Computer Oral History Collection, 1969-1973, 1977

Interviewee: Richard Martin
Interviewer: Richard R. Mertz
Date: April 27, 1970
Repository: Archives Center, National Museum of American History

MERTZ:

[This is an interview at the MITRE] Corporation offices in McLean, Virginia, on the 27th of April, 1970, with Mr. Richard Martin. The interviewer is Dr. Richard Mertz.

MARTIN:

I went to MIT, graduated in 1945 in their electronics option of the EE course, and in [the] early 1950s - I guess it was 1950 - became interested in computers and was in a Naval Reserve group with several other officers where we just took it upon ourselves to study computers. And, largely as a result of that, in early 1951, when I was called back to active duty, and - I was sent out to St. Paul to the Navy Computing Machine Lab. Prior to being called back in the Navy I had worked in the Boston area at MIT and at Boston University on things ranging from servomechanisms to helium liquefiers. The servo project was at Boston University Optical Research Lab, a stabilized aerial camera mount; and at MIT I worked at - with Professor Collins in liquid helium and with Dr. Von Hippel in the Insulation Research Lab. And this was setting up a helium cryostat. The Naval Computing Machine Lab was set up by the Bureau of Ships and it was responsible for .. inspection liaison in the procurement of classified computers for the Naval Security group. This was located in St. Paul, Minnesota. It was located right in the factory of ERA, which later was taken over by UNIVAC. The people that were out there were Mr. Norris, who is now President of CDC; Bill Kye, who I believe is Executive VP of Control Data; John Coombs, who later went with IBM; Seymour Cray, who also went with CDC; Arnold Cohen, who is still with UNIVAC and who was probably the foremost architect of computers at that point in time. The key engineer at ERA at that time was Jack Hill. He still works for a small local electronics firm in the Minneapolis-St. Paul area. Chief engineer on all the machines they built; so a lot of the techniques of plug gable units, laying out the components and so forth were attributable to Jack Hill. Seymour Cray had just started with what was then UNIVAC in 1952 and his job was on the 1103. At the finish of that project he was project engineer. The thing that he did on that project was to do all of the back panel wiring for the entire machine in a period of two or three weeks. This developed his interest in design automation and as a result of this, the story that I had later heard about Seymour Cray from Captain Svensen, who is now, I believe, with the Naval Security Group, was that Seymour had built his own small computer in the basement of his house. And - when Control Data Corporation was formed, Seymour joined them and the first 1604 computer was a paper design which had be en done on the

computer in Seymour's basement. At that time I worked for a Captain who was in command of Svensen at the Naval Computing Machine Lab, which was responsible for liaison and inspection of one classified machine which was to be delivered to the Security group plus a few other small projects. That left me with a considerable amount of time on my hands which I devoted to studying computers among other things. I was in the Navy for about two years and when the time came to go back to civilian life I had pretty well decided I wanted to work for IBM, and fortunately they made me an offer. So I went to work for them and immediately started on the SAGE project at [the] Poughkeepsie, New York plant. [I started] with IBM in May of '53, and was assigned immediately to the SAGE project where I worked on the central computer as a logic designer. And when my part of the computer had completed test I became the associate leader of the computer group, and then almost immediately was pulled out of that group to set up the group which designed the production version of SAGE. And by design -- this group did the logic design, which meant that any new functions which had to be incorporated were design ed by this group. As it turned out, we had to generate almost a completely new set of logic and plug gable unit drawings. When I started at - on the SAGE project, there were about 75 people on it and it eventually built up to about 5,000 people. [It] was, oh, perhaps within 6 months of when the project started at IBM. I didn't have too much contact with the Lincoln Lab people initially because I was always in the backroom designing and it was much wiser to avoid contact with them since they always wanted to change things. During the production stage part of my experience at IBM we had a parallel system engineering group whose job it was to interface with Lincoln Lab, and this was headed by Dan Ross, who is in the Washington area and is President of a company called Ross Telecommunications. Although the SAGE had been supposedly des--maybe I shouldn't say supposedly: it was based on the design of WHIRLWINDI - it was necessary to do almost a complete redesign so .. the equipment would be producible. For example, IBM had a circuit group which had about 50 people who were taking the WHIRLWIND basic circuits and redesigning them, essentially doing a complete redesign. .. And in almost every case of the design of the machine there was a very large group at IBM. For example, in components, in the selection of high reliability vacuum tubes, and in the selection of the components which would be used in genera l, there were 50 or 60 IBM people. The core memory was in effect a complete redesign and there again that group had 40 or 50 people in it. Yeah, the Q-7 was always designed to use a core memory. Initially it was going to have two 4,000-word core memories, 32-bit words, and as it turned out as the problem grew and grew, it was necessary to go to a larger memory. A 65,000-word core memory was designed and incorporated into the system. In addition to the core memory there were six drums which were used partially for auxiliary storage, partially to drive displays, and partially for input/output. This was later increased to a total of twelve drums. At that time ERA was using drums coated with a ferrite coating, a paint which they sprayed on in many layers, whereas IBM had gone to a nickel-cobalt plating. The drum was based on a drum which had originally been intended to be used in the 650. However, it was ten inch diameter instead of the drum which actually was used in the 650, which was, I believe, at about six inches in diameter. Periodically IBM would forget how to plate these drums. At that point in time no production core memory had been designed. IBM found that they had to initiate the design of a new ferrite material and Dr. John Gibson, who later became a Vice President

of IBM, in a period of one year came up with a new ferrite mix which did the job for a 6 microsecond core memory. The other problem in core memory was in sensing the switching of the cores, since the drive pulses generated a very large response which came out on the sense windings and you were looking for a .. a, a small glitch [Laugh] on the winding to determine whether it was a one or a zero computer and the WHIRLWIND was ... significant and yet there really was a very strong family resemblance. Almost every part in SAGE was new and carefully selected. The tubes, - the -- of course there was a new plug gable unit design, the mechanical frame design, hardware, .. cabling - everything about it was a new design so the relationship was sort of that of a breadboard to a production model. ... One of the problems that they had had with the WHIRLWIND was what they called silver migration, which was actually that. The silver would form crystals or I don't know quite what, between contacts and after a period of time this would actually short circuit the two contacts. Early [in] 1955 the duplex design project, the design portion had been completed and it was turned over to a product engineering group who were then responsible for carrying it through manufacturing. .. I went into an advanced planning group which was writing technical proposals for the advanced computer system design work. Some of the key people at IBM on the SAGE project were John Coombs who had moved to IBM from UNIVAC in 1952, headed up the entire activity for three years and at that point Bob Crago took over –

MERTZ:

How do you spell his name?

MARTIN:

C-r-a-g-o, Bob Crago. He took over and was responsible for the SAGE activities at IBM, and became manager of the Kingston plant at the age of 29. He is currently located at IBM Gaithersburg, as the Vice President of the Federal Systems Division. Other key people were Mort Astrahan, the first chairman of the IEEE professional group on electronic computers; Harold Ross and Nate Edwards were two other key people at that time. One of the interesting things about the SAGE computer was that it was designed for a ten-year life so consequently when it was first put together for debugging it was considerably over-designed. For example, cathode followers which were put in to drive AND/OR gates, [at] times. It was impossible to tell whether these cathode followers were working or not because at [the] beginning of life the flip-flop would drive right through them and drive the AND/OR circuits. Once this was recognized, of course, tests were devised to make sure that the driver circuits, the cathode followers, were working properly. Completing my role in the design of the SAGE system, I went into the advanced development activities which were mainly financed by Lincoln Lab under the same contract. A common theme of these design activities was the design of an advanced transistorized computer. Eventually such a computer was built, the AFSQ-31. Following the advanced development activities I went into a process control group as manager of system engineering. The objective here was to put IBM into the process control business, a field which they had very little knowledge of. Several studies were initiated with public utilities, petroleum refiners, and so forth. The two problems in process control were the

lack of knowledge of the environment and the establishment of the time constants of the process itself that was being controlled. The environmental problems were resolved by building models and installing them in actual refinery locations. The time constants, as it turned out, were not too difficult to predict because all of the processes at that point were controlled by humans, and therefore the time constants could not be critical since the human might be off drinking coffee or who knows what. On completion of the process control work I did some studies .. computer application studies for a short period of time and was involved in the establishment, or the attempt to establish, a standard IBM .. interface for peripheral devices. .. On completion of that assignment in 1961 I moved to Washington as a senior planning representative, doing product planning for a line of militarized computers. The SAGE computer, the Q-7, was with a large high-speed memory and as a matter of fact for several years the speed capacity product was higher than that of any commercial machine. It was also notable in that it used 50,000 vacuum tubes. I believe it was also the first full duplex system. Although this was considered a rather brute force approach at the time, most highly reliable systems have utilized essentially the same approach since then. The Q-7 was one of the first pieces of equipment to use worst-case circuit design. In this approach each component is varied in the worst direction to the value it would have at the end of its life, namely ten years, in both directions end of life. The other components in the circuit are then varied to their worst purchase condition, which means that to the -- within the purchase tolerance but in the worst direction. Special vacuum tubes were developed for the Q-7 and special manufacturing lines were set up to produce them. It was the first large-scale computer to use printed circuit boards. The state of the art of computer technology was moving at such a rate that by 1957 or '58 the Q-7 was essentially obsolete, even though it is being used right up to the present date for its problem. Programming of the Q-7 was perhaps the first major software job in the -- of this type of command and control system. The systems concepts that were used in Q-7 have been carried on. The current NAS system being designed by the FAA is based largely on the Q-7 .. over-all system approach. In 1961 I left IBM to form my own company, .. primarily interested in building small digital black boxes under contract to the Government or to anyone who would give us a contract and eventually we hoped to come out with a line of products We found that the Government business was very difficult, in the first place to get a job and in the second place, once you got a job to make any money on it. It required day and night effort and on completion of the typical Government contract, since we were in the under $50,000 category, on completion we would find that we hadn't done any sales homework, so the only thing we could do is get another one just like it, on the same basis. In addition to the HYBRA work we also did some consulting work.

MERTZ:

And this concludes this portion of the interview with Mr. Richard Martin of MITRE Corporation, conducted in his office on April the 27th, 1970.

End of Interview