An Interview with

CUTHBERT C. HURD

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Conducted by Nancy Stern

on

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Portola Valley, CA

Charles Babbage Institute
Center for the History of Information Processing
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Abstract

Hurd discusses International Business Machines' (IBM) commitment to research in computer technology, IBM's support for academic research on computers, and his own work at IBM--especially on the IBM 701, 704 and 705 computers. He also describes John von Neumann and his contributions to the development of computer technology.

CUTHBERT HURD INTERVIEW

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STERN: Before we discuss your relationship with Von Neumann, I wonder if you can just give me a little biographical

information about yourself?

HURD: I started mathematics with a Ph.D. [from] the University of Illinois, 1936. Dissertation concerned asymptotic

solutions of differential equations. Taught at Michigan State College, now Michigan State University, until the war.

And organized and staffed department for reserve officers of The Coast Guard Academy, and was educational officer

for the academy, helped the admiral revise the curriculum, and was briefly dean of Allegheny College, joined the Oak

Ridge Project in nuclear energy. In 1947 was a Technical Research Head. Did work which involved dealing with lots

of data. Felt we needed something more, became acquainted with IBM. Called on Mr. Watson Sr. told him I wanted

to work for IBM. Joined IBM, organized the Applied Science department. Got IBM's first computer announced in

about a year and a half.

STERN: Okay, we'll stop at this point, because I have a lot of questions. You were one of the first Ph.D.s hired by

IBM?

HURD: Yes.

STERN: Did they make a conscious decision to get involved with people who could do basic research for them at

that point, do you think?

HURD: The Ph.D.s who were in IBM when I joined were three in number. They were Wallace Eckert, L. H. Thomas,

and H.R.J. Grosch, who were at the Watson Laboratory which was either on or attached to the Columbia University

campus. And those three gentlemen taught at Columbia University as well as being employed by IBM. So in a sense

they were full time IBM, and in a sense they were part time IBM. There was a research effort in IBM at that time, what is called research as opposed to engineering. It was centered around Wallace Eckert and what he wanted to do. Wallace Eckert at about the time I joined IBM, began to hire people primarily from Radiation Laboratory to do research in what we would now call components.   Byron Havens was one such person, the Havens Delay Line for example.

STERN: That's a long time ago.

HURD: Long time ago. For example one of them began to work on the fifty mega-pulse counter which was very advanced research in those days.

STERN: But wasn't it surprising that IBM had so few people actually involved in research, or was that normal for that period of time?

HURD: I would say with the exception of Bell Labs it was normal for that period of time. Because Union Carbide operated Oak Ridge, so I got to know Union Carbide. And Union Carbide had no organization formally known as a research organization, and I'm not aware of any of the other contractors who were at Oak Ridge at that time whom I knew had a formal research organization.

STERN: Bell Labs could have, I would have thought RCA also had.

HURD: I'm sure that's true because Rajchmann by that time was at RCA, and I presume GE did but I have no personal knowledge. To the best of my knowledge the only research, only formal research facility in 1949 at IBM, was at the Watson Scientific Computer Laboratory.

STERN: And you were not hired to work in that organization?

HURD: I was hired to work at IBM, and nobody knew where I was to work, because there hadn't been anyone with my interests at IBM, and Wallace Eckert and I talked, and he said "Do you want to come up here and work?," and I said "No, I don't want to come up." So eventually I just went down to World Headquarters, started work.

STERN: 590 Madison ?

HURD: And after six months or so I got a title.

STERN: Which was director...

HURD: ...of Applied Science.

STERN: Did you assemble the staff?

HURD: Yes.

STERN: Ph.D. people?

HURD: Whenever available [and] as many as I could find.

STERN: And Watson was at least becoming committed to the concept of having a research organization?

HURD: They were becoming committed to whatever needed to be done to get started with computers.

STERN: Really in the 40s, this was in '49?

HURD: Nobody knew how to go about this exactly, there was no plan. I was hired with some notion about helping

IBM get in the computer field. It was vague. When I came in I talked to Mr. Watson Sr. who was the chairman, Mr. Phillips who was the president and Tom Watson Jr. who was executive vice president, the director of sales, the director of product planning and John McPherson who I guess was vice president of engineering. I talked to everybody, we all talked about this subject.

STERN: Did they all feel strongly that IBM should get into the computer field at this time?

HURD: No, Mr. Watson, and probably Mr. Phillips, felt that the SSEC was probably what was necessary. In those days we didn't talk about what is a computer, and isn't a computer. That machine was called a calculator. And in my view it was a calculator. We didn't talk about that, and he felt it had such tremendous capacity in his view that it would solve the scientific problems and, there was no unified belief in IBM that a computer was necessary to solve the problems which we now think are computable. There was no unified belief at all at the time.

STERN: But nonetheless they did hire you with the idea that they might get into the computing field at this time..

HURD: Yes.

STERN: So it was of kind of fuzzy concept?

HURD: And there was rough correlation, rough negative correlation between age and belief in that. Tom Watson Jr., who was my age, I guess he was my age, I guess, 39. Tom Watson Jr. believed strongly that something needed to be done. He didn't know what. And there were others who were about the same age who believed something had to be done, I left out Birkenstock, but he believed strongly something had to be done. And Ralph Palmer who was manager of engineering in Poughkeepsie, and who was hiring a small group, and I think Rochester was hired by Palmer shortly after I was hired, and Buckholtz and Stevens and some others, anyway. He believed strongly something had to be done, we didn't know what needed to be done, and there other people who thought what we needed to do was take all the money we had and build more plants for punch cards and this kind of thing. And

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everybody knew where everybody stood, because we were so small.

STERN: Is it your sense that IBM got into the field late? Would you say that when they decided it was early, late, or just at the right time--to get involved?

HURD: I think as a practical matter they got in at the right time. What I mean by that, because of the Korean war, and the fact, along with the 701s, the defense calculators, were sold to people who in one way or another were supporting that, which gave a focal point and this was the right time for IBM because it focussed on something and they were able to get done what they needed to get done. So in that sense it was the right time. Now technically would they have been better off starting off earlier? I suppose so, I suppose so.

STERN: But then again in '49 they were able to adapt existing technologies where as they would had to do more inventing if they had started earlier. Think that's fair?

HURD: That's true.

STERN: Can you tell me about when you first met Von Neumann?

HURD: I'm fuzzy, I don't know whether it was 1947, or 1948. I met him at some meeting of the American Mathematical Society. I don't know whether it was in Washington or New York. Some place east with the American Mathematical Society. And of course he was known as a great mathematician. It was also known he was interested in computers. One of my first conversations with him, would he become a consultant with Oak Ridge and we were working on a design of a gaseous fusion plant. There was a lot of numerical analysis what we would now call computing, and I thought and a colleague of mine, Dr. George Garrett, who was my boss, he's a mathematician, thought that John Von Neumann would be useful, and when we told Alston Householder about this, Alston thought it would be a good idea to get John to become a consultant. John was already a government consultant, so I talked to him about this. He examined his schedule and after some period of months I guess, decided he would have time

and the interest to become a consultant also at Oak Ridge so he became a consultant. But the first time he visited was after I had left.

STERN: I didn't realize that. What were your first impressions of him?

HURD: I suppose the word brilliant always occurs, highly articulate, versatile, personable, charming, a few eccentricities.

STERN: Like what?

HURD: He always wore the same suit.

STERN: Did he really?

HURD: It was hardly ever pressed. He always liked to run up the stairs, and he was awkward at it and I never knew why he wanted to do that. But he liked to run upstairs two at a time. When he drove a car and the conversation lagged he would sing. The tune was indistinguishable, so he would sway from side to side like this and the car wouldn't go very straight, and it was quite an exciting thing to ride in the car with him, and I always tried to arrange it so that I could drive. That was unusual.

HURD: He had to have hard rolls for breakfast. We were in the Amsterdam Hotel once having breakfast, and they brought him some kind of dutch bread, and he asked for hard rolls. He got more and more upset, and I finally got up and went to the kitchen and asked for rolls which they brought to him. You know, terribly upset about the one little thing, so it was unusual.

STERN: I had heard that he was a strange driver and had difficulty finding his way from one place to another.

HURD: After he became a consultant he'd spend two and a half days a month and he'd drive usually from Princeton and then get on the west side highway and go up to Poughkeepsie and he'd drive fast, and I think he believed that I had some magic, so when he got tickets I would pay them. Because he'd hand me ticket, no way to fix them. What we do, I'd take that ticket and give it the downtown manager in New York, where the Police court was, and he would go around and pay the fine.

STERN: Now, when he was a consultant for Oak Ridge was it a financial arrangement that he had with Oak Ridge or did he do this as part of his consulting with the government?

HURD: That's it.

STERN: It was part of his consulting with the government?

HURD: That's it.

STERN: And the expectation would be that he'd come down once a month, twice a month, what was the frequency?

HURD: I think he just came once for a preliminary visit and then it would be decided how often he came. I think he went once or twice. Because I believe he decided that, with the devices available at that time, Oak Ridge was doing as well as it could, on that particular problem with the calculation stage by stage, very slowly.

STERN: Well Oak Ridge did eventually build a IAS type computer.

HURD: Yes.

STERN: But you were not involved in that end of it you just arrange for it initially?

HURD: I just arranged for it.

STERN: You were a relatively young man at that time?

HURD: Yes.

STERN: Did he know about you? Did he know about your background?

HURD: I think not.

STERN: And he was still, wasn't the kind of great man talking to somebody that was at a lower level.

HURD: I just went up and introduced myself to him, and got acquainted with him. We communicated standing up someplace. I have a vague recollection. We just talked about it. He thought the problem was interesting and important, so he decided to do it.

STERN: He seems very unusual in that regard that he was willing to do that kind of thing.

HURD: Very approachable, very approachable. And you know it meant nothing to him financially, I think the government stipend was perhaps fifty dollars a day or something like that. It was hard to get to Oak Ridge. You'd go down there and back for fifty dollars a day plus expenses, it was quite a service. And his services were in great demand.

STERN: Now when did you meet him again after that initial [time]?

HURD: I met him at normal times, up between whenever that was until the time I joined IBM. I met him at normal times in the sense of, there were a few conferences which we would now call computer conferences. And I'd see him

around, at one of those places that he was on the program.

STERN: Can you recall where some of those conferences were? We're talking about the Harvard computing conferences?

HURD: Yes. I would be fairly sure but not certain that he would not be at one.

STERN: Why not?

HURD: I don't think that he and Aiken were close.

STERN: Well they both sat on the National Research Council Meeting.

HURD: I don't think they were close.

STERN: Was it a kind of competition because they were both doing computing projects, do you think?

HURD: I think so, although neither one ever said that to me. Neither one ever said, I knew Howard Aiken very well. Neither of them ever said anything to me, derogatory or anything whatsoever about the other, but I just observed that those two gentlemen were not necessarily very close. So, they might or might not have been. I know there was an IRE convention, before the AIEE there was an Institute of Radio Engineering, another forerunner of the IEEE. They gave something like Computing Conference in New York at The Waldorf. And I know I saw him there. Whether it was before or after I joined IBM, I don't know.

STERN: I think it was about '51.

HURD: Was it?

STERN: Yes.

HURD: And then there was this conference at Los Angeles with John Curtis and the Institute of Numerical Analysis put on, in 1948.

STERN: I didn't know about that.

HURD: And there was a man named Boelter who was dean of engineering at UCLA, and he organized it, and I believe Von Neumann was there but I'm not sure. And Metropolis and Taub and Householder and Curtis and a lot of other people. I was not in any sense intimate with Von Neumann.

STERN: Did you know about his Institute computing project?

HURD: Yes, I did.

STERN: From him, did he discuss it with you?

HURD: Whether right then, I can't be sure of the time, around 1949 I certainly did. And I certainly began to visit the Institute after I moved to New York with IBM. I certainly began to visit the Institute then frequently.

STERN: That was prior to Von Neumann becoming a consultant for IBM?

HURD: Yes.

STERN: What did you think of the Institute project?

HURD: Well, in a technical way, I became convinced by him, that that style and organization of a machine was the proper one. In the 701s, except for engineering details, it was that kind of organization, of binary machinery. I became convinced based on his discussions of unreal liability of components, primarily, in cost and the kind of problems you're going to solve and this sort of thing. I became convinced that that was the proper kind of machine to do the work, as opposed to, I suppose, the Univac which was under way about that time. So I became convinced as a mathematician, I didn't have any judgement of, whether that was a way to organize a project. I was convinced that Bigelow was competent, and Goldstine was competent, and Pomerene. And some others, let's see George Brown was not there, no, George Brown was never there. George Brown was RCA laboratories. And I would see Metropolis around there occasionally and Taub, other people, just looking at the collection of people who were working around there you became convinced that it was certainly well staffed. I didn't have any, as I looked at, I've always thought to myself this direct couple, the idea that they had, which they were very proud of, for their purposes it was probably correct. The purposes of IBM who wanted to manufacture if they did manufacture lots of machines, and service lots of machines. I didn't think that that package was the best package for their purposes. For their purposes, [an] experimental machine got built. That's good.

STERN: Do you have any information about the Selectron? At that time?

HURD: Yes. I talked, this is probably after I joined IBM, to Von Neumann about it. I talked to Franklin about it. And later I talked to Arthur Samuel and people in IBM who eventually worked on the version of the Williams tube, but I certainly talked to them about it. I'm sure I talked about it with Von Neumann even before he decided not to go with the Selectron.

STERN: Did you think it was viable at that time?

HURD: I didn't know.

STERN: You said that you thought that people working on the Institute project were competent people, did you visit

Eckert and Mauchly and see how the Univac project was going?

HURD: No.

STERN: So that really this was your first first-hand experience was with the Institute machine. Now there seems to be a lot of controversy over the management of the IAS project. Now, Von Neumann himself did not seem to mange it. It was administered essentially by Goldstine and that Von Neumann was not around all that much, but you didn't have any sense of that at all?

HURD: No, I thought until this instant Bigelow was involved.

STERN: Well Bigelow was chief engineer, Goldstine was associate director, and Von Neumann was director. But it didn't seem to me that Von Neumann really directed, but you have no sense of any of that?

HURD: I didn't know that Goldstine was associate director. I probably knew and forgot. No, I didn't know.

STERN: But engineering wise they were functioning okay, there was not a problem.

HURD: I'm sure I saw Goldstine. When I'd go down there, I'd spend time with Von Neumann and then I'd go and visit Bigelow and talk with the engineers about what they were doing. I can't remember any discussion about, what they were doing at that time, except to get an interpreter or maybe a discussion about, what we now know as software, I don't remember anything at all about it. You say that my introduction was, was an interesting thing, but about the same time that I began to visit there I also made visits to MIT. So the reason I didn't go to Mauchly-Eckert that was, that was the competition, but if I wanted to get there, I'm sure they'd been polite, because Eckert and Mauchly were polite, friendly people. But I doubt they would have wanted me to come into their laboratory.

STERN: John McPherson made visits with some regularity to demonstrations.

HURD: He'd go regularly?

STERN: I'd say he was there. There were write ups to IBM management explaining what was going on there. I thought perhaps you had been there as well.

HURD: Never did.

STERN: Could you compare the MIT project to the IAS project in general terms?

HURD: I remember seeing Forrester and...

STERN: ...Everett?

HURD: Everett and whoever the man was who turned out to be the software man, I can't even remember his name.

STERN: Adams?

HURD: Charlie Adams. Bernie Woodrow. Benson ?. And they seemed to be very comfortable.

STERN: Because after all you did decide to go with an IAS type computer. Was there ever any consideration of going to a Whirlwind kind of a machine?

HURD: I don't know. At the time we decided to build the 701, we thought about the Whirlwind machine as being substantially different than the IAS machine. When we say we build an IAS machine we really mean we build a machine that was described in general terms in the Burks-Von Neumann-Goldstine paper. Clearly there were a lot of similarities between that and the Whirlwind machine. So I think, we didn't make a conscious decision we're going to build one like the IAS machine and not like this. We're just going to build a binary machine and have certain block

diagrams and system sense, so I don't think there was any conscious judgement there. The people who built the system knew as much, and, maybe more about the Whirlwind, than they did the IAS machine. Because Rochester you know, worked on the, what was it, he did something for the Whirlwind machine. He studied at MIT and then he got a job, I think Raytheon. And I think Raytheon was a sub-contractor to Whirlwind and Rochester was in charge of that sub-contract, he built something for Whirlwind. So he knew that and knew the people. And there were other people who were in the Poughkeepsie laboratory ultimately during that period, who also knew about MIT. I don't think there was any MIT versus IAS, thinking about it. There was thinking back to Eckert-Mauchly. But that thinking initially was highly in favor of that because Rochester and Stevens and Buckholtz, and Asteran, they really wanted to build something which was not the 701. They wanted to build what became the 702, the 705, that is they wanted [an] alphanumeric serial machine, which Univac was. I'm sure it was.

STERN: Yes, it was.

HURD: So they wanted a machine in function more like that.

STERN: Quote "so called commercial?"

HURD: Yes, but, to answer the question, there wasn't any thought that would distinguish IAS and MIT. And I suppose also at that time we knew about what was going on at The Bureau of Standards and UCLA. We knew about it, so, I think that's an answer to your question.

STERN: Do you know anything about efforts to acquire Eckert-Mauchly when they went bankrupt in 1950?

HURD: I was not directly involved. I know that either Eckert or Mauchly, or both, came to New York and called Mr. Watson Jr., and I know there was discussion about purchasing Eckert-Mauchly. And this was at a time when the 701 program was already under way. Do you remember the exact date?

STERN: They were seeking support late, very late '49 early '50. They were acquired by Remington Rand in February 1950.

HURD: Then I think my story is wrong. I thought that when they came the 701 program was already under way and had some momentum. So it was not a viable thing for us to stop that program and acquire some different program. I'm mistaken about that, I thought it was later. So I did not participate in the meeting, somebody asked me some questions about it, but I don't remember what it was. What I thought about it, but I, essentially I know nothing about it.

STERN: So you don't know what transpired between Watson and Eckert and Mauchly. Now they claimed that they were turned down. Well they claimed that Watson was willing to hire them but was not willing to acquire their company. Given that it was true, could you speculate as to reasons why that would be the case? Why Watson would say that? Could it possibly a matter of anti-trust difficulties? The potential for anti-trust difficulties?

HURD: Well if you're correct about the period, and I'm sure you have the facts, I never heard any discussion of anti-trust until actually that first suit. My recollection is wrong clearly, because I thought it was after I thought it was after maybe 1951, after we'd already we started the 701 project and we had people assigned already to go down that line. I thought that's when the discussion took place. So if you'd ask me what I thought the reason was, IBM had momentum in a different direction and didn't want to change it. Now let's see what happened when Norris came and wanted to start CDC, I wasn't at that meeting either.

STERN: That was later.

HURD: When was that do you think?

STERN: My guess would be, and I'm not sure about this, would be in the '50 '51 period, that would be my guess. But definitely Eckert and Mauchly came earlier than that.

HURD: I know nothing about that. I remember somebody like Birkenstock, MacDowell or somebody. Naturally it would be Birkenstock because he was in charge. He was a special assistant to Tom Watson Jr., and he was in charge of looking for new ideas and new opportunities. At a later time we spent a lot of time with talking with Consolidated Engineering.

[INTERRUPTION]

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HURD: I don't anything about that, because, when Electrodata had that electrodata machine, we certainly thought very carefully about buying that project. I don't know whether it was buying the division. I don't remember what it was, but we certainly thought very carefully about buying it.

STERN: Would you think buying Eckert-Mauchly in 1949 to 1953 would have been a good idea for IBM?

HURD: I don't know.

STERN: You mentioned Birkenstock just recently. If I read the your testimony correctly, Birkenstock had to be convinced about computing, is that fair?

HURD: No, he had to understand the difference between a special purpose computer and a general purpose computer. Because his notion was that the military needed something, and what the military needed was different than what other people including even military contractors might need. After he understood what general purpose computer was, then he realized what the military needed was a general purpose computer. This is only a matter of his exposure and his understanding the situation. Now he was always enthusiastic about doing something as soon as he could find out what to do.

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STERN: When he was sick, Von Neumann, there seems to have been a transition, a personality transition, over and above what one would normally experience when someone is terminally ill. Would you say that's a fair, a fair estimate?

HURD: You have been told that?

STERN: That's my sentence, yes.

HURD: You've been told that by someone who might know?

STERN: Yes.

HURD: Do you want to say who?

STERN: Well, most of the people who knew him well towards the end have indicated there were tremendous personality changes. Bigelow among them, because Bigelow saw him with some frequency as well.

HURD: With one or two exceptions, which I'll relate, I didn't see any change, in his personality that one would not expect in someone who's terribly ill and less and less able to use his faculties. I'd go and see him in Walter Reed hospital, and he couldn't move except he'd talk and he'd look at you with his eyes. How can you judge a personality when someone's that ill?

STERN: Well, I was thinking even in terms of things that had nothing to do with what people tell me, but the conversion to Catholicism at the last minute would not be something one would expect from someone like Von Neumann.

HURD: That's right and that was the one thing I was going to mention to you.   And I never understood that. I didn't. I didn't have anything against it. He and I never talked about religion at all. We didn't talk about philosophy, and I spent two and a half days a month for this period or whatever it was. Plus other times. And I had the impression somewhere along the line he became interested in psychiatry. And their was a colonel I think in the air force who was his psychiatrist, and somebody told me that when John got interested in psychiatry, that he quickly learned more about formal psychiatry, than the people who the psychiatrist knew. And I didn't understand the significance of that. But I was told this, maybe by Klari. But other than that, I was surprised, because at the time of the funeral, let's see, I went down and I hired a car, and I went to where Klari was and his family. Took them to church, wherever they went afterwards. It was a Catholic church. And I was a little surprised, because he never talked about religion.

STERN: She didn't tell you he converted?

HURD: Yes.

STERN: She did?

HURD: At that time she didn't make a special mention of it or anything like that. So I don't know. Anybody else have a view on this?

STERN: I haven't broached with it with many people, because not that many people that I spoke to knew him very well, and went to visit him with some frequency the way you did and the way Bigelow did. Even Goldstine's claimed he rarely was able to see him, although he'd come down. For one reason or another he couldn't see him that frequently. Bigelow was the first person I had an opportunity to speak to about this, and you're the second. But was Klari surprised about the conversion?

HURD: I don't remember her saying so. I don't think she was Catholic either.

STERN: I don't think she was either, I do not know.

HURD: I remember now I never came down from New York casually. I would always call up Klari and find out if it was convenient. Now it seems to me I used to come down late in an afternoon and go up to where she lived out north [of] Washington, across a great bridge I remember. Then she and I would go out there and we'd probably have supper together. And then she and I would go over to Walter Reed hospital at night, and possibly again in the morning, depending on how he was doing. I'd spend a few days there.

STERN: What did you talk about, technical things or general things?

HURD: Both. Never very long. He deteriorated very rapidly.

STERN: Well, he was in the hospital about two years, is that correct?

HURD: Was it that long?

STERN: I thought it was.

HURD: Well, I don't believe so.

STERN: '55 to '57? He might have been in and out of the hospital.

HURD: I think that might be true. But I don't think he was in Walter Reed that long. It was a full time thing you know. But that's the only thing, the only change in personality, that's the only thing. And I don't really call conversion a change in personality, not, probably not. But I didn't see it other than what you'd expect in a person who's very ill.

STERN: Now in terms of this interest in psychiatry that you mentioned, he also had this interest in the McCulloch-Pitts research that related to the computer, or the brain as a kind of a computer. Did he speak about that at all, to you?

HURD: Well, yes. I think it would be clearer that he knew at that time as much about neurophysiology as was known.

STERN: That's quite a statement considering he was a mathematician.

HURD: He believed, I am sure, that it was possible to find out how the brain works. There were ways to do that. And I think he had in his mind the way of going about discovering it. And he thought it was associated with what we now call software. The kind of coding, programs in the brain, and I could never find out how he intended to go about that. I'm convinced that he thought he could do that. Well we talked about that. And we also talked about his paper on how he proved that unreliable components can be used to produce a reliable machine. We used to talk about that. And how we arrived at that numerical analysis. You asked once of a great man talking to the subordinates, in our association he never talked down to me. But in almost every case he always was far ahead of me in his thoughts about a subject. He never talked down to me, but I know he had lots of thoughts including the one that you just talked about, but he never discussed them.

STERN: Getting back to his working as a consultant at IBM, can you give me just an approximate date for when that started?

HURD: This says "subject to your approval IBM would like to modify and supplement the letter agreement between us dated October 5, 1951." So that must have been the date, October. And all this does is terminate that contract at the time he's going to AEC because all that letter says is that, that we're going to pay him the rest of the money we owe him.

STERN: This is a letter from G.E. Briggs assistant treasurer of IBM to Von Neumann.

HURD: Yes.

STERN: October 21, 1954.

"Subject to your approval IBM would to modify and supplement the letter of agreement between us dated October 5, 1951 as follows: You make yourself in IBM laboratories in each of ten normal working days. You will assign to IBM its successes and assigns all your right title and interest into any and all inventions and improvements whether patentable or not. You will promptly disclose to IBM all inventions and improvements in the nature specified here in. Upon completion of the consultation services specified in paragraph one, IBM will pay you the sum of three thousand dollars representing the remaining payments of the calendar year 1954, under aforementioned letter agreement".

He accepted and agreed to it on October 21st, as well.

HURD: Let me see the question you asked was the kind of thing, when first asked is date, and I don't seem to have a copy of the contract, but I think that these are all press copies. That isn't it. What was your next question?

STERN: Well that gives a date for a previous contract of October 5, 1951. The question of, is whether the '51 contract was the first.

HURD: Yes.

STERN: It was the first?

HURD: Yes.

STERN: And essentially he was going to provide information that would help with the 701?

HURD: No, the 701 was already almost completely designed by this time.

STERN: Without Von Neumann's input?

HURD: Yes. Could this have been ten days a year and twelve thousand dollars a year? Think it might have been? Doesn't say, I was mistaken, I thought it, see how long ago it is I thought was thirty days a year. It was ten days a year, and I think the compensation was twelve thousand dollars a year. You see. Well you can't tell, from this thing, but I think it was twelve thousand dollars a year.

STERN: That was a lot of money at that time.

HURD: Oh yes. Now let's see. I do think, I think I have it in here, if I can find it, something about some comments or questions he had about the 701. This is the most important thing I ever did in IBM.

STERN: Can I see it?

HURD: Sure. For bad reasons nothing came of it. Not bad reasons, but for unfortunate reasons.

[INTERRUPTION]

STERN: This is a memorandum to Mr. T.J. Watson Jr. from C.C. Hurd, dated May 17, 1956.

> Recently I spent a week in calling on top executives of large customers. The following two general impressions were obtained. 1. The question of centralization of data processing for accounting is receiving considerable attention. This was the main topic of conversation at North American,

Safeway, and Standard of California. In each case careful study is being made on the type of

transmission equipment which is necessary for such an operation. North American expects to use

a centrally located 705 and transceivers. In their own engineering they're working on a magnetic

tape transmitter. Safeway expects shortly to use transceivers. Standard of California has not yet

made a decision. 2. The great need for a machine which will do both accounting and computing is

recognized. Lockheed will use 704s for both accounting and computing at Glendale. Marietta will

use a 705 for accounting and a 704 for computing. North American will have four 704s primarily for

computing but with a small amount of accounting on each, and will later install a 705 for centralized

accounting. Standard of California has decided to use a 704 for accounting and computing going

later to a 705 in addition. This customer's already started a course of instruction on binary

arithmetic for the methods staff. The interesting point is that each of these customers is well

staffed with competent people and each of them made a careful study. The decision was not easy

in any of the three cases because either machine can be used for either purpose. Also each of

these customers would like it if we had a single machine which was suitable for both problems.

And you have something here that I can't read on the side.

HURD: Now that's Tom Watson. He says, "What are we doing to achieve this? It would be a tremendous saving to

us." In here two more things on this.

STERN: And this is a memo of June 19, 1956, to Mr. T.J. Watson Jr. from C.C. Hurd. Subject: My memorandum of

May 17,1956.

In reply to my memorandum of May 17, you asked what we were doing to achieve machines which

can be used equally well for data processing and scientific calculation. This subject is receiving

considerable attention in planning for STRETCH, the very high speed machine, and also in the

planning for an intermediate machine. the intermediate machine of which the 750 represents the

present thinking, is to be between the 650 and the 700 series in performance. But considerations

under discussion by product planning, sales engineering, and on some points by military products,

are: 1. Character representation within the machine. 2. The extent of checking, area detection, and fault detection. 3. The generality of the input output system.   Engineering has been considering these questions and Mr. Haddad, and I have had one all day session with appropriate people in Poughkeepsie. Product planning also is considering these questions, and Mr. Pendery, under Mr. Simmons, together with his group now being formed will carry out joint discussions with engineering. The sales department has recently conducted a study of the performance of the 704 with improved input-output on commercial problems. A similar study is now to be made on the possible on a possible, improved 705 with greater speed characteristics. These two machine plans bring 704 and 705 closer together. The above indicates that is activity but no decision have yet been reached, no decisions have yet been reached.

Let me ask you a question on this. Why did IBM decide to think in terms of two separate computer developments to begin with?

HURD: In hindsight it was lack of knowledge. We thought, when the Korean war came along, we will build a machine. All the customers to that machine were people who were in the government, or defense industries, and all of them wanted to do problems. But the people who wanted to do problems to use that machine were all engineers. We confused the fact, and we confused the job titles of the people with the character of the application. So we thought, "Well, they're engineers they must want an engineering machine, and so if they use this machine it must be an engineer machine."

STERN: Well it seems to me that Von Neumann was one of those people that really pushed for the concept of separate scientific computers verses commercial computers. He, in his statements concerning why IAS should build a computer, said he knows there are other developments going on in industry. That's a different type machine. He is building a scientific computer. And on the other hand Eckert and Mauchly say they don't see the difference. You know a computer is a computer. And I wonder if Von Neumann wasn't in some way responsible for this bifurcation.

HURD: I don't know. If we get through this file, we'll find out that later he was an advocate of one machine, for all

kinds of computing you can think of.

STERN: Later being the time of your memorandum?

HURD: During his consultant phase. Maybe I can find such a memorandum. Because we had one time, after we had the 701, and the 702, or maybe it was after we had the 704, and the 705. We sat down and said, "What would you have to do to the 704 so it would do everything the 705 would? What would you have 705 to make the 704 work?" And he contributed to that. He believed that we should do one or the other. He had a prejudice for modifying the 704 to do the work the 705, rather than modify the 705 to do the work of the 704. But he understood perfectly well it could be done. So, by that time it was possible. And of course by that time I was convinced. And that, what I was trying to do was get that started. By the way, that effort never got off the ground because IBM shortly after that reorganized. And, I got off on other things, didn't push it, maybe I wouldn't have been able to push it. But there's no reason, if that thing had been followed through based on what we had then, the 360 could probably of come out in late 1950s, instead of middle 1960s. But who knows. You know you're always smart afterwards.

STERN: Well here's a document that shows you were smart ten years before the fact.

HURD: Well I tried. But you know, it could probably be what you said. On the other hand I'll show this to you, if you want to read it. It's so hard to read maybe I should read it to you. This is [a memo of my] conversation with John Von Neumann at the Institute for Advanced Study December 11, 1951.

> The purpose of this discussion was to prepare for Dr. Von Neumann's next visit at which time we
> will discuss the content and organization of the manual of instructions for the Defense Calculator
> which is now being written. We will also discuss sample problems which we should program in
> order to assist the customers in using the machine quickly and effectively. In incidental
> conversation we touched on the following points:

You see this is after Briggs' letter and implies that he is a consultant, but I think this consulting contract had not been signed by October 5, 1951.

Price of the Defense Calculator Dr. Von Neumann asked if the price had been established and I answered that it had not. He states that pressure of some sort is being applied to the Atomic Energy Commission to purchase a UNIVAC. He feels that an annual rental of from $200,000 to $300,000 would give serious consideration to the UNIVAC even though it is a machine inferior to the Defense Calculator for scientific work. He believes that a monthly rental of $12,000 for the machine at its specified capacity would achieve reasonable results. In this connection Dr. Von Neumann did the talking. I gave him no indication whatsoever of our thinking.

I guess we didn't know what the price would be. I'll read the section on reliability. It's very hard to read. It says something here about it being "highly desirable if you had not more than one error in one hundred million operations or not more than one error every three and a half hours." And it also stated why IBM's machine would be operable with one error every twenty minutes. And then

Logic Designs of the Defense Calculator: Professor Von Neumann was given the information not being made available to customers. He is pleased by the set of orders which the calculator contains. He made these remarks. For the next two or three years drums will probably be more useful to customers then tapes for purely scientific problems. Consequently, if the capacity of the calculator is decreased he would prefer to omit the tapes first. Should it be necessary to decrease the size of electrostatic memory, he believes it would be desirable to incorporate an order on the calculator which would read out a block of magnetic drum storage for s specified size.

Now here's the thing I'm getting to...

Non-defense applications: Professor Von Neumann has been consulting with Standard Oil for a number of years and was instrumental in placing a Standard Oil problem on the SSEC. Further calculation on this problem will be made in 1952 on the CPC. If all goes well he believes that Standard Oil will be ready for a Defense Calculator in about two years in order to solve the important problem of secondary recovery from an oil field--that is after the fluid has been exported by ore drainings as much as 50% of the oil may remain underground. Various methods of exploitation are then available such as flooding with water, pressurizing with gas, [and] chemical treatments. On the basis of geophysical information, calculators are used to determine which of the

above methods should be used.

I thought that had to do with commercial problems. It doesn't. It just says it's still a scientific problem. Where are we now?

STERN: Another question. Von Neumann having been associated with the Institute--a very ivory tower kind of place--and being a mathematician as opposed to an engineer, do you think that it could be construed as unethical for a man like Von Neumann to get involved in consulting for a commercial organization?

HURD: It's such a common practice now, but I guess that was 1951.

STERN: That's why I asked the question.

HURD: How could it be unethical?

STERN: I'm thinking of mathematics as being pure mathematics and the Institute for Advanced Study being a very esoteric kind of place that people should undertake developments at the Institute for which they can then use that expertise to go out and consult for commercial organizations and make profits, large profits, from that sort of thing. Do you think it could be construed, not necessarily would you construe it that way, but would others at that time have considered it as being unethical?

HURD: I never heard any discussion on it.

STERN: Nobody ever commented on it? He was, Von Neumann himself, very critical of Eckert for being to commercially oriented.

HURD: He was?

STERN: Yes, and I find to reconcile his feelings in '46 concerning Eckert and then in '49 getting involved with Standard Oil and then later with IBM.

HURD: I never heard any discussion of it. And the years that I knew Von Neumann I never heard anything critical by him, of Eckert in any way, or Mauchly. Never anything critical at all.

STERN: Did he talk about them at all?

HURD: I asked him one time, I was trying to understand the thing that'd been written on in *Annals* extensively about the invention of the stored program concept. He and I talked a couple of hours about that once. And he never said to me that he invented the stored program. We did talk about it. Consulting in Aberdeen, and at the Moore School. We talked about the interaction of all those things. He did say to me that he suggested that those switches on the ENIAC were used to store orders. I don't know his exact language. But he said he made that suggestion. But he never said that he said, "oh here's stored program, I invented it." He never said that to me.

STERN: Did he ever attempt to sort out who actually was responsible for what aspect of the concept?

HURD: Not that I know.

STERN: Did he talk about the patent difficulty, that he encountered?

HURD: No, nothing he never mentioned it at all.

STERN: So he just talked about the concept in general, when he spoke to you about it?

HURD: He talked about the interaction with all those people down there, including Burks, and Goldstine and Mauchly and Eckert, and there was somebody else down there, I can't remember. And Metropolis and some other

name I should remember. It was interesting because I thought Von Neumann was ingenuous for respect to patents. Because when we first talked about consulting for IBM he was anxious to move ahead, after he found out what the assignment was. He wanted to do that. And I think he wanted to do it because he wanted the interaction with the engineering department. I raised the question of whether he was working on any ideas that were patentable. And he started to tell me about the idea, which later was the subharmonic oscillator. And I stopped him and I said I don't want to hear anything about that. He said what should I do, and I said well you ought to get a patent attorney. And he said who should I get? And I, I said well I don't want to tell you to get, because I don't want you to have any association with IBM. And I don't remember how we resolved it, but eventually I got a list of patent attorneys from somewhere, and I didn't get it from IBM, and he went and selected one of those patent attorneys and he then he wrote up that patent. And then this was really the delay in signing the consulting thing, because after he said the ideas that he had which he thought were patentable he had disclosed then we signed the agreement. But I thought he was ingenuous, because if he'd been experienced he wouldn't of thought of telling me what an idea was before we had some kind of agreement. So, when you ask me had we ever talked about any difficulties with Eckert and Mauchly, I'm surprised I didn't know he knew anything about that (patents) until after he joined us.

STERN: There was not only the issue at the Moore School but there was an issue at the Moore School . And I think he was naive even then because he was willing to give Bigelow the patents relating to the Institute machine and have the Institute's attorneys on behalf of Bigelow, but that never came to pass, and then by '48, '49 the government insisted that that be changed. So that there is some consciousness, but some naivete about patents.

HURD: That checks with my information.

STERN: Did he ever indicate to you that he was dissatisfied with the progress with the Institute machine?

HURD: Never in those terms, I know he hoped it would be done earlier. But he didn't go to questions like what's the matter with so and so and what's the matter with so and so. The famous Von Neumann concept (everything 6 months late). He used to joke about that, everybody used to joke about that. The machines were never right even

when their designers thought they would be. But I don't recall anything specific.

STERN: So it was just a general desire to have it done faster but a recognition that was not possible a that time?

HURD: I think so.

STERN: Bullom in the obituary you showed me, frequently talked about Von Neumann being interested in power, if you recall. Did you have any sense of that being the case?

HURD: No.

STERN: What do you think his reasons for consulting for IBM were?

TAPE 2/SIDE 1

STERN: Or just speculate?

HURD: I think he liked the opportunity to be with a group of bright people. He clearly enjoyed his consulting projects. He liked it. And there were some problems to be solved in IBM which were challenges which he could solve. For example we discussed the possibility of writing a simulator of the Endicott plant. And we decided it was silly. I think he was interested in money. I don't think that was a primary reason but when we came to discuss the terms why he was clearly interested in what the honorarium would be. I think I remember at first he thought it was terribly high. I don't know what Von Neumann thought later. I think he was also interested in having his ideas put into a practical application. I don't think our association was a deterministic thing, because he and I could have seen each other [at times other] than when he consulted.

STERN: Did he ever indicate any concern about the Institute, the members, the current members of the Institute were

not favorably disposed to having the completed project.

HURD: No.

STERN: Do you have any information about that at all?

[INTERRUPTION]

HURD: I 'm trying to remember if he ever said anything in respect to Oppenheimer. He was always, always very careful with his relationship with Oppenheimer. But I never heard that. The only thing that possibly did have any connection with it. After he decided to join the AEC commission. He asked me to come down and said that he was going to do that. And therefore he would not have a direct involvement with the IAS project. I know he had a great deal of respect for those people and he also felt he had responsibility for them. So he wanted to know what to do about them. And we did interview Herman Goldstine, and James Pomerene, and who else did we talk to?

STERN: Willis Ware?

HURD: I don't know. Maybe Willis had already gone, I'm not sure. And we either, I think we did not talk to Bigelow, because I think Bigelow did not want to be talked to. Our view was that they were all good people, and any of them who wanted to join IBM we would be delighted to talk to.

STERN: In their own right not because Von Neumann asked you to?

HURD: Absolutely not. No connection whatsoever. You know Goldstine's a good man, Pomerene's a good man. They're all good people. The ones I knew were all good people. So that would be, we might infer from that that he thought they would not get the support they needed at the Institute without him. I don't remember that in conversation he just said that he'd been the leader, he'd gotten the funds, he was now leaving he wanted make sure

they were taken care of.

STERN: So that, my sense, what I'm getting from what you're saying, but he was not the kind of person to speak negatively about a group or an individual or anything like that. When he went to AEC he had to give up his consulting for IBM did he not?

HURD: Yes.

[INTERRUPTION]

STERN: The 701 used the Williams tube. Is that correct?

HURD: Yes.

STERN: Can you recall why the decision was made to go with that instead of the MIT? Even the Selectron I suppose.

HURD: I suppose because of Arthur Samuels, but I don't know.

STERN: I don't know anything about Arthur Samuels, can you give me some input here?

HURD: Arthur Samuels was at one time at the Bell Labs, and he was a professor of either physics or electrical engineering at the University of Illinois, and joined IBM, I think in 1949. And he was in charge of making the Williams light tube work to the satisfaction of IBM engineers for the purpose of random storage. Did a lot of research work on it, and actually made some improvements. I think the answer to your question is Arthur Samuels thought [the] Williams [tube] was the best thing to do and that was what was pushed.

STERN: Was it on the basis of the fact that it was implemented in the IAS machine? Or, you don't recall?

HURD: I don't understand what you're asking.

STERN: Who were some of the people that were in your applied sciences division that you were recruited?

HURD: Well let's see, one of the first was a man named Don Pendery. He is now vice president for Xerox. John Sheldon was a physicis t from Columbia. John wrote the test problems for the 701. And then John Backus was already in IBM. Working on the SSEC. And shortly after I joined IBM it was decided among other things I would have responsibility for the SSEC. So all those people from the SSEC, all of them, they joined what was called Applied Science. John Backus was one, of the most productive ones. Then there was a man, Bill McClelland, who was also on the SSEC staff. And Ted Codd, whom you may know. Paul Knaplund. I think Paul is now vice president for planning for IBM. And Joe Smith. I'm trying to think about applied science people who worked directly on the design of the 701. And all these people did. Joe Smith. And, a man named Walter Johnson. And Ted Glaser. Do you know Ted? He's professor of computer science at Case, and is blind. He's an extremely good systems programmer.

STERN: Was he blind at the time?

HURD: Yes. One of the interesting things about that, when Von Neumann came to study some of the subjects that we had, such as this question of how to make a 701 do commercial light work like the 702 did, Von Neumann would take an algorithm and write the code in his head. And that was the only way Glaser could do it, was to write codes in his head. So we had the two people who for quite different reasons were writing code in their head. Either could correct it in the middle of it and then write some more code. It was very interesting to see the two. And Von Neumann was faster, but Ted['s] memory was as good on that kind of thing. So he was there. And I think those are the principle ones who were coding on the 701.

STERN: The Institute's computer became a prototype for the JOHNNIAC and the MANIAC and the ORDVAC. Would you put the 701 in the same category as those? In what sense was it a distinctive machine?

HURD: I think circuit design was quite different. The 701 depended on what was called the Havens delay line which was a one micro-second delay line. That was novel and completely different from the general circuit philosophy, in the IAS machine. And I think also the direct coupled idea, I don't know how many of those machines, of the IAS machines used the direct coupled idea, but do you ever see the IAS machine? With all those wires going from this point to that point?

STERN: The Smithsonian has it on display.

HURD: The notion of the pluggable unit which IBM had developed in the 604 went to a multi-pluggable unit. That was quite different philosophy. This is from the standpoint from manufacturability and quantity and servicing and quality. That was quite different. As originally built, the fact that the 701, had a larger variety and more input and output organs than the other IAS machines, was different, although as the machines were built and extended I'm sure that ultimately many of the IAS machines had the same result. Drums and tapes, magnetic tapes, card equipment and printers, and so forth, but initially that was different. And the other thing I think that IBM is again compared to the university machines, but not as compared to Univac. I think IBM saw a greater need for what we now call software then university machines.

STERN: Were you involved at all in the uh, attempt to make IBM card equipment adaptable for the IAS machine?
HURD: Remember when it occurred?

STERN: About '49.

HURD: Well I guess the answer should be no I was not. I knew about the effort and I think it was John McPherson who was directly involved and responsible.

STERN: Is he still alive?

HURD: I believe so, he's in New Jersey. I think about John McPherson in the Institute, first place John was a graduate of Princeton. And, when IBM decided to make a gift to the Institute, Tom Watson took John McPherson along, and I don't remember all the antecedents of that. Formal interplay between the Institute and IBM that I know about, first would be [when] Von Neumann [was] wanted as a consultant. Von Neumann wanted to make sure that I talked to Oppenheimer as this came about. For all I know it might be the reason that we went to lunch. Some people thought it was an apartment, I don't know. Anyway I went down there and we had lunch, and talked about this. Dr. Oppenheimer expressed his willingness. And then, but even before that when we wanted someone to be the speaker at the dedication luncheon for the 701 we wanted Oppenheimer. And I'm sure that John felt, I don't want to say persuaded, I'm sure that John and I went together to see Dr. Oppenheimer when I asked him would he do that. So that may be the first official connection between IBM and the Institute that I knew anything about, but it must also been about that time that they were negotiating for the punch card equipment. Then the next association I had with the Institute in a formal way was when we announced the 701 we said that some fraction of time would be used for university research. And John wanted to put the three layer weather forecasting problem on, which we were trying. And so we made a formal grant, however much machine time that was, at the, I can't even remember what the hourly rate was. Several hundred dollars an hour. We made a formal, formal grant for that kind of work. And then the next thing that happened some time later, without any request, Tom Watson Jr., decided that there should be a grant made at the Institute of Advanced Study which he made personally.

STERN: Was that something that he had done with other institutions or was this an atypical kind of arrangement?

HURD: It'd been done with other universities, but it'd been done the limited way. For example when the Mark I was dedicated at Harvard, Mr. Watson gave President ? a check for a hundred thousand dollars to be used anyway he pleased. And I know there had been gifts from IBM to Columbia, because of some things that Ben Wood and Eckert did. But the program of gifts to universities was really --- well as I say I started, I don't think that's right. The

program of educational grants for universities who were teaching either business school courses or a set of courses in the liberal arts colleges on computing where you'd get up to sixty percent rental reductions. That was a program that I started, in I guess in 1955. That became very widespread. No the Institute was not a singular event,it was more like a number of events.

STERN: Do you recall the magnitude of the grant?

HURD: I would guess a few hundred thousand dollars but I don't know. I think by that time also there probably a gift to the California Institute of Technology, because, President Milliken and, Mr. Watson, this is the senior Milliken and the senior Watson, were well acquainted, and I think they'd been a gift to the California Institute.

STERN: All of these places, Harvard, Columbia, Cal Tech--the rationale is clear, I mean these people, there were a lot of work being undertaken in terms of computing. The Institute, by this time, really wasn't interested in maintaining it's computing expertise, and having further projects. Doesn't it seem odd that IBM would give a grant to the Institute?

HURD: I don't think that IBM necessarily made grants, because of a direct business interest. And again I was not directly involved in this, but I knew this happened. I think the grant was made to the Institute, because Tom Watson Jr. thought that the Institute was one of the greatest intellectual centers.

STERN: As simple as that?

HURD: I think the computer push might have been completely incidental. He thought Von Neumann was outstanding, he thought Oppenheimer was outstanding, he thought Einstein was outstanding, and I think it was that rather than the computer. Although I repeat I was not directly involved, I knew about it. One of the others told me about that at the time of the computer, because I knew about it.

STERN: This was Watson Senior?

HURD: Junior.

STERN: Now, when did Watson Jr. take over, was it '55, or thereabouts? Now you've mentioned and I've read elsewhere, that in the late '40s, Watson Jr. was really interested in getting into the computing field and Watson Sr. was not. Did you experience any kind of difference of opinion over this issue?

HURD: First let me say as I said earlier that I think, in 1949, Tom did not think specifically that IBM should get into the computer field, because the computer field was not defined. He used to talk about electronics. He talked about two things. He'd talk about electronics, and he'd talk about magnetic tape, and he understood instinctively that something had to be done with it, but we were all aware now--what do I mean by all? Half dozen people were aware-- that there was a difference of opinion. Which would sometimes have a very strong expression between Mr. Watson Sr. and Mr. Watson Jr. The away we knew about this was, Mr. Watson Sr.'s on the seventeenth floor, Mr. Watson Jr.'s office was on the sixteenth floor. My office was on the fifteenth floor. We'd sometimes have meetings on the sixteenth floor, and Tom would disappear, and sometimes if somebody happened to go up or down, they never took the elevator. There was a stairway. You'd go outside Tom's office, and in fifteen or twenty feet there was a door and it was a stairway, and it was not unusual to hear very loud voices.

STERN: [Laugh.]

HURD: And nobody ever said that you know explicitly that this is what this is going on. But everybody had the impression that these two gentlemen, who had very strong minds were disagreeing about something. And my conclusion out of all of this, I'd never want to say that Mr. Watson had any lack of vision whatsoever. And I was never in on a meeting where he and his son had any real disagreements, I was in meetings with the two of them, which I'll tell you about, but I had the feeling that Mr. Watson Sr. was gradually loosening the reigns, and he wanted his son to prove that he was able to do it. But I know there were disagreements, and there were certainly

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disagreements at IBM, two different courses as to what should be done. Did I get that answer?

STERN: Yes you were going to tell me about the meetings you attended, and the dynamics.

HURD: Well I remember specifically that the meeting which we were trying to decide what to do about the SAGE contract. Forrester and, I think Valley, Weisner...[TAPE UNINTELLIGIBLE FOR SEVERAL SECONDS]...Burroughs because they were suppose to be the assistant contractors to the state, and ultimately Dr. Kilian invited a group of us to come up to Lincoln Laboratories, which I think, which I know at the time was on the campus of MIT campus. We'll talk about this. And then asked at that meeting--Tom Watson was there and Dick Watson, and Birkenstock, Williams, MacDowell--after we were asked if we would be willing enter a research and development contract to build a model SAGE and then for production privilege. And that was a very big event at IBM, because what we had at that time, small laboratory in Poughkeepsie, what we called a production line which was really a special section in the factory, and we did have several main frames under construction at the same time, but not really modern production line, but that's what we had. We had several of these machines built and maybe one or two delivered, I can't remember, that's all we had. We knew that SAGE was not only a large project technically production wise but also had large support in the country. So it was big decision. And Watson Sr. ran a meeting in the board room to make that decision. So I remember a meeting. There's absolutely nothing except respect and goodwill and friendliness and perfect communication between the two Watsons. So I don't want to give the impression there was anything other than that, but we conscious of the fact that there was a decision being made, and we all felt that Tom would move much faster than Mr. Watson did.

STERN: And awhile ago you said that you thought that that had to do with age, a younger man being less conservative. What you're saying now sort of supports that point of view. Did you work at all with Pomerene once he came to IBM?

HURD: At the time he came I was still director of electronic data processing, which was, if there was a general manager of computing of IBM that was it. When we got the SAGE contract, and got the NSA contract, and then

right after we'd gotten those contracts--and by the way that's the time I was trying to get this uniform for them, after we got those contracts--IBM reorganized. And recognized that computing was IBM's main business, so it was organized along functional lines. And I got out of that activity completely, and the STRETCH, and the HARVEST machine were turned over to regular engineering in the functional area and I no longer was directly involved so I did not, I did not spend much time there.

STERN: What did Goldstine do when, when he first, when he came to IBM?

HURD: He was hired by Pioree, and Pioree had just come in as first director of research, he was called Director of Research, and that was the first formal recognition of a[n] IBM research organization. And I think Goldstine was made manager of, maybe computer research within research, maybe I have the wrong title.

STERN: How did this relate to your applied sciences group? Your's was a research organization, too.

HURD: Well, by that time, or just about the same time, my philosophy was there are bright people with different kinds of background in IBM, and as quickly as possible put them into existing departments. By this time there were existing, there were applied science, equal in engineering, manufacturing, sales, planning, of course in programming, and then gradually the Applied Science Organization came to be known as the Systems Engineering Organization, which still exists.

STERN: Right.

HURD: And by the time Pioree came in, this transaction ,this transition was going on very rapidly. So, it would not be proper to say that Applied Science at that time was in any sense a research group because it was so big. I had the job of finding candidates for the Director of Research. Von Neumann was one of the persons nominated for Director of Research. They wanted an outstanding scientist. They didn't care about anyone who was interested in managership, although clearly Von Neumann could have [managed].

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STERN: Did you have any dealings with the Bureau of Standards?

HURD: Yes. Dealings in the sense when I joined IBM, I'd already known John Curtis, Mina Rees, and I kept up an association with John Curtis and the people who worked with him, Franz Alt, and there were a couple of women down there who were very influential and very good. Sure I knew them. I tried to keep in touch with them because at that time the Bureau of Standards had a responsibility to the Federal Government of, doing what computer research there was and also disseminating any information on all government agencies so I think they knew.

STERN: So they were free to give out any kind of information that any organization would need?

HURD: Oh yes. They were very good. Leaned over backwards.

STERN: In my sense they [the Bureau] really carried the ball in the '40s.

HURD: Along with The Office of Naval Research--Mina Rees and John Curtis were very close to each other.

STERN: To summarize what, what would you say Von Neumann's most significant contributions to the computing field were?

HURD: I think they were, they were two quite different things. I think irrespective of who really had the ideas first, that the publication, the promulgation of those papers which he and Burks and Goldstine wrote. I think those were very important documents. The other thing was, Von Neumann because of his reputation as a mathematician would gain the confidence of people and because he was so highly articulate gave people confidence in the fact that a computer if built would work, it would be a success. And I want to support that thing by two, two instances. When I first met Teller, and I don't know when that was, in 1954, and Livermore got one of the first Univacs and Livermore got one of the first 701s. When I first met him, Teller said to me that the fact that Von Neumann, for whom he had the

greatest respect, and who had some experience with computers felt, that use of the computer would be highly useful at Livermore, that that fact was a deciding influence on Teller's part, on deciding to make the investment. It was a big investment, it wasn't a money, it was the investment that knowing you had to have, at that time problems weren't very well, weren't well formulated for computers there wasn't any systems analysis. There were no programming aids whatsoever. It was a big investment to make a computer, in the stand point that you have to have people, so the confidence that he gave Teller was a very important thing for Teller, and of course as soon as Teller made the decision other people would make the decision on the same basis, just because Teller did. I can illustrate it another way. I talked to, I just happened to be talking to Tom Watson, over the phone to Watson, and he said "Cuthbert I always remember the time you brought Von Neumann up to see us, and Von Neumann gave us confidence in what we were doing". And I don't know whether this memorandum that I read to you about his list, we talked about several, I have no idea what it was, but someplace along the line when IBM was taking risks, of going from an old established business where they make good profit and good growth, and everybody is happy, into a new field, that gave Tom Watson Jr. confidence in the project. So I think Von Neumann's personal influence in that sense because he was thought to be so good in his own field, and was so articulate.

STERN: Kind of legitimating the computing field in general?

HURD: Yes.

STERN: How about your own contributions if you were to sum them up? Your most significant to the computing field.

HURD: I want to be careful not to compare myself to Von Neumann in anyway, but in the same way that Von Neumann gave some key people confidence in the field, I think the fact, that I could talk with engineers and understand what they were doing in any detail I wanted to. I was also able to communicate with people about what I knew about computing. I think that's it in contributions. Let me know the story about when we started. I have a block...

TAPE 2/SIDE 2

HURD: ...diagram, on one sheet of paper, and essentially copied it. The block diagram from Burks, Von Neumann, and Goldstine. It had on it, under the memory section, it said two thousand ten digit words, down under the charismatic control section, it said a thousand operations per second, and it had a little thing going off for four magnetic tapes, and a place for a drum and a printer. And we had that thing, this was, before the days of Xerox, and so we, we photostated that and made thirty of those. I went around the country and in a period of a couple of months we had thirty letters of intent for the 701. So if I made a contribution because I understood enough about what the engineers were going to do, and I could tell those people enough about what they were going to do, and I could tell those people enough about what they were going to do that they'd believe me. And I think that's probably a contribution. Plus the fact that I was able to tell Tom Watson Jr. and people who had to make the decision. Again in the terms that they could understand what a computer was. And for example I taught the first programming class In IBM ...

STERN: Really?

HURD: ...to the IBM executives. They didn't know what a computer was. And I just taught a little about what the stored program was, and wrote a few little simple codes and got them to write codes and corrected them just so they'd understand a little what a computer was. So, I guess that's a contribution.

STERN: That's very interesting. I've only treated IBM and your role at IBM very lightly. I'm trying to get a picture of Von Neumann during this period. Do you think there's anything I've left out?

HURD: Well there's the subject of, after he joined IBM, and had already applied for the patent on the subharmonic oscillator. Then we had a session which was held at the Watson laboratories, whether this device had promise or appeal. And Byron Havens was given the responsibility of investigating that. And Byron Havens gave a

subcontract to a company now called Watkins-Johnson which was in California to build, I don't know what they built. They built an oscillator, they built something. Because Von Neumann had this idea of smashing a thousand mega-cycle device against a thousand and fifty mega-cycle device, to try to get pulses which were the difference between those fifty mega-cycles. And there got to be a test of that, and then, based on that test, IBM bought the rights to the patent. And then when you talk to Birkenstock, you can ask him how important that was, because Birkenstock had the job of negotiating with the Japanese government, and the Japanese government decide they were going to take control of all companies operating in Japan. Birkenstock used this as negotiating point, to keep IBM in control of IBM's own facilities in Japan. So, that patent is very important to IBM. It was never embodied in the machine, but at least the fact that there was a patent is significant. So that's another thing for you, that is ?. It was a valuable idea, and that idea at the time, is said by the patent office to be the largest ever seen that depended on mathematical analysis. It was all harmonic analysis. You know about the fact that he was the speaker at the NORC dedication, and made this speech which said usually you ought to be careful about costs and ought to make sure that what you build is effective and make a profit, but then he said something like one time in a hundred you ought to be bold and do the best thing you can. And he thought that was the NORC, so he made that speech, which was a very distinguished speech.

STERN: That speech is in this collective works, two page[s] or three pages--very interesting. IBM bought that patent from Watkins-Johnson or from Von Neumann?

HURD: Von Neumann. But then it had some of the hardware built by Watkins-Johnson and tested on.

STERN: Did that turn out to be lucrative for Von Neumann? The purchase of that patent?

HURD: I think it was around fifty thousand dollars.

STERN: I think you're right.

HURD: And I think he asked that he be paid in an annuity form of some kind. But I'm sure it wasn't a hundred thousand dollars, it was around fifty thousand.

STERN: Did you know his daughter at all?

HURD: Yes. But I, I knew her only as a young girl around his house. And I think she might have been a high school senior, and then a college freshman, at the time when I used to visit his house.

STERN: You say you were a consultant to the AEC, at the same time that Von Neumann was a consultant?

HURD: Yes. But just as a coincidence, when I left Oak Ridge in March of 1949, they asked if I would continue to look at the problem I had been working on. And Von Neumann was a consultant and continued as a consultant at least at AEC, up until the time he left, so we overlapped, but we never consulted on the same tests.

STERN: Was his involvement computing related or did it involve other aspects as well?

HURD: I think in the case of Los Alamos it involved other aspects as well. But I think as a general consultant to the AEC, of course he and Teller were very close. What he consulted at Livermore I don't know. But I think as a general term, it became, at least as I knew him, a computer specialist. But you know also he knew, a lot about shock wave theory, and that's why he was originally brought to Aberdeen, I think to consult on fluid mechanics rather than on computing and then got into the computing. I think the same way at Los Alamos. Talked about fluid mechanics rather than computing.

STERN: He was made commissioner at AEC. Now AEC has lots of commissioners, but he was just one of many?
HURD: I think he was one of five.

STERN: And Strauss was director of the AEC?

HURD: Strauss was the chairman.

STERN: Did you know him?

HURD: Yes.

STERN: What kind of person was he?

HURD: I did not know him well. But, at the time of the big trial...guess isn't right, Oppenheimer. I knew a number of the players. I had dinner with Teller, the day he testified for the commission,or whatever it was, jury, against Oppenheimer. And I always felt that the main thing behind it was two very strong characters. Namely Oppenheimer and Strauss, who didn't like each other, and were just going to fight. Oppenheimer was suave and, deeply cultured person. I think he deprecated Strauss technically at a meeting. And for him to do that, it's almost unthinkable that he would do something like that, but he did. And I thought Strauss was equally strong having come from a different background, those two fellows were just enemies. But I never knew Strauss, I knew Oppenheimer better than Strauss.

STERN: So Strauss was in some way behind or in part one of the characters in this thing against Oppenheimer's security clearance? Did Von Neumann ever talk about his testimony?

HURD: Yes. I don't know whether I can remember anything about it or not. But I know he talked to me at the time he testified, and I think he had the impression that they were two very strong people in opposition. I'm sure that he never said to me that Oppenheimer should or should not get clearance.

STERN: I think he testified for Oppenheimer.

HURD: Did he?

STERN: The Institute wanted to send a letter, in fact they did send a letter, indicating their disapproval of the entire proceedings. And Von Neumann did not want that letter to go out. He and Goldstine did not sign it, but everyone else at the Institute signed it. So I think he felt compelled to testify in Oppenheimer's behalf, but it was not a very strong supportive [testimony].

HURD: Do you have any idea why he wouldn't sign the letter?

STERN: People tell me that there was a great deal of rivalry, if you will between Oppenheimer and Von Neumann.

HURD: Oh really?

STERN: That's what I've heard. Based on their days, their boyhood days, I think they went to ? for awhile. I have a hard time visualizing that, knowing Von Neumann the way that I do.

HURD: Now he told me something about the relationship between Strauss and Oppenheimer.... and I can't remember, I just can't remember. But again with the question about Von Neumann and Eckert. I don't remember Von Neumann saying anything about Oppenheimer that indicated that he thought he was his rival or wasn't bright or anything. Never did.

STERN: It could be a hard to thing to say if you thought he wasn't bright. I think it's a question of a lot of people speculating about that. Anything els e I've left out in terms of personality, in terms of contributions?

HURD: I'll tell you a couple of things that, The International Congress of Mathematicians was in Amsterdam. He went and I went, and we spent a good deal of time together. And we went out to the beach, and at the beach they have these half enclosures and you can sit in them, ...and he said my family and I were at this beach in 1930 so and so

when we decided that we had to leave Germany because I remember now, its always been impressed on my mind, that a great person like that would be forced by Hitler to leave Austria. And then while we were there we had lunch at the Hotel Amsterdam I mentioned this before and our host was the president of IBM Holland, his name was Schotte. At the luncheon table were Schotte, Von Neumann, and Kogbetliancz, and Mrs. Hurd. And Kogbetliancz was a well known physicist, and ultimately got interested in computing, and was a professor at Columbia. And we hired him as a consultant and he worked on algorithms and methods of computing short forms of algorithms. He's also the inventor of three dimensional chess. So we're sitting at the luncheon table, and Mr Schotte, was a man who was percunious, entertaining, and voluble, and he was among other things awed with the fact that he was a having lunch with Von Neumann. And he wanted to find something to say, and he says "You know Dr. Von Neumann I read the most interesting thing in the newspaper". He says, "You know chess is a very hard game". He says, " this person invented three dimensional chess, now can you imagine that Dr. Von Neumann?" And Von Neumann stood up, pushed his chair back, put his hand on his little fat tummy and says, "Mr. Schotte allow me to present you to the inventor," which [Laugh] is lots of fun. So that's the kind of the thing he did, he was whimsical and had a good sense of humor. No I don't think anything. Probably dozens of things I can't remember.

STERN: We'll both think of things when I leave. Thank you very much.

END OF INTERVIEW