hired at Northrop. Northrop was setting up a BINAC programming group. BINAC was the first stored program computer in the United States and, I think, in the world. It was designed by Eckert and Mauchly. It was the follow-up to ENIAC and the forerunner of the UNIVAC. When we started out with BINAC, it ran for fifteen minutes once. We did ... problems on it, and one of my jobs was to get a NIM game set up. I had 64 players on 64 checker boards. It was a fancy setup, but we never did get it working, since the machine never ran long enough to run it. Our input-output was zeros and ones until the engineer, Jack Strong, set up an 010 keypunch, so when you punched the button you got three digits in one. So we had octal input, we had a typewriter for octal output, 512 words. and we had no way of getting in and out except on a typewriter. We had no intermediate storage, a mercury delay line memory. The idea was that the two machines would work in parallel with each other, so that they could check each other all the way down the line. We never got but one machine working at a time. We would use different parts like one memory from one machine, and the arithmetic from the other, and put them together to make them work. I went from there to the MADDIDA, which is Magnetic Drum Differential Analyzer, developed by Northrop. It was the first electronic digital differential analyzer, but it was put on the market before it was ready. One of the problems was that it took a genius to figure out what curves it was following, because you could take off on a solution, and it may be the wrong solution to the wrong problem.

I maintained MADDIDA and worked on MADDIDA for a couple of years [with] Ed Mookini, that's M-O-O-K-I-N-I; he's now at the University of Hawaii, he was working on his doctorate degree and got his doctorate degree at UCLA, and went back and taught at

the University of Hawaii. My first boss was Florence Anderson, who was head of the BINAC group. She worked also on CPCs, Card Programmed Calculators, developed by Northrop. They hooked IBM equipment together and made a scientific computing machine of sorts. After Northrop, I went to North American to work on the Defense Calculator, IBM 701. I worked in Frank Wagner's engineering group, engineering computing group. The machine was run by the Finance Department under Jack Strong, and the job of Frank Wagner's group was to be consultants to the open-shop programming. In the early days engineers were about the only ones who did programming and the aircraft industry was the only one who had machines. On the 701 everyone did their own thing, and I participated with checking out, helping with matrix inversions. We had probably the largest program that was ever put on the 701, we had 22 binary decks. In those days it was all binary. ...You want to hear some anecdotes, that type of thing?

MAPSTONE:

Yes.

MILLS:

As I said, the 701 was run by the Finance Department and they were sticklers as to how to do business. First thing they did was to figure out that the mathematicians should run the machine. Well, any mathematician who ran the machine for more than two months would need his head examined, so the good ones would leave and the bad ones would just stay there. We had one guy in particular who had come to us from teaching school. He'd worked with RAYDAC.

Oh, I had forgotten, by the way, that I had a sojourn at Point Mugu working on the CPCs and RAYDAC. The RAYDAC was RAYtheon's Automatic Computer. It was a unique machine and it was a four-address computer; it had A, operate on B, store the result in C, and jump to D. I did a little work on RAYDAC. When I got to North American, they hired this guy in to be a programmer on the 701 from that group up there who had been a teacher. He was an old man and had been a teacher for years. How he got to be a computing engineer I don't know. He started out as a programmer, but he wasn't any good, so they put him on a machine as an operator. Now we had a "Happy Time," which was ten minutes on the machine, twice a day, 10 in the morning and 2 in the afternoon, and this was for an hour. So you would sign up and you could see your job run and you could attend it. We were running it in a language called Speed code, which was an interpretive language for the 701 that IBM put out. When you got a stop you had to find out what was location 22, because it held the address of your program, otherwise you had no idea where you were. So I got a stop and I looked at this guy and I said, "Can you find out where location 22 is?" He said, "Sure," and started to play the machine like an organ. I knew he didn't know what he was doing, but we couldn't tell him, we couldn't touch the machine. So I took the instructions and I put them on the console. He said, "Oh yeah," and finally he looked down. By that time he had cleared the machine on me, all the electrostatic memory was cleared.

One other time he was working on a machine and we had a Cajun named Kito, and this guy was from Northrop Institute originally, teacher over there, and he got on the machine. He was teaching this character how to work the machine. All the Vice Presidents and Jack Strong were standing around looking at the great "brain" and about that time Kito says, "If you put those blankety-blank cards in upside down again, I'll wring your blankety-blank neck." They finally denoted him to reproducing cards on a 519. He was reproducing cards and Ed Law came up about thirty minutes later and asked him how he was getting along. He said, "Well, I got along fine after I found out how to make it work. This red light kept lighting and the machine kept stopping until I found out that I could hold down the clear lever and everything works fine." He went back to teaching finally. He got out of the business.

MAPSTONE:

MILLS:

They had a bunch of rules. One of them was to check your cards and see if you had verified keypunches in your data card. If your data cards were not verified, they wouldn't run them, assuming that the programmer could bootleg the cards, which they had. So Jack Strong looked at me one time and said, "What do you have in your pocket there?" I handed him a blank verified card. He got rather upset, and he said, "You can't do that." I said, "what do you mean I can't do that?" He said, "You can't have blank verified cards." And I said, "I realize that's bad, but if you are going to check the holes in the cards, I'll make a deal, I'll throw all my blank verified cards away if you stop looking for those dumb holes." So we struck up a deal, he didn't look and I threw all my cards away. I told him I wouldn't claim a keypunch error except where the verified blank card that I'm responsible for, a non-verified card.

Another time, he wouldn't let us have copies of our decks. Well, I had this great big program of twenty-two binary decks all of the same origin, and I knew it would be a disaster if they ever dropped it, because it was an 80 column card and there were no sequence numbers on the cards and they were all independently punched. So I bootlegged a copy and put it in my drawer. I got a call one day and he says, "Hey, Roger, can you come over?" So I came over and there was this deck all over the floor, and I knew what it was. I recognized the cards. I said, "What's that?" They said, "That's Joe's deck, we dropped it." I said, "It seems to me as though you have a problem." Jack said, "Do you have a back-up copy?" I replied, "Jack, you know that's illegal, but as a matter of fact I do, and I'll make you a bargain. You get rid of this stupid rule and I'll give you a back-up copy. Otherwise, I'll give you 22 memory prints and you can put the cards back together." He saw the light. Over at Northrop, one of the times, on the MADDIDA, Rex Rice, who went with IBM and is now with Fairchild --

MAPSTONE:

...

MILLS:

Anyhow, he was my boss, and he came in to see the MADDIDA, and it was sitting idle, Mookini and I had nothing to put on it. He said, This is terrible, a quarter of a million dollar machine sitting idle." So when he left we put the sine-cosine routine in it, and MADDIDA ran sine-cosine very well, I think, because alternating current it ran off of. We didn't plot it, but we looked into an oscilloscope to see the integrator so that we could catch an integrator as it spilled over. Rex came in about 30 minutes later, he looked at the oscilloscope and went over and looked at the printer and said, "Ah, that's more like it." All we were doing was wasting electricity, but we were keeping our boss happy.

At North American, I had quite a few crazy incidents. One of them was that it was a challenge between the programmer and the machine, and if you found a machine error, all programmers always holler, "machine error." Usually, it was the programmer's error. I found this error, and I couldn't figure out what had happened, so I got John Carlson to verify with me that "Yeah, it must be a machine error." So we went over and I proved to Ed Law and Owen Mock and Jack Strong that it was a machine error, so I got my time back and my money back. As I was walking back to the office I thought there is one thing I hadn't checked, I stopped in the hallway and checked it and, by golly, it was my error. So I went back to Strong and I said, "You know that machine error you gave me credit for, well, it wasn't a machine error, it was my error." And I showed it to him. He said, "Get up on top of the table and apologize to the machine." We had a great, big conference room with a glass window. So I took him up on it, and I crawled on top of the table and apologized to the machine. One of the things about the early days was that we had a bunch of crazy people and we had a lot of fun. It wasn't so staid as it is now, everything was sort of free-wheeling.

MAPSTONE:

MILLS:

Machine-wise, we went back on the 701 and the 704, we went back to IBM to check on the 704. Well, at IBM you couldn't go on the machine unless you had a coat and tie on during the day. The machine was in the display room and they couldn't have slobs running around the display room. At night they'd close the drapes and you could get on the machine in a sports shirt or without a coat. We were back there checking out our 704 system. General Motors and North American were working on their monitor system, it became the

NAA System. Most of it was generated by General Motors and a little improved by North American.

MAPSTONE:

That was the Bob Patrick, Owen Mock venture?

MILLS:

Yes. This was when we had the peripheral idea where you would take all your output on tape and take it tape to printer, then put all your input card to tape, however, the card to tape program wasn't working, so we took and put our cards input and Owen Mock and Irv Marshall were running the machine for us. You've never seen anyone handle a machine the way Owen Mock does. We had an hour of time that we split up with RAND, North American, Lockheed, they used to give us eight hour blocks back there. They gave one company an eight hour block, you couldn't possibly use it. So we got together a bunch of companies, said we'll all go back together and we'll share a block. So we were running on the peripherals, we'd take all our output to tape. Well, one time the tape to printer went down and we had 14 tapes of output and no place to print them. So we put Irv Marshall into a Cadillac and he drove to Poughkeepsie to print the tapes. DeCarlo saw me in the hall one day and said, "How are things going?" Well, he shouldn't have asked me, because I told him, I said, "When IBM realizes peripheral gear is as important as the main frame, it will be a great day forward." His answer was, "We never thought people would use the machine the way you people are." I don't know what he thought we were going to do with it.

MAPSTONE:

I think that is a really significant West Coast contribution that you really took these machines they were building and stretched their uses, and stretched IBM because of it.

MILLS:

There was a great dichotomy of opinion of how to do that between the East and the West Coast. The West coast was a bunch of renegades and East coast had some sharp ones, too. Roy Nutt was from the East Coast, one of the sharper ones in the industry. Then you have all your geniuses at MIT and all the academicians were out there. All the clowns out here just wanted to do a job. General Motors, by the way, was in the west, even though it's in Detroit, it acted and reacted like a west coast, they had more in common with the west than the east, in my opinion. On the 704, Lockheed, North American and Rand got together and generated a matrix tape thing where we shared the work. Now SHARE got developed at this time, too. Frank Wagner, Rand, and Lockheed said, "There's no point in all of us doing a square root routine and all of us doing a sine-cosine routine, why don't we split the work." Fletcher Jones was the first secretary of that, and I think Fletcher, in spite of the fact that I don't think he was much of a programmer, he did a good job on that because he put out voluminous notes at the

expense of two people: Yvonne Young and Ginette Orville, Frank's secretary. They worked themselves sick. Fletcher did all the notes, and they did the editing and producing. It was a fantastic job, and I think that's why SHARE was a success, because the first set of minutes that came out were just voluminous. He did a good job of recording everything. As I said, we worked together back on the 704, and Paul Tanny did the tape output. And at the end-of-file he had a routine when he'd wrap up the tape, we'd run Tanny's routine and we'd put an end of file on the message. And the message read, "This is the end of the job, will you please remove the tape." Then at the next end of file. "I said this was the end of the job, please remove the tape," and after the end of file "I said this is the end of job, now remove the tape." Then, next end of file, "This is the end of job, get off that tape," then went on to say, "Dammit, get the tape off." And what they would do, they would keep running this past end of files to see what was next. They would finally get past the last one and run off the tape, because it would run onto blank tape. IBM asked us to remove all of those comments. They weren't very happy when I asked them, "How did you get to the second message?" IBM did a fantastic job of helping people. They supported SHARE fantastically, and I think they should be given a lot of credit. When they came out to announce the 704, this guy came out and they had a bunch of instructions, and Owen Mock was sitting in the back of the room and noticed there was a conflict between two of these instructions, the numbers just wouldn't work, one number meant two different things, it had to do with indirect addressing and how you use it. So he asked the guy, and so they had to back off how they were using the machine. Then people started asking what would happen if you did off things. North American had a list of 25 or 30 items that Mock and Ed Law had dreamed up on different instructions, and that's how the store zero came in. To store the quotient in Q register and if you had a wrong sign on it, it would store zero, so IBM incorporated it as part of their instruction repertoire. That's how the store zero wound up.

Then we went to the 709. The 1401s came in about this time to replace all of the peripheral gear. When the 1401s came in, we had a Digital Computers Association (it was founded in about '52, I think, maybe '51). Anyhow, I joined it when I joined North American in 1953. When the 1401s came out, they had a guy come out and give us a talk on this great new machine. The guy from the East who had helped design it came out here, and so our local representative said he would have this guy present it at the Digital Computer Association, also known as the Drunken Computer Association. And he gave this spiel on how wonderful the 1401 was, and he said, "This is going to replace all of your peripheral gear. Being an Easterner, and being in the commercial end of the business, and thinking commercial, we asked him if it would punch binary cards. He said, "Yes, it can punch binary cards, but don't punch for more than an hour because you'll ruin the dies." Well, the way of life out here was binary cards, we took all our data and put everything on binary cards. So after we screamed and yelled at that somebody asked him, "That flying chain that you've got, chain printer, does it stop before it impacts, or just how is it handled?" Well, he didn't know the answer, so he tried to snow us. Well, snowing that bunch of reprobates was a thing not to do, and they jumped all over him. In the middle of this giving him a bad time, in walks Jack Strong. H had been out in the bar, hadn't heard any of the speech. He sat down and raised his hand and he says, "How many 407 systems will the 1401 replace?" This guy acted like, you know, this

drunk wandering in off the street, and gave him some flip answer. Strong says, "Well, I'm slightly interested, I've ordered thirty-one systems." About that time, Dick Baker piped up and said, "You ordered thirty-one systems, and you don't know what the hell they'll do?" And somebody else pointed out that he would be the firs test with the most test. But the guy went into shock, he had insulted one of IBM's largest customers, and he didn't know what to do. My guess is he never came west of the Mississippi River again. I can't even remember the man's name now. I'm sure he didn't come back. The 1401 replaced all our tape to printer and card to tape, and did a pretty good job for us. They went back east and redesigned the card punch and beefed it up so it would punch binary cards. ... After North American I went to FORTRAN class, in 1960, teaching us the guts of FORTRAN. It was a two week class.

MAPSTONE:

Was this at IBM?

MILLS:

And IBM held it. It was a fantastic course where you really learned the guts of the compiler. Now remember, compilers were fairly new at that time. And they did a good job putting that thing together, so you know how a compiler worked. Did a good job.

MAPSTONE:

This was 1960?

MILLS:

'60, yes. '58 was when FORTRAN came in.

MAPSTONE:

Oh. FORTRAN started earlier.

MILLS:

FORTRAN started in '56 or '57, but it was FORTRAN I, and it was not usable. I would say that usable FORTRAN came in 1958, I think. My memory's not that good. I say it came in '58 and should have been killed in '60. I'm a PL/1 man myself.

I left North American and came to TRW. Now BINAC was a serial machine, and then I went to random access machines, and then when I came to TRW ten years later in 1961, I went back to a serial machine, the PB-250. Electromagnetic delay lines, and if you stamped your foot, you'd lose your memory. But I got a chance of working on a PB-250, and it was an interesting little machine. They had used it as a hybrid over here to propose an orbital laboratory for an orbiting telescope. They lost that proposal. Then I worked on

the 1604s, CDC 1604. That's the first time I'd gotten out of the IBM line. Most everything had been IBM. Oh, I did work on Alwac.

MAPSTONE:

Oh, did you?

MILLS:

back in the old days, I wrote a couple of programs for ALWAC at North American.

MAPSTONE:

Was that I, II –

MILLS:

I think it was ALWAC I. I think it was the first set they had over there. I don't know, I wouldn't swear to it. I think they finally got to an ALWAC III at North American.

MAPSTONE:

Was it a good machine, did it work?

MILLS:

As all of those machines, it was prone to go down on you most of the time. Pretty good machine; I liked ALWAC. Then I came to work on the CDC 1604. Probably the most interesting thing that happened to be on that was that they had little lights on the 1604 when it was running. I'd been used to looking at the 704, 701s all had lights. The light would blink, and you'd know the machine was running. The 1604 had an audio and they had it turned down with the speaker under the console. So I was standing at the printer, and I didn't realize this, I had heard about it, but I wasn't really impressed. And this guy came along and he said, "I think you're in a loop," and then he crawls down under the console. I thought, why should he be under the console, it's my loop. What he was doing was listening and turning the tone up so I could hear the loop. I couldn't for the life of me figure why he was crawling around underneath the console.

MAPSTONE:

Was that a good way to figure it out?

MILLS:

I think so. In fact, we got on this big program we had, you could tell exactly which part of the algorithms were in by the sound. You got mighty good at it. So it was a very good

machine for that. Plus the fact it could play Oklahoma.

MAPSTONE:

All right.

MILLS:

It sang Oklahoma, they had a voice, they had put it together to make voices on Oklahoma.

MAPSTONE:

Oh really?

MILLS:

Unbelievable. Somebody had really done a lot of work. Better than the 704, they played Christmas carols.

MAPSTONE:

Yeah.

MILLS:

by turning the overflow light off and on. Flat Christmas carols.

MAPSTONE:

(laugh)

MILLS:

Computer music has improved a great deal.

MAPSTONE:

That's true.

MILLS:

That's true.

MILLS:

Then I went to the Philco 2000 and probably I got thrown out of ... Air Force Base as an undesirable character. I guess it started when I first arrived at ... Air Force Base. I arrived with my 2000 cards to be put in the machine. The Philco 2000 card reader read 2000 cards a minute, at 6 at a time. Well, what was happening was, I guess, the humidity and the change of altitude from Denver to L. A. and my cards had jammed six at a time. I would run to the keypunch, dupe the card and run back. After about 25 tries of this I found two cards on the deck and I asked what they were. They said they had dropped out of my deck. I said, "don't you think that it might be important to have them in the deck?" Well, we finally got the thing loaded up, after about 45 minutes of fooling around with the cards, reproducing an so forth. I took it over to the mainframe, it ran, but they said my master tape that I had brought was no good. I said, "change tape units." The Sergeant looked at me as if I had lost my mind, and he said, "But it's no good." I said, "change tape units." He changed tape units, didn't work. And I said, "now change channels." He thought I had really lost my mind, when I said "change channels" when it didn't work. So we got it working, ran the program, and took it over to an Analex printer, 1100 lines a minute, and about 24 pages of printing. It took me almost an hour and was spaced all over God's green earth and unbelievable. When I got through, I said, "does anybody maintain these machines?" I didn't get much of an answer. So I was sitting there with Grady Hansen, who was my boss at the time, and Captain Billy Joe Jackson walks in. He said, "Mills, from STL?" I said, "Yes, sir." He says, "I understand you have a problem." I said, "What?" He says, "I understand you have a problem." I said, "I don't understand." He said, "With the computer." I said, "Are you in charge of the computer room?" He said, "Yes, sir." I said, "I don't have a problem, but you do." The captain was a good Southern gentleman, and I don't think he had ever been talked to that way. Well, that started my road to ruin. Finally, I got a call one Friday afternoon. I had to punch the cards for a four field format, xy and z, t1 and t2. I found out that I could be punching xy and z, while calculating t1 and t2. So I punched them that way, t1 and t2 on the second card, and I had to have two cards. I get a call in the afternoon, about Friday, "this blankety blank card is in the wrong format ..." So I caught a plane out of here Friday night and got up there, got on the machine about 3:00 in the morning, Colorado Springs, changed the format, got it all checked out. 8:00 in the morning Captain Craig walked in and he said, "Oh, you're here." I said, "Yes, sir, I've changed the cards and I have three things to say. Number one: if you'd tried those cards I gave you they would have worked, because I know what program they are going to and you could put them in any order you want. Number two: the cards are in the format you wanted, and if you read the format I left you would know they are, but they're in the right format now. Number three: All you are doing is wasting my time by waiting for me to punch t1 and t2, I have to calculate both and can punch either card." He said, "Did you report in to the Major?" I said, "No, sir." He said, "don't you think you better?" I said, "I'm not going to look up anybody who cursed me out over the phone." so I left. The word was out that I had called the Major a bad mouth, and he told my boss's boss that I was no longer welcome at ... Air Force Base. That may have been a good thing because we just recently lost a proposal up there. I didn't have to worry about the proposal, but my name was mud. So I got out of it.

MAPSTONE:

Let's backtrack a bit. Let's go back to BINAC. You said that actually the two machines never did work together as a unit.

MILLS:

No, they never ran together. You could run one without the other. The idea was that everything was going to be checked, so every data transfer, every arithmetic calculation would come along a high speed bus and everything would be checked along with high speed bus. So the two machines high speed bus would be checked and they had to be in synch. So those two machines never ran together. Although we did get useful work out of the one machine.

MAPSTONE:

Oh, you did.

MILLS:

We solved the radial de-icing problem. We had several problems. Florence Anderson could probably give you a better rundown on those. There's also a law suit out. Sperry Rand is suing IBM for patent infringement, I understand, the patent on the basic flip-flop based on BINAC. The argument is that BINAC was never a production machine and so the patent wasn't valid. Some kind of legal maneuvers, and I don't know what ever happened to it.

MAPSTONE:

There's one project out that Dick Baker ...

MILLS:

That could be.

MAPSTONE:

Because at the moment he and I can't talk legally. Okay. It did so some useful work. Where is Florence Anderson?

MILLS:

Florence Anderson is at North American.

MAPSTONE:

As far as a significant machine, what would you say was the significance of BINAC?

MILLS:

BINAC was significant in the fact that it was a stored program computer and you could modify your instructions. Now ENIAC, remember you had to wire in your square root routine. One thing about BINAC was that it had the idea of double checking, like UNIVAC, the early UNIVACs did this. Every calculation was checked, so it made sure that when you got the answer you were checking. IBM went the route that if you weren't sure you could run it twice. They worried about that rather than two machines running simultaneously to check each other. BINAC had, I guess, the fact that it was a major breakthrough in computing, it was one of the first machines, I guess. But it was no better or worse than the rest. I think the mercury delay line memory for a serial memory was a good acoustic memory. The serial machines can't hold a random access, address a word and not worry about when it's coming round the drum or when it's coming around the delay line. It was so big. It was supposed to be an airborne computer, you realize. This airborne computer filled up an entire room, a big room. And for six months, one thing, well, they checked it out back at Philadelphia and ran acceptance tests. When they brought it out here it sat under a tarp for six months, they didn't know what to do with it. Northrop had contracted, in trying to keep Eckert and Mauchly from going broke, they tried to cut corners and had put 50 LC6 tubes, home radio tubes, as the main tubes. Seventy-five percent of these were ejected for too much emission. In fact, Strong developed an emission tester which rejected out of hand about seventy-five percent of the tubes.

MAPSTONE:

...

MILLS:

Northrop maintained it. The machine was built by Eckert and Mauchly, but Northrop maintained it, Jack Strong and, I don't know if Lou Coy went back or not, but Lou Coy and Jack Strong maintained it.

MAPSTONE:

... When it came in there must have been a whole bunch of internal politics going on, about who would use it –

MILLS:

Well, yes, that was part of the problem. One of the things that the engineering, and then they had the missile division over there which had developed the MADDIDA, by the way, I understand there was internal politics, but when I came in I was so low on the totem pole I didn't know what internal politics was. BINAC was under Lee Ohlinger.

Ohlinger set up an engineering computing set-up, I forget what the name was, but Ohlinger was the head man. Rice came in afterwards and became our boss, which is when I started to fall from grace.

MAPSTONE:

Now, the kind of programming you did. Was it very much different to program BINAC say, than it was to program MADDIDA and to program CPC?

MILLS:

Well, they are completely different machines. BINAC we programmed in absolute octal, we had 32 instructions. The CPC is a plug board machine and what you did you put in 60 steps. You had 60 steps where you could do operations on either storage registers, which we had called ice boxes, or you would do it on the thing coming down the line. The idea was to wire a board, and we had a general purpose board which would add, subtract, multiply, divide and test. The punches on the card would tell you what to do on the next card coming by. So that was a completely different animal.

MADDIDA was an integrating machine and the idea was to fill up an integrator and it would spill over, so you just had electronic integrators to solve differential equations. You had to write all your solutions. Your problems were always differential equation oriented, so we wrote everything in differential equations, and solved a differential equation. The problem with MADDIDA was that you had zeros and ones input, which was fine, but you had to fill up an integrator to a certain space, and you had to get it to spill at the right time and so you had to figure out all the rates, and you essentially had to do an awful lot of jobs of setting the program up before you could ever get it to run. You could easily go off the wrong track. You had to be a lot sharper to run MADDIDA, they had not set up good cookbook ways of doing simple jobs.

MAPSTONE:

Was that basically one of MADDIDA's downfalls?

MILLS:

I think that was part of it, and they build the whole thing on germanium diodes, the whole logical circuit was germanium diodes, and they wouldn't hold very long. When one of them went out you had the fun of trying to find out which one of those 500 and some off diodes that had gone out. That was my job, I maintained MADDIDA for a while.

MAPSTONE:

And it wasn't set up so that it was easy to find that out?

MILLS:

Well, you got better at it as you went along, but it wasn't self-locating like some of the machines nowadays. A part fails and it essentially tell you, "I'm failing, will you please fix me." That didn't happen. That was way before its time.

MAPSTONE:

Of maintaining the MADDIDA, were you maintaining just the Northrop one, or were you traveling around?

MILLS:

No, just Northrop, just Northrop. I worked with Mookini, and Mookini and I were the MADDIDA programmers.

MAPSTONE:

Were you involved with the Hagen politics?

MILLS:

No.

MAPSTONE:

This was the Hagen MADDIDA?

MILLS:

Yeah. Well, Paul Steele, I think, was the guy that developed the -- wasn't it?

MAPSTONE:

Floyd Steele.

MILLS:

Floyd Steele, right.

MAPSTONE:

Floyd Steele developed the first one.

MILLS:

Right.

MAPSTONE:

and then when he left and took the CRC group, Hagen then built the MADDIDA 44, which was the one that was produced and sold to various other companies.

MILLS:

Well, they also did the CRC 101.

MAPSTONE:

The CRC 101, which was a direct off-shoot from the early MADDIDA that Steele had built.

MILLS:

Well, the CRC 101, though, wasn't that a general purpose computer?

MAPSTONE:

No, it was the 102 that was a general purpose computer. 101 was a MADDIDA.

MILLS:

Oh, was it? I had gotten out by that time. Bendix essentially, had taken over the MADDIDA part of the company. So Bendix moved in, picked up MADDIDA --

MAPSTONE:

Do you recall when ...

MILLS:

No. It's too far ago.

MAPSTONE: ...

MILLS:

It was before '56, I know, 'cause that's when I left. That's when I left Northrop. I'm sorry, it was before '53, I left Northrop in '53, so it had to be before '53.

MAPSTONE:

Yeah. It must have been right around that time. Do you have any feeling about the

significance of CPC?

MILLS:

Well, I think the CPC showed that it was a necessity to do computing, high speed computing. I think it lent the fact that you could use those business cards and so something else besides just add and subtract in business accounting. I'd say the CPC was the major breakthrough in the aircraft industry, because they went totally CPC, and that's how they got their job done. When they found out, used to be when you'd take an aircraft wing up, you'd drop it a hundred feet; if it broke, then you'd patch it and do it again. When you started getting the size of the planes we have now or then even, you couldn't take them up and crash them to find out whether they're strong or not, so you had to do some analysis. And the matrices you had to do were fantastic, a lot of work, just dog work. And Fridens wouldn't do it, hand calculating Fridens. It's an awful lot of work.

MAPSTONE:

Yeah. So this was the breakthrough that CPC made that made large scale computing possible.

MILLS:

I think so. I think it showed the aircraft, I think that's how the aircraft industry got into it. And they were the first ones to get the machines, the first ones to find out what you're supposed to be doing with them, and so forth. And I think that's part of the fun, and I think CPC led the way for that.

[End of Interview]