An Interview with

MARGARET FOX

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Margaret Fox Interview
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Abstract

Fox describes how her Navy service in World War II led to a career in computing. She discusses the negotiations between the Eckert-Mauchly Computer Corporation and the National Bureau of Standards (NBS), as an agent for the Bureau of the Census, over the completion of the first UNIVAC computer, and the development at NBS of SEAC and SWAC. Fox recounts her involvement in the National Joint Computer Committee which led to her work in the American Federation of Information Processing Societies (AFIPS) and describes the role of AFIPS in the International Information Processing Conference in Paris in 1959.

MARGARET FOX INTERVIEW

DATE: 13 April 1983 INTERVIEWER: James Ross

LOCATION: Charles Babbage Institute (Minneapolis, MN)

ROSS: Let me begin by asking you how you got into information processing.

FOX: Well, it's a long story and it goes back to the fact that I had a lot of physics and math in college. I had a minor in math and sufficient credits in physics for a major, but I really didn't take a major in it; I took a major in English, believe it or not. And then I taught school, and someplace along the way, I won't say that it was entirely one hundred percent patriotic, I decided to join the Navy. I went into the radar field, and that was really the basis [of my computer background] because you got into a lot of analogue computing, not much digital, but you had the background for sliding over rather neatly. So when I decided to leave Navy employ, I took the job with the computer group at the National Bureau of Standards.

ROSS: How did you end up working with the radar group? You were located on the East Coast then?

FOX: I had left Chicago for Midshipmen's school and was assigned for a year at Harvard and MIT, and we thought we were going to be shipped overseas. I laugh at it now because no women really were--no women radar people, at least, until much later after the war. Six of my class were sent to the Naval Research Lab, and I had said that I wanted to go overseas; in fact, when we had our interview as to where we would like to be located, which was a laugh of course, I said overseas. In fact, I said, "Overseas, first choice; West Coast, second choice; South Coast, third choice; anywhere but Washington."

ROSS: And look where you are!

FOX: And so Washington was it. And in those days we were not provided housing; you had to find it yourself. And I had turned down a civil service job at the Naval Research Lab, believe it or not, before I joined the Navy. The

reason that I turned it down was because mutual friends of my mother's said, "Oh, it's terribly, terribly crowded there, and housing is impossible." Well, if impossible in '42, you can imagine what it was like in '44. It was doubly impossible. You were allowed to stay in a hotel two nights and then you had to move to another one. And so when we first came here we lived in a hotel, the old Roger Smith Hotel, for two nights and then we moved down to the Willard for two nights, and then, thank heavens, we found an apartment.

ROSS: Who were some of your classmates?

FOX: Well, Ruth Kahn, she was Ruth Howder then, and Bee Porter, and Liz Welty, and Eloise Anderson. In fact, Eloise Anderson and Liz Welty and I and my civilian sister, who had decided to come wherever I was sent (she taught school here at Antacosta High), shared a one bedroom apartment, believe it or not. We had many, many other people staying with us on occasion. 620 Mellon Street, South East -- we called it St. Elizabeth's Annex. We weren't far from St. Elizabeth's Hospital. Not all of the girls went to the Naval Research Lab; some of them went to ? May navy. But I was at the Research Lab, and so were Liz and Eloise. Marie Kline was another one. Isn't that awful, I can't remember... And this is our fortieth anniversary, and we were talking about having a reunion. There were only twenty-five girls who completed the Harvard-MIT course successfully. There were thirty-six who started. Twenty-five finished.

ROSS: That's pretty good, because that was a very stiff program.

FOX: Oh, I died the first month. I was a pretty good student in my day and I flunked the first month's tests. And, of course, the fact that seventy-five percent of us did didn't really impress me. I flunked! And my morale went to sub-zero. But I was interviewed, I recall, by a Colonel Fox, Colonel Phillip Fox, because there was the Navy (?) and the Marines, and everybody up there. And he said, "What are your study habits?" And I told him, and he said, "You're studying too hard. Get out and do things." So I did. I read a murder mystery the night before I would have an exam, and it did wonders.

ROSS: That's great. Yes, I've talked with other people who were involved with that program.

FOX: I was very intense.

ROSS: Did you end up doing any teaching? You told me you taught before.

FOX: No. This was strictly research work. Actually, my first job at the Naval Research Lab was in tube research, because this was long before transistors. And we were trying to miniaturize tubes. Would you believe that tubes this size were miniature?

ROSS: Two to three inches.

FOX: It sounds ridiculous now. About an inch and a half to two. And I used to go to some to the suppliers and look at some to their fabrication techniques, and things like that, you know. I used to look at those women putting one little piece in it and I thought, "Oh, my God, I'd die."

ROSS: Who were the manufacturers? Westinghouse?

FOX: G.E., Westinghouse, RCA... I really don't recall. A couple of years there were sort of frantic, and I don't remember the details as much as I knew the night work, because we were working fifty-four hours a week.

ROSS: One of the problems with tube supply was that they weren't standardized.

FOX: Well, and also the rejection rate was terrible.

ROSS: That's right, very high -- sometimes eighty-five percent.

FOX: They had to be darn reliable. And then we were into cathode ray tube. research, and we used to make more vases out of them. We got expert at taking a hot wire off from around the neck and then when we were through doing whatever we were going to do with the things, we made vases out of the bottom -- the glass part. The big problem was getting uniform tubes that were within a certain range. You know standards were non-existent. We were aiming toward it, but not...

ROSS: Well, the impetus did come from the government.

FOX: So what we would do is buy a skillion tubes and sort through and then use so many and reject the rest.

ROSS: How did this work prepare you to go on and do what you did next?

FOX: Well, there isn't a heck of a lot of difference in circuitry, and we thought that a quarter of a microsecond was a big deal. That was pretty slick, and now, my gosh. So you had this basic background. Engineering-wise it's pretty much the same, it's just faster -- from a different basis, but not a lot different. We used pretty much the same engineering principles, but I never really got into hardware development in computers because I ended up in management right away. This was kind of too bad in a way, because I loved it. When I was a civilian we were in the business of designing a better fire control radar, and it was the IF portion that really needed refining. I enjoyed that very much. We designed lenses until they came out my eyes--reflecting lenses, and what have you. And then all of a sudden I thought, "This is just destructive, and we're supposed to be in peace." I even thought of going back into teaching, but that didn't last long. I don't think I would have had the patience. But I did come from a family of teachers, so I've got lots of family teaching.

ROSS: So you left the navy...?

FOX: And came over to the National Bureau of Standards on September 10, 1951--best move I ever made.

ROSS: And you said earlier that you remember that day?

FOX: I couldn't forget it because for me it was just like walking into a new world. It really was a fascinating world. We had around-the-clock shifts. We were frantically trying to do things, and it was all a new field. My first major task at the Bureau, being technical alternate to Sam on the contract for the first Univac that had already been let, but they were in difficulty.

ROSS: Sam Alexander.

FOX: He was the technical advisor on the contracts and he turned it over to me. Eckert and Mauchly were in trouble. They were trying to produce an off-the-shelf item with research techniques--it just was unbelievable. When I dug into the contracts and into the background of it, I was just fascinated to think that anybody would be so stupid, and yet...

ROSS: All right, let's be clear here who's being stupid.

FOX: Oh, Eckert and Mauchly for taking a fixed-price contract--just unbelievable.

ROSS: Why were they forced to do that, though? You told me off tape that there were some other extenuating circumstances.

FOX: The Bureau of the Census did not have research money -- research and development money. They had what was called operating money, and when they asked the National Bureau of Standards to be the intermediary in letting a contract for a device that they hoped would help them with the 1950 census, the Bureau went out on bid. Nobody in their right mind would bid because a computer of that type had never really been built.

ROSS: OK, and because of the type of contract.

FOX: [They would say], "We'll be happy to take a research contract," but we didn't have research money. And I know this sounds funny to people outside of government, but there are kinds of money in government. You cannot use one [kind] to do the other, although I have known of times when they have exchanged them. That's another story and it's not really pertinent, but it can get people into lots of trouble.

ROSS: So the fixed-price contract for Eckert-Mauchly really grew out of the fact that the Bureau of the Census and the...

FOX: The Bureau of the Census had only operating money to transfer to the Bureau of Standards, and the Bureau of Standards' computer group did not have research money of its own (from the Bureau of Standards at least). So the contract was let eventually to Eckert and Mauchly who were, in those days, called the Electronic Control [Company] and they had broken off from the University of Pennsylvania, set up their little company, and bid on the contract. It was let primarily on the basis of a $75,000 trial--it was really a research contract but it...

ROSS: The way it was stated?

FOX: ... was to prove out certain elements that would be incorporated into what became the UNIVAC I.

ROSS: OK, now do you have documents that relate to the contract?

FOX: Indeed I do. I have the original contract, for one, and a lot of supporting material, correspondence and this sort of thing. When I came to the Bureau it was about the time that the Electronic Control Company had changed its name, and I'm not remembering exactly when. It was in the late '40s someplace, and became known as the Eckert-Mauchly Corporation.

ROSS: Computer Corporation. I think that was just a year later.

FOX: And they had backing, financial backing...

ROSS: Capitalization.

FOX: ...from somebody whose name I don't recall either, but he was killed in an automobile crash, no, in an air crash as I recall. They were going to be in trouble financially, and it was at that time that Remington Rand became interested in taking them over. I remember the name of the lawyer who used to come down quite a lot, it was George Eltgroth who became very knowledgeable in computers. He was really a fabulous person because he not only was a lawyer but he got to know what all this complicated data was all about.

ROSS: So he would have been the liaison between the government, Eckert-Mauchly and Remington Rand?

FOX: Well, he was actually between Eckert-Mauchly and Remington Rand, but because the contract had to be transferred then, that's how we got into the act. The contract had to be transferred legally from the Bureau and Eckert-Mauchly to the Bureau and Remington Rand.

ROSS: And those documents exist as well?

FOX: Right. See, the first UNIVAC I was in operation in Philadelphia in 1951 in a big, old warehouse up there.

ROSS: The Census Bureau came up and used it for awhile before...

FOX: Well, that was the Census Bureau's machine, and it operated up there for a year...

ROSS: That's right.

FOX: ...and it wasn't reliable enough to handle the census data, per se. They were doing an awful lot of experimental work with it, both the Bureau of the Census and other agencies because they all got in on the act and had augmented the contract to have a UNIVAC II and a UNIVAC III even before UNIVAC I was what I'd call sound.

ROSS: Do you have that inter-agency correspondence?

FOX: Yes. I have the augmentation to the contracts. The first one was the Army Map Service, which is now called something else, and the second one...Well, UNIVAC I, UNIVAC II, and UNIVAC III belonged to the Bureau of the Census, Army Map Service, and the Office of Air Controller. [I have] also all of the amendments which went into the contracts because it wasn't long before that original cost was augmented by additional requirements for $50,000, then an additional requirement for another $50,000, and so on and so on and so on. By the time the machines were moved to Washington they were not $259,600.

ROSS: What was your impression of Eckert-Mauchly taking the Northrup contract?

FOX: I never knew too much about that.

ROSS: Do you have any correspondence that would...?

FOX: There are some letters, but I don't know too much about that. I can't really give you any personal information, and whatever's in the files is all I have. Metropolitan Life in Chicago took on more aspects of the BINAC. I remember the gentleman, John... Oh dear, I can't think of his last name either, who handled that part of the contract which helped the government in many ways. Anything that would help prove in more of the technology of the thing helped the development of the computers for the government. And it was a very nice mutual arrangement. John Vinelli [was the gentleman's name].

ROSS: It was a nice relationship. The government at this early stage was encouraging industry's entrance into...?

FOX: Oh yes, and they shared information. It was just marvelous. For example, in 1946, there was the big meeting held at the University of Pennsylvania where there were government, foreign, British people there. There was just an exchange. I recall the German gentleman who had created ZUSE, whose name I can't remember right off the top of my head, and then the British people, whose names I can't remember. Isn't this terrible?

ROSS: That's pretty much public record. Who in the National Bureau of Standards was encouraging commercial or business applications of computing? Anyone in particular, or a group?

FOX: I guess the math division was, but Sam always had an idea that the computer ought to be able to handle any kind of information. We were laughing the other day, [because] the applications of computers today are what he predicted. And he couldn't see why, you know, we couldn't turn to and start developing all the, what he called, "monkey glands" for the computers so that they could do these things. Of course, when the technology continued to increase, I spoke of the radar tubes and the miniaturization thereof, we were still making tube machines. SEAC was a tube machine and so were the UNIVACs, and I guess the last tube machine that was ever attempted was the PILOT which never got off the ground completely. You may not know about that one.

ROSS: Was everyone in agreement within the National Bureau of Standards?

FOX: Oh, no. In a way I think they were and they weren't. They all were enthusiastic about potential of computers, but there was always a problem between the mathematicians and the engineers. The mathematicians wanted a solid machine that they could program and use, and the engineers always wanted to try something new. I recall in those early days when we had SEAC operating... of course SEAC was never supposed to have been an operational computer -- it was an interim machine until the Air Controller got its UNIVAC. Well, that interim machine worked for sixteen years. It never was supposed to be able to be moved either, and it was moved from one building to another. We found more cold solder joints during that move which proved that it never could have worked, but it did. But the mathematicians, primarily, were mainly in the scientific field, and you can understand that they didn't really want a

machine that wouldn't give them the proper answers. To have somebody always changing the thing every night was not to their liking. Eventually, they did get their own commercial machine.

ROSS: OK, so what you're saying is that the mathematicians and the engineers would work different shifts on the same machine and do different things.

FOX: I recall when we were developing and adding on the Williams memory, we had acoustic memory only to start with.

ROSS: This is to the...?

FOX: The SEAC. And then they had to do some major engineering to attach the Williams memory, even if it was only experimental. The poor mathematicians went out of their minds during that period because they had deadlines to meet with other agency projects that they had to come up with some answers. I hate to say this, but we were then in the process of helping to design the bombs with the AEC.

ROSS: The AEC was a big customer.

FOX: Yes, especially for the Math Division. Eventually then, I got involved with UNIVAC number 6, I believe it was, which went to AEC. I don't remember the exact number, but Bureau of Ships got one of the machines and AEC got one of them. So we handled the contracts; not direct contracts but advis ory.

ROSS: So, do you have documents relating to those as well?

FOX: I have most of the history of the Univac, most of it.

ROSS: What about documents relating to various inter-agency projects? Those were handled on a contract basis.

FOX: Between us, you mean, and the other agencies?

ROSS: Yes.

FOX: Well, yes. This kind of relates to budget because, as I mentioned earlier, I think, the computer group at the National Bureau of Standards had no Bureau money at all during the early days. It was all work for other agencies. Actually, the budget documents are the source of some information because they would be a statement of transfer of funds for some particular purpose, and that particular purpose would be the description of what they wanted done, either through us with outside help or within the labs themselves.

ROSS: And are these budget statements different from published ones?

FOX: Oh, yes.

ROSS: So these are disaggregated?

FOX: Yes. These are mainly in the form of letter transfers. It wasn't very formal. It was formal, but it was mainly in the form of a letter -- a covering letter that described what you wanted, along with a transfer letter that went to the budget office.

ROSS: So you found yourself involved, as a National Bureau of Standards employee, in a pretty central position?

FOX: I guess it was because of my curiosity more than anything. I felt the excitement of the times. I will have to say that when I joined our computer group, nobody really knew the status of the paperwork, and I had come from the Navy where you had everything neat and tidy. I said, "Oh my God, why isn't anyone recording all of this?" And Sam's answer was, "We don't have time. We're working." So somebody had to dig out all of the information that

pertained to all of the contracts and all of the transfers and keep some kind of tabs on them. As his administrative, technical aid that's the way I ended up. We had an administrative officer to whom I could turn the stuff over once it was interpreted.

ROSS: Who was that?

FOX: Mrs. Caren, Estelle Caren. She was a very knowledgeable administrative officer, but she wouldn't know "sic-um" about what was being done. Somebody had to keep tabs on all of that, and Sam loved to go do things, so he let me have full rein.

ROSS: What other projects did resources come to? Did the math people get more than the engineering people?

FOX: I don't really know. They had their, excuse the expression, stable of mathematicians, scientists, and programmers. Ida Rhodes, for example, was one of the chief ones. Of course, in the early days, you programmed machine language, and she was one of the best. I remember taking a course under her, and her teaching technique and mine were not the same, so we didn't really come eye-to-eye, but she was a fabulous person, she is a fabulous person--she's still here.

ROSS: Who else was involved with either the engineering or math departments?

FOX: Well, in engineering we had Al Leiner, who was head of the design group.

ROSS: How do you spell his last name?

FOX: L-E-I-N-E-R. He and his group went eventually to IBM and designed for years and years; some of them are still with them, I guess. I think Allen is retired.

ROSS: By design do you mean logic design?

FOX: Yes. They would be the logical designers. He, Bill Knots, Arnie Weinberger, and Lynn Smith were the senior logical designers.

ROSS: And above them was Alexander.

FOX: Right.

ROSS: OK. And then on the other side?

FOX: In the math division there was Dr. Cannon and Dr. Alt.

ROSS: And their first names are?

FOX: Franz Alt and Ed Cannon. And Joe Cameron, and Joan Rosenbalt. Dr. Joan Rosenbalt was a statistician. Lambert Joel.

ROSS: And his first name is spelled?

FOX: Lambert, L-A-M-B-E-R-T. I have lists of those people someplace in my files. All of the people who were working in 1951, let's say.

ROSS: Good.

FOX: It's terrible, but you do forget.

ROSS: Can you give any indication of other projects either of those two groups might have worked on?

FOX: Well, not those two groups, but coming down to another section in our engineering group would be the hardware people. Dick Witt was one of those and Jim Pike, who is not deceased, Leonard Kahn, Sid Greenwald, and, oh dear, what was that other fellow's name -- he lives in Annapolis now. It's gone. I, as I say, have the lists of who were in what groups. When we were building the mobile computer, the DYSEAC, Dick Witt was in charge of the construction group then, and Al Leiner was in charge of the logical design.

ROSS: You also mentioned one other interesting organization, or a group of people, while we were off tape, and that was a planning council upon which Mina Rees sat.

FOX: Yes, an inter-governmental...it really began, I think it was formed, at the request of the Bureau of the Census for a device, because they were not...

ROSS: So this would be late '40s?

FOX: This would be mid-'40s.

ROSS: Oh, yes, because the UNIVAC contract come out of the...

FOX: SEAC was born at the beginning of 1948 when UNIVAC had already gotten into trouble with technical delays. I shouldn't say trouble, because these things were not proved in at all. They were struggling as hard as they could, but they had a lot to do with a machine that had never been built. Well, you know, the gross idea was there, and then they had to pitch in. I recall seeing the correspondence that went on and the visits. We had resident engineers with them--Bob Elborne, that's another one. He was both a mathematician and an engineer. He kind of bridged both sides and he lived with them practically for awhile.

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FOX: When I came to the Bureau in 1951 and found out that they had been working for five or six years and had no formal publications to speak of, I was aghast. I said to Sam, you know, "Why aren't we publishing?" He said, "Because we don't have time." Well, that was just silly because the so-called *NBS Reports* were not considered formal publications, and while some of them had been created, they still were not formal. It was in 1951 that the first computer conference was held, thank heavens, because that made people put on paper a formal document. I remember that one was in Philadelphia, and all two-hundred and fifty of us knew one another; it was kind of funny.

ROSS: The *NBS Reports*. You have some of those?

FOX: Oh yes, indeed I do. I think I have a complete set of those that pertain to computers.

ROSS: Great! Let's go back to Mina Rees for a moment...

FOX: Yes.

ROSS: ... and the inter-agency council.

FOX: I really can't remember enough about it because it was mainly the mathematics (division's) -- not ours. The hardware people were not involved. It was mainly (concerned) with the requirements, so this was mainly mathematicians and statisticians and so forth. As I recall (and I do have the minutes of their meetings so that they will have lists of who was involved), it was inter-agency so that they were trying to define equipment that would be used for what we used to call "business-type applications" rather than military. Don't forget that all of the computers up to this date had been special military-type computers, and now it was the hope of these people to develop a plan or plans for machines that would be useful in business applications. Business applications included things like drawing maps and identifying points and so forth, that the Army map service wanted.

ROSS: This is a rather intriguing development -- to have the mathematicians telling the hardware people exactly what is needed.

FOX: There was a bit of friction between the groups because the engineers then said, "You can't do it this way. If you had involved us from the beginning, we would have worked with you." Well, it didn't seem to happen that way, at least not initially, and it never quite came to that at the Bureau. We got more friendly as time went on, but it really was a problem of not talking to each other at the proper time. So that when the mathematicians would come in with their plan, the engineers would say, "Good heavens, we can't do this. Now if you will do this and this and make some changes, and if you had involved us at the beginning, we would have told you what you could and could not do." Well, I'm not sure that either side was pure.

ROSS: Do have documents that relate...

FOX: Some of that?

ROSS: ... suggestions that went back and forth between the group?

FOX: I really can't tell you how detailed they are. It's been years and years since I read them and that part was not my immediate interest and so I can't honestly answer that.

ROSS: Do you remember specific machines that came out of suggestions made by that council?

FOX: Well, of course the UNIVAC I was *the* machine, and everything kind of hinged on that for the moment. Later on, when the UNIVAC did not get off the ground in the time frame that was hoped for, and the Office of Air Controller said, "We've got to have a machine," and the Navy said to the National Bureau of Standards out on the West Coast, "We've got to have a machine," That's really how SEAC and SWAC got initiated. I don't know as much

about the SWAC situation because while I have some of the documentation I've never read it. I acquired that much later when they found out that I was busy collecting all this stuff, you know, they sent me some of it. But I really don't know too much about that because there was also a lot of competition between the two groups, the East Coast and the West Coast. Don't forget that the SEAC started out being Standard's Eastern Automatic Computer, not electronic, and SWAC was Standard's Western Automatic Computer. One was built for the Office of Air Controller and the other for the Navy. The Navy requirements were different, the engineers were different, and I remember that Sorenson was the name of one of the fellows out on the West Coast. I knew several of them, but not well. Sometimes they would come to our place and sometimes ours would go out there, but there wasn't a great deal of interaction. Mainly, I think, because each of them had their own pride in what they were producing and the requirements were just enough different. The Office of Air Controller was nearby and the Navy requirements people were near the West Coast people, so we didn't have as much interaction as we probably could have. I might also add that the West Coast people, the team there was mathematicians and engineers, which was different from out here.

ROSS: That is good to add.

FOX: And it was in a university complex too, which we were not.

ROSS: That would make an interesting historical investigation. Any other people who you could add to that list of council members, besides Mina Rees?

FOX: I have them down in the report. I remember that at the head of each of the minutes there was a list of the people...

ROSS: Oh, good.

FOX: ...and I just don't remember.

ROSS: That's fine. That's what the documents are for.

FOX: I think we received them, kind of courtesy, because we really weren't theoretically involved directly. We did receive copies of them. I latched onto everything. I'm the original packrat.

ROSS: This is a hard question to ask. How aware were the programmers, or the mathematicians in general, of hardware deficiencies and what did they do in order to get around them?

FOX: I think most of them found it a challenge to program around the deficiencies, but I think we were kind of fortunate in having Ida Rhodes who was in the math division but who was also a good friend of Sam's and terribly interested in the hardware. She might not have always understood it, but she certainly got in there and looked at it and kept close tabs and talked with the engineers, especially to Sam. She'd say, "This is very difficult, you know. I can program around it, but it's not really the way to go." I think this interaction really helped on our side because Sam would have a meeting then with the design team. Also, Ida spoke with and stayed very close to the logical design group, very close. Al Leiner's wife, Henrietta, kind of also bridged the two [groups].

ROSS: That, by the way, was very often the case.

FOX: It's kind of funny, but she had quit working when I... I kind of took over some of her job when she was still at the Bureau, but she stayed very close. After all, she was a mathematician and she had a husband who was a logical designer and she was very close to Ida. There was a lot of what I guess you'd call a social interaction. Nobody talked about anything but computers. You had a party in those days and you had a party of your peers. And what did they do? They did nothing but talk computers, nothing. And lots of interesting things came out of parties. I used to give one a year to the whole staff, and nobody talked anything but computers. Wives sometimes said, "Well, we hear it all at home and now we're hearing it all again." That's the way life was.

[The following segment of the interview consisted of a tape recorded informal review of some of Miss Fox's personal

papers and computer artifacts.]

ROSS: This is SEAC's input/output device?

FOX: Yes. Input. The output was a...

ROSS: Tape to card?

FOX: Not to card.

ROSS: Just tape?

FOX: This is what the program was on. Sorry about that, so it is input to a degree. It's a single wire, you know. It was a converted device that was already available.

ROSS: And you have all of the division's calendars?

FOX: I think they are all there, at least from the time we started keeping them. This box has a lot of computer literature, bibliographies, (e.g.). "NJCC Sponsorship of Abstracting," personnel backgrounds. As I say, I don't really know what I have here.

ROSS: And you have really a partial if not total collection of Sam Alexander's papers.

FOX: Yes, that I have, because as I say, I had planned once upon a year to write him up, but I never did. Preliminary Draft: Alexander, "Electronic Information Processors: A New Kind of Tool for Science and Management." That probably was back in '50s.

ROSS: You said that the UNIVAC people gave you a memorable device. What was that?

FOX: When we had their twentieth anniversary or twenty-fifth, I am not remembering, as a pioneer who worked with them on all that stuff, they gave me one of their metallic tapes, and it weighs a ton. I've been trying to figure out who would appreciate it? I don't know who else was given them but I have it here someplace in this mess. This folder I'm just looking at has a lot of correspondence that relates probably to Sam and even personnel actions. Oh, my Lord. That's Sam's own writing, I remember that. No, that's Mary Stevens' writing. That has to be from the early days of the division. As I say, some of this stuff I don't even know what I really have.

ROSS: Now, what is this here? A personnel list?

FOX: It's an appendix, a list to a report.

ROSS: Oh, it's an index.

FOX: Yes, and I'm trying to find...Oh. We had our little moments of levity too, if I may speak about them. We had, for April Fool's Day, THE SUBSTANDARD, and see, "SEAC aids in Discovery of New Scientific Law." It's all nonsense, you know, but it's kind of fun, and it discusses some of our people. Bill Youden was a young designer, logical designer; John Rafferdy was an engineer; Jay Hessman I don't remember, but he must have been an engineer; McNally and Kent Scahill were technicians; Dave Jones was a technician; Erickson was a technician; Foxie, that was me. And "An Uncanny Prognostication of the Weather." Oh, well. Anyway, that's our nonsense bit. Then here was a...

ROSS: What's this, for example?

FOX: Oh. It's a program. This is not ancient, but it's one of the first to create indexes.

ROSS: And it's called: "SYX."

FOX: SYX stood for Saber, Youden, and whose the "X"? I don't recall who the "X" was, but anyway they were the programmers. They were engineers too, but Bill Youden was a very innovative young man.

ROSS: This is a sorting progrm.

FOX: Yes, basically.

ROSS: It used card input.

FOX: Yes. It had to eventually produce an index.

ROSS: And these are the Moore School Electrical Engineering Conference lectures.

FOX: That was the big conference that was given in...

ROSS: In '47?

FOX: 1946. July 8 to August 31. "A Special Course Entitled: THE THEORY AND TECHNIQUES FOR DESIGN OF DIGITAL COMPUTERS, was Conducted at the Moore School Under the Auspices of Office of Navy Research, U.S. Navy, and the Ordinance Department."

ROSS: Which included you then?

FOX: We were attached to it at that time, working for it now. See George Stibitz? I'm sure you must have. Imagine, a history of computing devices, at that time. Mauchly; Leiner; now he was West Coast; Hartree, now he was from

England; Goldstine of course was up here; and Arthur Burks, was Michigan, University of Michigan; Mauchly; Eckert. Included in here is a list of those who attended because that's almost as interesting as (the proceedings). Let's see what else we've got. "Thirty-three digit magnetic drum serial computer, ERA, 1949," and...

ROSS: So ERA had a contract with...?

FOX: Well, don't forget that ERA was a division of (Remington Rand). Have you ever heard the stories of the 1101...?

ROSS: Yes.

FOX: ... and how it got numbered?

ROSS: No, I haven't heard that.

FOX: Well, see they worked mainly for the unspeakable agencies.

ROSS: That's right.

FOX: And they had designed twelve computers. And when they did the 1101, that was really number thirteen. You just look at it -- 1101 = 13.

ROSS: Yes.

FOX: When they asked to go commercial and the Navy gave them permission, they marketed it as the 1101.

[At this point, Miss Fox and I left her personal collections and continued the interview under the more formal

conditions with which it began.]

ROSS: You said you were a little aggravated with the lack of publications at the Bureau. Give me some examples.

FOX: Well, the example that has always irritated me the most is our experiment with interconnecting two computers. We built a DYSEAC which was put in two vans. One of the vans held the power equipment and the air conditioning and the other one held the computer. In the early '50s, as I recall, the DYSEAC was taken to White Sands in May of 1954, so it had to have been in the year before that. Mary Elizabeth Stevens and others on the staff interconnected the SEAC with the DYSEAC and ran a master-slave relationship between the two computers. One computer was ordering the other computer what to do. And, as far as I know, that never got into the literature per se. There were some remarks about it later on, but we were still not publishing. My boss, God rest his soul, was always saying, "We don't have time. We're too busy to write papers and get them accepted through the rather ponderous editorial system of the National Bureau of Standards." And I've always regretted it. While they were developing SEAC, it wasn't publicized properly. While they were doing this kind of interaction, when they were putting the first computer in a van, no credit.

ROSS: And also very little credit in the historical literature.

FOX: Because it's not in what I call "the published literature," and so why should it be recognized? We did ourselves a disservice.

ROSS: And the documents you have contain information relating to that.

FOX: Oh yes. We had a series of reports within the Bureau which did not require editorial review and approval, and they were called "Grayback Reports," mainly because they had gray backs, and they were informal communications--that is what they were considered. Mainly they were given to the sponsor as progress reports. So we do have it in that kind of a report but not in formal publication, unfortunately.

ROSS: Any other memorable incidences?

FOX: Well, coming a little farther into the future from the SEAC-DYSEAC days, I kind of get a kick out of it now, but we started the projects on packaging circuitry. Now this sounds funny, because in those days we were still using tubes, so a package was like eight by two inches, and actually we were using etched circuitry, believe it or not. And I recall we used to have Kite Sharpless (what was his company? Technitrol) do some to the etching for us and then put the other elements on both sides of the board. In fact, the third machine that we never completed was known as the PILOT and it was built with packaged circuitry. It was still a tube machine, but the packages were inserted in a frame and could be removed and replaced.

ROSS: WHIRLWIND had some packaged circuitry, not a great deal, and it was tubes. You were talking about eight inches by two inches. Those were much larger than that.

FOX: Well, these were a flat board which could be etched on both sides, you know, with some kind of epoxy. I don't know what the board was made out of, [it] that would not bend; it was pretty fixed. The tubes and resistors and the capacitors were put on each side. Actually, it had a merit, even at that size, in that the heat could be dissipated easier than it could on the standard racks that we used on SEAC and DYSEAC. But then I recall that we kept on encouraging manufacturers to miniaturize. Little by little you saw it going smaller and smaller and smaller and smaller, and now when I think you can put the computing power that SEAC had in the palm of your hand, it's just absolutely fabulous.

ROSS: It's astounding.

FOX: Absolutely fabulous.

ROSS: Now, beyond Technitrol being aware of that through its contract association with you, who else was aware

that you were doing that kind of...?

FOX: Oh, any company. We had very close relationships with all the companies.

ROSS: We were talking about the problem of the lack of publication and dissemination of information outside of the government.

FOX: Well, I guess there was such a close relationship with all potential suppliers of any devices that nobody ever complained because they all knew what was going on and they could come down and look at it at any time and say, "Hey, why don't you put us on your bid list?"

ROSS: That may explain why publication didn't seem so important to Alexander.

FOX: It could very well be, because everybody knew everybody else and there was a close relationship between government and industry. Very close. In fact, I still think that many of the patent problems arose because there was this very informal relationship. Nobody was taking credit. They all would say, "Hey, that's a great idea, but why don't you do this with it," and so forth back and forth, so and it really became a very big problem later on.

ROSS: What was the NBS's policy on patents on the contracts it let?

FOX: The company could retain the patent rights.

ROSS: So it was just the same as all the other government agencies?

FOX: Yes. We had no problem with that at all.

ROSS: In retrospect, that was a very foresightful move.

FOX: It was the only way to go. In fact, some of our guys had patents in their own rights, you know, but they have to be assigned to the government and then they were available to anybody. I'm not remembering exactly, but Bob Elborne had a patent and Dick Witt had a patent, I'm not sure on what anymore, some little thing or other.

ROSS: Tell me a little bit about your participation in professional organizations outside of government.

FOX: The National Bureau of Standards has always encouraged involvement of its professional staff in professional societies. Since we were a small group of computer people in the early days, it was just natural that we became involved in the computer conference. The first conference was in 1951, and there were like two-hundred, and fifty of us gathered up in Philadelphia, and everyone knew each other. Then, eventually, in the next year or so, I don't remember exactly, the National Joint Computer Committee was formed which was sort of an informal way of getting together. It had mostly the eminent people from industry and government on it. And then as the '50s went by, it was decided to have an international conference, and in those days they decided they should formalize a little bit more. Now, in the meantime there was the IRE, which is now AIEE, and the AIEE...No, the AIEE...I always have trouble with these. The IRE and the AIEE joined to form the...

ROSS: IEEE. It's very difficult. It really is.

FOX: And the ACM had been born in the '40s, and we all belong to ACM. That was just pro forma. And I guess I belonged to AIEE. And then Sam was often not available, and I was always available, so I ended up sort of being his alter-ego and eventually became a secretary of the NJCC in my own right. When AFIPS was born, I helped write the constitution. I have a copy of it...

ROSS: You do?

FOX: ...with all the names of people. You know, we had a big photograph with all of it, the names of the people who

participated. And I remember being out at Mort Astrahand's office in IBM-San Jose when we had election of the first officers and I counted the votes and burned them. So then I guess I was an officer for awhile, I don't recall exactly how long. But we helped, of course, put on the first International Computing Conference which was the International Information Processing Conference in Paris in '59, which was the year that we had the exchange with the Soviet scientists, earlier in that year.

ROSS: For which you also have documentation?

FOX: Oh yes. Lots of it. Bob Elborne and I were the two members of the joint computer committee who lived in Washington, or in the Washington area, so when the Russians came here, we were their official hosts. They stayed a week or so, we had them in for the business they were permitted to make, plus the social events. They were very interesting. Most of them could speak French. I don't speak French, but I can understand a little of it and they could also speak reasonably good English, most of them. [However], when one particular person in this group came around, they all immediately went into Russian. That was very interesting. So then Sam was a member of the team that went back; the Russians came first, and then they went. So he and his wife and Paul Armer, Harry Goode, Morris Rubinoff, Mort Astrahand, I think Professor Burrs from New York University, and there had to have been someone else--there were seven of them. Oh no, there were seven Russians and eight Americans; that was the exchange, and a few wives. So those were exciting days. Sam also, over those early years, gave technical assistance to Sweden, England, and India at some length--he was over there for a couple of months. And, of course, there was always interaction between the British, the Canadians, the Spanish, and Italians. So we were always having visitors. It was an exciting time.

ROSS: You mentioned to me off tape why it was necessary, for example, for Alexander to go to India. What was the situation there?

FOX: Oh, that was very interesting because the Indian Statistical Institute needed a computer and they really were going to try to build their own, but they were having difficulties. So, I don't recall exactly what international affairs

were like at the time, Russia magnanimously gave them a computer. However, they gave them no software. So, they ended up with a computer that they couldn't use.

ROSS: And you said no peripherals either.

FOX: Nothing. It was just a computer. So, they ended up asking Sam if he would come over and help them for awhile. I'm trying to think of the Indian who had visited us several times. He was a very fine mathematician and was with the Institute. And so Sam went over and spent some time with them, and they were very capable once they got going.

ROSS: I saw you had records relating to that interchange. Do you have correspondence as well?

FOX: I have all of Sam's files, so I think that, as I don't exactly remember what's in them all left over. But yes, I have all his personal files on that.

END OF INTERVIEW