Interviewees: Robert Dietzold and Bernard Holbrook
Interviewer: R.R. Mertz
Date of Interview: September 3, 1970
Repository: Archives Center, National Museum of American History

MERTZ:
This is an interview conducted on the third of September 1970, in Summit, New Jersey, with Mr. Robert Dietzold at his home. The interviewer is Richard Mertz. The other party is Bernard Holbrook.

DIETZOLD:
As soon as the transistor was available in quantities of six or twelve, which was not immediately, people started trying to use it for something, and I suspect that the first transistor circuit that was actually, used for other than investigation of transistor circuits was a gauge matrix for a simulated warfare unit at Whitney, which was working in the laboratories sometime in the year 1949. It was part of a machine which had all other kinds of technology in it, but a digital circuit.

HOLBROOK:
The transistors were so costly, a [?one?] hundred dollars a copy, so that the military applications built out of rejects. They made it work.

MERTZ:
Was this something to replace ...

DIETZOLD:
It was to use something that would have taken one hundred times the volume of [?] to do otherwise. I don't know the precise number of tubes. There is a paper about it I think in the Bell Laboratory's records, by W.H. McWilliams, that was published along about 1951 or 1952, or thereabouts. Or you can call Willard and ask him. Then followed that James Tucker proposed building, the TRAG.[?]

HOLBROOK:
That's transistor digital computer.

DIETZOLD:
But before he got that going a group at Murray Hill under the supervision of Arthur Hartman built and demonstrated an all-transistor [?] scan system which I think never went beyond the laboratory model. It was built in connection with the Mark-65 control system for the Navy, and demonstrated I believe sometime in the year 1952. Meanwhile, Bucker and Company had been working at the TRAG and this was a general purpose computer. The Trackwell scan machine was a highly special purpose machine.

Sometime I think in 1954 James Bucker and his people demonstrated the TRAG and went on from there to the rubber bond.

HOLBROOK:
The TRAG was Air Force-supported with the idea of having a digital bombsight ultimately. The system was prepared in a research laboratory model with the ultimate application in mind. The transistors available at that time were point contacts, and we had to have a protective environment, air conditioning. The early computer had a sort of fixed rate of operation, with a very small set of registers for memory. They were the circulating type that happened to be commercially available. They were other delay lines of solid state of one kind or another.

DIETZOLD:
So, the memory of the Trackwell scan computer was an acoustic delay line.

HOLBROOK:
May I interject what an acoustic is really? I mean, it was going through a crystal.

DIETZOLD:
Perhaps we should say something about the research atmosphere. James Tucker in those days used to give a speech on transistor computers, and he said transistors--or at least the transistors that I can get--if you are lucky, you can tell if they are turned off or on, and this is is why we use them in digital computers.

HOLBROOK:
The transistor art was pretty young in the early '50s, and Velkirk had a genius for catching on to something at just the right time. A little bit earlier, you really couldn't tell the rejects from the acceptable transistors, and he got the first set that you could possible[?] use in an 800 transistor-- I guess maybe it was 8,000 transistor assembly.

DIETZOLD:
I don't know the number, I've heard it. The TRAG used transistors essentially for gain, although logic was performed on data. The Leprechaun used essentially diodes and was all-transistor, and I think was the first machine that used junction transistors.

HOLBROOK:
Right, and used many more of them. It had almost exactly the capability of the WHIRLWIND computer at MIT, which used tons and tons of air-conditioning, and this thing was well s et up. It had a magnetic core memory.

DIETZOLD:
The Leprechaun used 250 Watts; I remember that figure.

MERTZ:
Did Darlington work with Bucker?

HOLBROOK:
With TRAG particularly. At that point nobody had really the foggiest idea of how you we're going to have a memory. Everybody thought these little teensy magnetic cores of the unit would be that. So, the brain work that went into TRAG was trying to accomplish mathematical operations useful in bombing without using any memory capacity. Sid was very smart in figuring computer organization to avoid blowing the thing up with registers.

MERTZ:
If we could jump back just a little bit before the pulse locator to the prewar period: 1930's and some of the early work. First analog machines in the '30's. The question was raised, I had a conversation with Richard Haley some months ago and he always wanted to know where it is. Do you happen to know where it is?

DIETZOLD:
That's a painful question for me because I was a wet nurse of Partin Price isograph from the time it was conceived until the time it was delivered -- until the time it was moved from pillar to post as the war came on and the Bell Telephone Laboratories required for military purposes mor and mor of the office space. After it was put in storage, I sort of wandered around trying to see if maybe we couldn't get a college to take it. I succeeded, and when I came back to my management and said my problem with the isograph is solved, he said "Yes,"--this was H.W. Bullet, incidentally--"this solid offer, I gave it to Tucky for Princeton." [?] It was delivered by freight and left on the siding at Princeton. Nobody at Princeton thought about this until after the weekend, and the isograph had most of the characteristics of a grand piano: beautiful mahogany case and a lot of extremely corricible[?] materials inside. That weekend it purred and purred and purred. That was the end of the isograph. I don't know what junk pile it's in, but it never operated after that.

MERTZ:
Did Princeton recover any of it?

HOLBROOK:
Nothing, no. They disposed of it.

DIETZOLD:
It was a beautiful mechanism.

HOLBROOK:
Thurston Frey had [been?] interested in the extraction of the complex roots of polynomial equations because his man--my boss, H.W. Bullet--was interested in network theory, and he had evolved a systematic approach to wind filter design, the only hitch being it involved extracting numerals of a high degree, polynomial equations with real coefficients. But the thing was their roots were all complex except for perhaps one bi-aggregate of two. They were not frightfully closely grouped, if you were real smart, but they could be grouped; which meant that all the numerical methods of getting at the roots failed to converge. So, Darlington bent his mind to this to make the theory work, and adapted that to the root extractor problem of Cochese and Lord Calvin's time predictor machine. Our shop built it, and Martin was proud as punch about this and suppressed this from the records, so he insured that if it turned out to be a white elephant, it wouldn't appear to management to be a very costly one. Like, the construction was $5,000, and nobody talked about the $5,000 work of drawings in addition, and that was swept under the rug. Only Corsin Frey knows.

DIETZOLD:
That's less than I thought because the Model I, as I recall, cost about 15 million.

MERTZ:
Well, in those days $5,000 was a lot of money.

DIETZOLD:
The Model I reel computer did not have a number of the things that George [?] envisioned for it because they ran out of money before they managed to get any of them in. He had $15,000 and he had to come up with something for $15,000.

MERTZ:
Where did this one go?

DIETZOLD:

The Model I. The Model I, I regret to say--and I wish that thing were turned off--in 1949, when we put in the Model VI relay computer, some ass (and I don't know how, or I would have strangled him before now) had it all torn down and the relays given to universities and things like this as surplus material.

MERTZ:
Whole machines?

DIETZOLD:
Well, it wasn't much of a job. Well look, the Model I relay computer consisted of about-- I think of about three frames of relays and crossbar switches. Registers were crossbar switches. They were cheaper than relays. There were three problem stations distributed on three different ...

HOLBROOK:
This was the Tom [?] calculator. Was that the Model I?

DIETZOLD:
The Model I. There were three problem stations, each of which consisted of a teletype writer and about twenty-odd keyboard with about a 40-foot cable between it and the calculator. The calculator lived in a small closet ...

HOLBROOK:
There were three bays of relays.

DIETZOLD:
And the calculator was in a small closet and nobody had a key to it except the janitor and the maintenance men. If you wanted to use it you went to one of the problem stations, and if when you pushed the button the green light came on; you had the machine. If the red light came on that meant that somebody else was using it, and you waited your turn. You couldn't put a problem into it by going to the calculator itself. This was one of the problems in maintaining it. I know because for a couple of years during the war the only man alive who could fix it was working for me on a Navy job, and every week or two something would go wrong with the damn thing an I'd lose him for a day while he got it fixed.

HOLBROOK:
You are sitting in the room with the guy who junked it. Me.

DIETZOLD:
Well, I still think you were wrong.

HOLBROOK:
Well, the engineering demanded too much. It cost more to keep it going ...

DIETZOLD:
No, we should have gone to the Smithsonian right then.

HOLBROOK:
I wasn't that smart.

DIETZOLD:
So, the Model I was the only machine I know of that could be used from a remote station. If you saw the red light you had to wait for the guy who was using it to get off. There wasn't any time-sharing or any nonsense about that. It operated that way, however, for about nine years, and I point out for your benefit that it was first demonstrated to the public over a teletype link to Hanover, New Hampshire ...

DIETZOLD:
[should this be Mertz?] Really remote ...

HOLBROOK:
A really remote point, and they were allowed to put problems on it. We simply moved a teletypewriter up there. But the word came down ... When that meeting was scheduled, somebody said, "Let's put a teletypewriter up there and we can run a girl to one of the consoles at West Street, and have them phone in problems and she will put them on the keyboard. Everything you put on the keyboard appeared on the page-printer, then the answer will appear on the page-printer." A little too late somebody said, "Well, why don't we use the teletype in both directions?" This merely involved getting on the teletype what we were doing on something like thirty pairs of wires locally. But the word came down, "Well, let's try it." So, Sam Williams called George Tibbets and me and said "Let's have a meeting in my office tomorrow." I don't know what they did, but I sat up until about 11:30 thinking up ways to get all this stuff onto a teletype circuit. In the morning we met in Sam's office and we came up with a system that consisted of about 75% Williams and about 25% Holbrook, because he was a damn sight better relay circuit designer than I was. Immediately after lunch he called in all the experts, including Ralston Partridge and the trial installation people and a lot of other experts, and Sam would look at his drawing and say now we need six relays, each of which has to have two mix, one break, four transfers, and it has to come up in about twelve to fourteen milliseconds, and we've got plenty of time to release it. The relay requirements people would do a little figuring and then the relay requirements people would say, "Well, try a U-88," and trial installation people would look in their books and say, "It isn't in stock." The relay requirements people would say, "Try a U-125," and they'd say, "Well, yes, that's in stock in Baltimore." We went through the whole thing if they didn't have anything that would do it then Sam

would revise the circuit a little and try something else. By about 3 or 4 in the afternoon, they had a list of all the relays we needed, and we went to see Hawthorne, and every other Western plant that might have these things in stock, and they shipped them by air freight, and the next morning Sam had people putting them together, and in about two weeks we ran the trial from Hanover, with Sam sitting there like a mother hen in West Street. As soon as the thing was over, I guess Martin Price called him from Hanover and said, "That went off fine, Sam," and Sam immediately had three workmen with soldering irons start tearing the thing down before somebody wanted to have him make it work again. But this was the first time that anybody used the computer over a long-distance circuit, good old fashioned teletype.

DIETZOLD:
Concerning Andrews, you know about Sam Williams doing all the relay computer work ...

HOLBROOK:
Ernie didn't have anything to do with Model I?

DIETZOLD:
Not with Model I, but with a later one.

MERTZ:
I understand Sam Williams' son lives outside Washington, Silver Spring. Did he work on a sort of a biographical study?

HOLBROOK:
I didn't know about that. When Sam died, I know the short biography of him that appeared in the SAM Journal was made up by me on the spur of the moment when somebody called from the SAM office and said we ought to have something about Sam Williams, but I didn't even know Sam had a son. So, I didn't know him.

MERTZ:
I had a comment (rest inaudible)

HOLBROOK:
His father was a great and unappreciated man.

DIETZOLD:
He had a terrific exuberance and drive and geniality.

MERTZ:
Very enthusiastic.

DIETZOLD:
Great competence. Most of the ideas about switching were St idisent's[?]

HOLBROOK:
The ideas about computing were Stidens[?] Sam took all the stuff that he knew that had ever been put in a machine switching central office and stole all of it from here and there and put it all together and there was a computer. If Tibbets had been working for IBM at that point, we might have had a computer in 1955.

DIETZOLD:
Just imagine the communications problem. Stidents[?] knew what a relay was all right, but he was a mathematician, Ph D from Cornell. He had no knowledge of switching. So, he invented his own rotation for drawing up circuits.

HOLBROOK:
But Sam had been in the switching development business for 30-odd years I guess when I came along. Sam could search in his memory or call somebody up and immediately come up with something that they put in this funny panel machine he developed for Omaha in 1919 or something like that and never used again but that's exactly what we need here.

MERTZ:
This touches on something that strikes me as being more relevant to his contributions to the technology, computer technology, switching itself, probably more than any other group or organization that had developed the technology capability.

DIETZOLD:
About 1947 or '48 Bernie was invited up to MIT to give a speech and he entitled his speech: "How to Tell a Computer from a Telephone Central Office."

HOLBROOK:
I still used to tell people before I retired, new employees, that .... I guess these were candidates for employment who knew all about computers and thought dial switching was some kind of nasty little two-bit trade, that after all a central office is merely a computer that has been rejected by the Army and it doesn't know how to do fourth grade multiplication but does know how to do logical multiplication. This is very true.

MERTZ:
This touches on another area which I have been very intrigued by [THERE SEEM TO BE ABOUT THREE LINES MISSING]

DIETZOLD:
That's true, but let's go back to MATS. Mr. Sturgiss invented the step-by-step system which, to a great many people's amazement, probably including his own, actually worked. The Bell System never adopted this. We later ... Much later, we did. It had the difficulty that it was a very nice system for a small town, without much toll business. But the Bell System in those days operated from large cities for the country and saw no way to make step-by-step applicable to those problems of the large city

MERTZ:
About when was this?

DIETZOLD:
Sturgiss' invention was in 1889. The Bell System manufactured a few simple-minded dial central offices as early as 1902. They weren't very good, but of course [?] wasn't very good either. As a matter of fact, manual central offices had some difficulties at the same time. But by about the period 1905 to 1910 the people in the Bell System knew that Sturgiss didn't have the answer for them. Without going into the details of the technology: step-by-step in those days was a suitable solution for a place of fifty or a hundred thousand people but not for a place with a million people. So, they sat down and invented a new system and we almost came to blows about it literally. They finally began installing the panel system in, I think, Wilmington and Newark, New Jersey, were the first places. This was around 1916 or '17. Unlike slow jerk, they actually operated the panel as a semi mechanical system for a couple of years where the subscriber thought he was on a manual system but the first operator he reached then dialed his calls. We operated that way for at least a year before we let the subscribers try it. We had our fingers crossed on what would happen. The panel system was in some sense from the computer man's point of view a table-driven computer. It was full of tables. It viewed a certain exchange in New York, the central office looked in a table to find out how to get to it. It didn't simply use the numbers you dialed. It might go through a tandem office. It might make a first trial on direct trunks and if this failed it might then go to a tandem office. Things of this sort. This is the sort of thing necessary in a metropolitan area.

The panel system was very successful, but it had technical deficiencies that were seen coming. We then went to number one crossbar which was first installed in the middle thirties, I believe, which was much more a table-driven system than the panel, in the sense that we didn't find out where the subscriber's line was located by looking at a table depending on what digits the originating subscriber dialed. Finally, after the Second World War, we went to number five crossbar which is, I think, as far as it was

profitable to drive electromechanical switching, but panel to a considerable extent, and both crossbar systems and a couple of others used for toll purposes were by and large computer-controlled systems where the computer had access to the sorts of things we now put indiscriminately, along with other sorts, with core memory, although in those days we put them in a much more expensive memory and had to figure it much more closely to find out. A crossbar system is to a large extent as assortment of very private telephone directories to tell you what to do if a subscriber dials such-and-such. Of course, this then went into the SS which is almost indistinguishable from a large electronic computer.
Sam Williams had a great deal to do with the development through all its stages of panel.

MERTZ:
I had heard the story, please correct me, that when George Tibbets originally promoted this idea there was some question whether the computer would work.

HOLBROOK:
By a good many people, but I would imagine not by Sam.

MERTZ:
Was it Frey?

DIETZOLD:
He was the boss. George Tibbets and I-- Don't ever let this come to Price because he's alive. George Tibbets and I were hired on in 1930 together and I was Price's white-headed boy, and nothing George did would win, and he was bright, and I was stupid. Frey invented the isograph, and I was wet-nurse to it, and George invented the electrolytic tank together with a marvelously effective transformation which avoided the poisoning effect of the edge. You didn't have really an infinite cap plane to work on. This was the electrolytic tank [which?] involves many [?] to guess what? Extract the complex polynomial equations; and you do this by setting the coefficients in, here and there, with electrodes. You go around with a probe until you find Zero [?]

MERTZ:
[TWO OR THREE LINES APPEAR TO BE MISSING]

DIETZOLD:
Well, I mean a sight of the electrolyte through the probes and you get currents flowing through. Then you have guides. A probe is really [two?] things. It's reading a sense of direction as well as intensity, and, you can go around and find a Zero and by God you've got a Zero!

HOLBROOK:

Did you mention how it smelled?

DIETZOLD:
What?

HOLBROOK:
George's thing. The electrolyte was odoriferous. Girls complained about the way George's thing smelled so he came up with the Model I.

DIETZOLD:
Everything was swell except in chemistry. The electrodes ionized-- is that the word?

HOLBROOK:
Well, he kept having to use more and more selids [solids?]

DIETZOLD:
You leave it in overnight; and we kept putting in stronger and stronger stuff .... Price said, "Jesus, Tibbets, throw it out." This is why he went with [?] solution.

HOLBROOK:
George had brilliant ideas every Monday, Wednesday and Friday.

DIETZOLD:
Saturday night he would be sitting in the kitchen eating supper, and he'd have an idea. By 9 o'clock that night the kitchen [?] he'd be pouring juice through instruments.

HOLBROOK:
I'll tell you something about George. He invented a very simple two-magnet ball-coning relay ...

DIETZOLD:
That was the one he did after supper Saturday night.

HOLBROOK:
He thought it was a wonderful idea. The counting of dial pulses is something that has been the bane of Bell System's executives since 1902, or some such. George had this brilliant idea, so he hunted around the house and he came in on Monday morning or thereabouts with one which actually worked. He had brought some steel coils at a garage and had soldered some old copper weather stripping to them as springs, and he had [?] apart from his daughter's [?] and wound it around with wires

so it was a magnet, and I don't know what else there was, and he wrote a memorandum about this. He sent [to] the memorandum to me and I promptly went on to George's office, and he pulled this thing out and by golly! it worked, somewhat to my surprise. While I was there, a fellow from Amherst Development Department came in who had written another memorandum as to why this thing [F?] George's couldn't possibly work. This was a very nice memorandum. It was an analysis of the things you'd need to count pulses.

Unfortunately, he had not appreciated one thing that George had said, probably in slightly mathematical language. This chap--and I can't remember his name now but he was a very smart detail engineer—came in while I was there, and with his memorandum: which I read and appreciated very much; and I thought the whole thing was quite funny. But George immediately blew his top and produced his machine and set it out on his desk and it worked perfectly. At this point, the apparatus development man looked at it and said, "I don't think I understood that fully," and picked up all the copies of his beautiful memorandum except page 6 and tore them into small pieces and threw them in the wastebasket. I always regretted this because he had a beautiful analysis of the things, you'd have to have in order to do pulse counting. But this is the kind of man Tibbets was, and, I think, is.

MERTZ:
Having been trained as a mathematician and a physicist, aren't mathematicians very often prone to prove they can make things work even though an engineer would say it's wrong.

HOLBROOK:
This is the bane of the existence group. What good is an existence group if it doesn't tell you how to get it into existence. I'm not a mathematician so I can talk on either side of this, depending on ...

MERTZ:
It's a challenge to some mathematicians to do something concrete with their ideas.

DIETZOLD:
And some mathematicians don't give a damn.

HOLBROOK:
Another mathematician who doesn't is Claude Shannon. I think now maybe he's a little bit more interested in predicting the market than when he worked for me, but he was working for me when he got married, and his wife....

END OF TAPE ONE

START OF TAPE TWO

DIETZOLD:
Stenists realized that a binary machine would die because of the necessity of making the decimal a binary and the binary a decimal convergence to get in and out, so he built a decimal binary machine with four relays, four bits for decimal digit. In addition, he and Williams put in two calculators, one for the real part and one for the mechanized part of each calculation. They also arranged it very interestingly so that the machine gave the appearance of thinking while it was working.

You would put in the two complex numbers of which you wanted the product or the quotient, and then push the 'equal' key and then wait. After a considerable wait it started to print out, as I [?] 1, the real part and it would print out perhaps several digits and then wait for 1 or 2 seconds and print out another digit, etc. So, it gave a very good imitation of actually thinking. Now this machine was used continually from January 1940 to sometime in 1949, when the Mark VI was turned over for our use.

HOLBROOK:
Can I put in a word? George used the four digits, four bits for a decimal digit, but his code was so smart that he used the slack he had to put in a negative side. So he didn't have to use anything more to show a negative number you were adding. That, I thought, was awful slick, didn't you?

DIETZOLD:
He was a very smart guy. Now Sam Williams essentially took the requisite parts of all kinds of stuff all over the panel and crossbar system, and simply offered them a number of contacts for relays; but, after all, Bell Telephone Systems had been registering 4-digit or 7-digit numbers as dialed by subscribers since long before the date in question. So, Sam simply snitched things from all over the Bell System technology and slightly modified them and made the Model I computer.

HOLBROOK:
Did Sam do that?

DIETZOLD:
Sam did that, yes sir.

HOLBROOK:
He got started before ...

DIETZOLD:

Oh yeah, the man that made the Model I work. Stidets[?] probably could have designed the Model II but he couldn't have designed the Model II without the education he got out of Model I. He was going to school with the old master.

HOLBROOK:
Very interesting.

DIETZOLD:
Now the Model I did not include a good many of the things that George wanted in it because of lack of money and time.

HOLBROOK:
Is this the $15,000?

DIETZOLD:
This is roughly $15,000. I won't give you that number positively because I cannot find the actual number in our dollar books, but it was something like that.
Now, the MOD II, III and IV were all built essentially without Stidets[?] help because Stidets had gone to the MERC(?) by then, but I think Sam Williams was on all of it.

HOLBROOK:
That's when Andy came in.

DIETZOLD:
Yes, Andy came in on one of these. But these were considerabl[y?] more astute than Mod I because the success of the Mod I had told us that what Stidents[?] had originally envisioned would now be useful, since the Mod I worked. One other thing about Mod I, I should say is that Bell has a laboratory experiment, and because of the lack of money ...

HOLBROOK:
Where did Frey go? On Mod I, he got that up.

DIETZOLD:
He got money. The Mod I was still built without the normal safeguards that Sam Williams would have put into his central office equipment. It didn't have contact protection and things like that. We can't afford ... All we're trying to do is find out whether it should actually calculate on relays. You can't afford all this nonsense, see if it works. Unfortunately, it worked. It was hell to maintain because there was no check as to whether anything was wrong or right. And nobody but Bill Malthaner could

maintain it because Bill had a sort of rapport with the second world that enabled him to make guesses that nobody else could.

MERTZ:
There are people like that. It's interesting.

DIETZOLD:
And he couldn't tell you now how he did it, but he could. But anyway, later in the war the difficulty was, this was developed as a laboratory experiment just to see if it would work. Then, if it worked then they would redo it with contact[?] protection and a lot of things they had to put on this model. Unfortunately, the war came along just at that point.

Then a lot of people working--I guess some of them for Bob, and some of them for the network designers and some of them for Nyquist and God knows who-all--insisted that they had to have the thing all the time. I remember two-thirds of the way through the war even Malthaner botched(?). At this point we tried to see if we could re-equip it to do relays but we [we?] didn't have enough priority to get the relays. Fortunately, the telephone companies had been in the same problem and Western Electric had developed two very nice little hand machines, one of which would strip the precious metal contacts off the springs and the other would weld new precious metal contacts on the same springs.

HOLBROOK:
Platinum alloys?

DIETZOLD:
Well, they are always precious metal alloys. We quickly glommed onto these, and we took the thing out of service for about three days and we took every contact off every spring and put new contacts on every spring and with that we managed to last out the war. But if the war hadn't come on, undoubtedly the success would have resulted in a redesign of it, which Sam Williams was perfectly competent to do just off the top of his head. All of that he could have put on, but he didn't have the money to do it since this was a laboratory experiment. If the war hadn't come along, we wouldn't have had all this trouble. But the succeeding machines, II, III, IV, etcetera, all had the things that we knew ought to be put on for central office use anyway.

HOLBROOK:
I think this is a very good example of how you convert technology and know-how to new purposes. I know this is no way to do computing, but this is what he knew how to do and we did it.

MERTZ:
There is a parallel in an entirely different field. That is when a decision was made to put a man on the moon, the technology was there.

HOLBROOK:
Well, in sight, anyway.

MERTZ:
Well, in sight. If it wasn't already in existence, it was well in sight. So it was a matter of putting together a new way.

DIETZOLD:
You adapt the most of what you know how to do, convert it quickly, get off the shelf into the field, and by the time you're finished you see a better way of doing it than that. This is the whole experience of the telephone company. By the time our people have labored and sweat[ed] and practiced and tested in getting a new communications system into th4e plant, they always knew how to get through much better.

MERTZ:
There is a parallel. Maybe such a thing exists in the difference between the labs and the manufacturer, Western Electric, in the early days of the air defense system the Air Force is responsible for. They wanted to pattern a computer after the [?] and IBM was the prime contractor. They designated only one engineer to be the contact because they hadn't gone into production. The reason why they did this, as I understand it, was because they didn't want every MIT engineer to play around with new ideas on how to improve it. They would have never produced a piece of equipment at all.

HOLBROOK:
This is a matter of discipline. The Bell Laboratories in the first ten years has established branch l laboratories in half a dozen Western Electric plants at least so that there are people at Allentown or at Indianapolis or near Hawthorne who may not have participated in the early development but know somebody at Hondall or Murray Hill or Whippany[?] whose phone number they know that they call up and say, "What would happen if we let Western do so-and-so?" I guess it was about 1955 we started doing this, wasn't it Bob? At at least half a dozen Western Electric plants we have a hundred to three hundred[?] people.

DIETZOLD:
In the military before '55.

HOLBROOK:
Yes, with the military. Anybody in Western, in that place, not a routine production man, but a fellow who was trying to get something into production, knows three people locally that he can get on the phone and each of them knows twelve or fifteen people at some place in New Jersey whom they can call and say "What would happen if....?"

MERTZ:
So, he gets some feedback.

HOLBROOK:
We have to; we couldn't live without it. We couldn't have set up WEstern in the manufacture of transistors on a routine basis without doing this.

MERTZ:
Incidentally, you might just for the record like to describe the joint panel that you welded.

DIETZOLD:
I'd like to comment on the IBM SAGE effort because I was commanding the Laboratories' contribution to this. The semiautomatic ground environment scheme was promoted by the Lincoln Laboratories was a succession of disasters. Failures by this contractor, failures by that contractor. Western Electric Company was given the mission of coordinating all this. They called it systems engineering so the Philco computer would talk to the IBM computer and the Corps of Engineers had the air-conditioning in, so the Philco computer didn't go 'puck' and this sort of thing. And I would say that the decision and you required [?] the IBM people had taken worked out exactly right. The computers that got on the job were the most trouble-free items in the whole system which was complicated beyond imagination. No service had ever tried to get anything like this done before. Of all of the things that they went through, the IBM things were the least. Also, they were most rapid press [?] I mean, IBM would have just loved to have up-dated ... I mean the displays. The men could catch on to them after years or months of training. They were complex. I don't know how you win. You can play it safe ...

MERTZ:
Obsolescence is attached on ...

DIETZOLD:
Obsolescence is always a problem. The telephone company has had to live with it since 1876, I guess it was.

HOLBROOK:
We served in '76?

DIETZOLD:
That's when Bell got his patent. Maybe it was '75, I don't know. Well, the Laboratories didn't. Since no later than 1880, there has been an obsolescence problem in the Bell System. It gets worse rather than better and it's going to keep on getting worse, and this is something we have to live with. You have to build the Bell System so that it would be the least progressive company and will not fall on its face when a most progressive company puts in a later improvement. You have some men to build a fire under the least progressive company, but you may have to go around and build a fire under two of the service commissions at the same time. This is something the Bell System knows how to do.

HOLBROOK:
They didn't exhibit it in New York.

DIETZOLD:
Not always. The New York company is in trouble. It is in trouble partly (and for God's sake don't tell them because they might cut off my pension) for three reasons, one of which is that the New York company has got too large. The second one is that the New York company did not believe that the panel Bell system would last this long and consequently the equipment has lasted longer than the maintenance men. All the maintenance men who knew how to fix the panel have now retired and, they hoped they would get rid of the damn stuff before this happened, and it's very difficult to train people how to maintain something which was designed in 1920.

HOLBROOK:
You said 1916 and 1917.

DIETZOLD:
Well, the first panel in New York was closer to 1920; I don't know exactly when. The first panel in the United States was put in in Wilmington Delaware, Newark New Jersey, and Omaha Nebraska, between sometime in World War I and about 1920. I don't know the exact dates any more than that. The New York company obviously expected the panel to be replaced by something else before their last maintenance man who knew how to fix it retired. Unfortunately, the growth of their requirements prevented them from doing this and the guys over here weren't looking at what the problems of the guys over there were worrying about, so they didn't train any young fellows to maintain the damn stuff. The third problem is that they used classical methods of anticipating the load which did not include having spies in architectural offices to note that the architects were now designing office buildings so that 65 square feet per person would be adequate where you used to use 110 square feet per person.

Also, they didn't believe a guy by name of Holbrook who told them that they would have by 1970 more damn daily communication business than they thought was possible in 1965.

MERTZ:
They can't turn business away either.

DIETZOLD:
You can't turn business away. This is why if you have money to spend you have to provide service. This why ATT is issuing bonds at 8.75% and New Jersey at 9.35%. They are not in the position that [?] General Motors. A public utility, a telephone company, a power utility, has to provide the service people want, whether it is to their advantage or not. They've got to do it, or they will have more people like your friend Cox champing at their heels.

MERTZ:
There is a parallel, to get back to a computer I'm familiar with, a WHIRLWIND computer which is closed now in Massachusetts. It was shut down about eighteen months ago and one of the interesting things are that to get people who know about vacuum tubes first generation high speed electronic digital computers of 20 years ago is probably very much like trying to find people-- trained maintenance personnel. It was put in in 1950 and you literally cannot find computer technicians today.

HOLBROOK:
You know, over a good many year I used to get a lot of mileage out of the fact that when a new employee came to work for me I could tell him that I used to work for R.B.L. Hartley, who invented the Hart Vascillator, who incidentally died about six months ago. The last five years I was at the laboratories before I retired, I found to my amazement that when a new employee came in, and I told him about Mr. Hartley, he would say who in hell was Hartley. This happens in all fields. You were asking some questions about correcting coding.

MERTZ:
Yes, I thought that was an interesting example because I don't know if it's the first but it was a very early example of whether or not a code could be patented.

HOLBROOK:
Well, the first example I know of of equipment being patented is my own patent on the two-out-of-five code which is used all over the Bell system, and I insisted to the patent department that they could write claim claiming for any fixed-count code that had these as part of it, and they did.

DIETZOLD:
The two-out-of-five patent has also elapsed.

HOLBROOK:
Oh, yes. All my patents have expired by now. I'm getting to be an old man. Your patents have expired too, probably. But mine have all expired. The two-out-of-five code has been used and the circuitry has been patented in connection with the centralization of step systems in Los Angeles.

MERTZ:
About when was that?

HOLBROOK:
This would be about 1938 or '40. The problem is this. Step-by-step systems have two problems. One of them is that from every switch you have exactly ten outputs, whether you need three or thirty. This made sense in 1939[?] but not recently. The second difficulty is this. The exact digits the subscriber dials for the office code, if you don't do something about it, control the assignment of trunks all the way to the desired office, whether it makes any sense or not. This runs into the fundamental mathematical theorem which I don't know the name for, which is that you cannot map a two-dimensional continuum on a one-dimensional continuum and maintain contiguity.

DIETZOLD:
Well, one dimensional continuum isn't very much dimension.

HOLBROOK:
OK. Well, let's take a problem. If 836 points to Pasadena, it points to Pasadena whether you are in Santa Monica or Santa Ana. OK? These are the two great problems with step-by-step.

DIETZOLD:
Of course, I think it ought to be mentioned that even though this lousy [?] step-by-step thing has been the solution of the problems of the telephone company. We used a hell of a lot of it in these little bitty places.

HOLBROOK:
What [?] designed it for, it's ideal. Well look, they had to put translators into storage of step-by-step years and years ago to solve their running code. Now Bell system had enough sense to look at the problem before they equipped large cities with step-by-step except in the case of Los Angeles. Now Los Angeles was a place where the Bell system and an independent both had large amounts of service. The Bell System, unfortunately, bought the independent, just before Los Angeles started to bulge at the

seams. As a matter of fact, Los Angeles from 1918 to 1925 was the only place I know of (there may have been places since) where the local telephone company was ordering central offices without knowledge where the hell they were going to put them, until Western Electric delivered them. Merely because the city was growing so bad so fast that they knew they would need an office somewhere and by the time Western told them they were delivering, they were putting it on the freight cars, they would f figure out where the hell to put it.

Essentially, this was the trouble with step-by-step, and this is why we developed an [?] panel and later crossbar. As I mentioned earlier, particularly crossbar systems are very good examples antedating the computer era of where we used, not table-driven compilers but table-driven XYZ and W to get the calls through from here to there. One thing now, I would like to go back a little bit, the Bell relay computers, and point out that our experience with the Bell relay computers was an essential part of our decision to mechanize subscriber billing. That was about 1950. The Bell System had to get out something (and my numbers are rough) between fifty and sixty million subscriber bills per month. By 1960, we would have been deluged if we hadn't mechanized it, and in 1948 we started recording data on pertinent calls in the central office and delivering to accounting centers and putting it on the subscriber['s] bill. This depended almost entirely on what we knew about the Mod I, II, IV, V computers. Without that, Bell System would have gone up the flue sometime in the '60s because we couldn't possibly have collected our revenue.

At the present time, any time since 1950, the Bell System has had as many accounting clerks as the average operating company has had operators.

DIETZOLD:
No. Well, I used to hear this, but I thought it was a joke. When was this from Bernie?

HOLBROOK:
Any time from 1950 this has been true.

DIETZOLD:
Up to now?

HOLBROOK:
Up to now.

DIETZOLD:
Aren't they mechanizing any?

HOLBROOK:
We are mechanizing on both sides. I don't know about the present figure, but at the moment the Bell System has within a few thousand, about as many operators as we had at the peak. No matter how we mechanize, the business grows so damn fast that we still have to furnish operators for the things we haven't been able to mechanize yet.

MERTZ:
What you really strive for is to maintain a constant ...

HOLBROOK:
Well, if we can stay even that's par for the course. Bell System started turning from operator service to dial service as a policy in 1924 or 1925. The peak number of manual subscribers we had was since the end of World War II, 1946 or '47. The peak number of operators (and I haven't looked in the last few years) but up until then the peak number of operators was around 1955. It may have gone higher again since then. Now this is the best we've been able to do. The Bell System decided in 1924 or 1925 ...

DIETZOLD:
Only two thousand operators out of a million employees?

HOLBROOK:
Wait a minute-- Only two thousand, hell --

DIETZOLD:
Well, 1955 was the year? All right.

HOLBROOK:
We had six hundred thousand, or thereabouts by then. Now we then dipped slightly, and I haven't looked since, but I suspect we now have more operators than we had in 1955.

MERTZ:
To inject something that we discussed earlier but not recorded: handling was not considered passable?

HOLBROOK:
Oh, it was considered passable. I considered it passable.

DIETZOLD:
Not by me.

HOLBROOK:
Before we heard from Bob, I got Hanning's men off and I said to my boss--who was Arthur Hartman at that point--"Somebody ought to draw up a circuit for this so we could patent it." Arthur said, "Sit down and draw it out, damn it." So, I did. That was that. This is the difference between me and Bob Dietzold. Anyway, I got my name on the patent although it didn't do me a damn bit of good because Hanning comes before Holbrook in the alphabet. Worse luck (and this I will confess only to you), when the drawings came out, I looked at them and they looked all right so I signed off on them and the US Patent Office granted this patent and we then applied for patents in X foreign countries, and the first patent office came back and said there is a mistake on your damn drawings. So this appears as a re-issue patent. Holbrook didn't find it, the patent attorney didn't find it, and obviously Dick Hanning didn't find it. Since then, recently I dug up the old patent and I got the re-issue patent and I spent an hour, and I can't find the difference between them. So, something is wrong because I can't find it myself now, but anyway that's what happened.

DIETZOLD:
Look over this list and see what else you have. Look at the second page and see whose names I've given you.

MERTZ:
One thing I would like to touch on very briefly is the area of ... There have been a few people who kept diaries, personal correspondence. Do you know somebody named Palmer?

HOLBROOK:
I do indeed.

MERTZ:
He kept a diary which is quite interesting. I have been told this is the case; I don't know. We're interested in computer documents such as diaries, correspondence, etcetera.

HOLBROOK:
Do you know where to get hold of Alex?

MERTZ:
I don't have anything down here.

DIETZOLD:
He was very close during the war to a British mathematician, who-- Turing. You're ahead of me all the time. Well, that gives you an idea

HOLBROOK:
Who was this?

DIETZOLD:
Alex Fowler. Fowler is the man who worked on what Bell called generally security systems during the war. He introduced me to Touring and introduced him as "My young numerologist."

HOLBROOK:
Touring is dead, isn't he?

DIETZOLD:
Yes.

[THERE MAY BE SOME EXCHANGE MISSING HERE]

DIETZOLD:
Turing, Alexander D., 445 Vreeland Avenue, RD 1, Bloomington, New Jersey 07005.

HOLBROOK:
He was interested in computing in a very special way. He was a cryptologist rather than a cryptanalyst, if you know the difference. Cryptologist is a man who devises names which nobody can possibly question. A cryptanalyst is a guy who knows the cryptologist is wrong.

MERTZ:
Sometimes you get the same person.

HOLBROOK:
Alex was a cryptologist rather than a cryptanalyst. I will explain the whole thing by pointing out that sometime during the war, I was approached by some cryptologists as to how to use your distance noise to generate code.

DIETZOLD:
Who was that, I was in on this?

HOLBROOK:
Well, that was Bob Mathis, actually. I did a little thinking and came up with something that startled him badly because he hadn't realized that you had to look at the integral and not the function itself. I told him how to do it, and about nine months or a year later a guy who was working for him came around to

see me. I was working on something totally different. He said, "Here are some numbers and Bob Mathis said you should tell him whether these are random or not." I said, "How the hell would I know?" He said, "Well, Mr. Mathis said you are the man that should tell him." So I looked at them and then referred him to John Reardon.

DIETZOLD:
Walter Schubart was the specialist in this.

HOLBROOK:
I didn't know that. I only knew enough to send him to John Reardon. This was ... I had since had some experience in cryptanalysis but at that point I hadn't. The laboratories did a good deal of work in both fields during and after the war, and nobody will admit this.

DIETZOLD:
I think we ought to drop this. Technically, everything we have said we're sure is declassified by now.

MERTZ:
Well, if I may just for the record assure you that according to the director of National Security [subject needed] has in fact declassified the historical study and publication.

DIETZOLD:
Anybody knows that the laboratories must have been in this and by and large I don't know who the people were. I know two or three people that were connected with it, but I don't know who did what at all, because I was not concerned with it.

MERTZ:
One of the interesting problems that is raised in engineering design is the selection of randomized generators to select random integrals.

HOLBROOK:
I think perhaps I was one of the first people to do anything with this and you won't find it in the records because nobody could write it down. I observed to somebody, probably Bob Mathis, during the war that…

DIETZOLD:
Was he bright?

HOLBROOK:

Oh, God, yes. Bob Mathis, for the information of both of you, was my boss for a good many year and it was well known to the smarter people who worked for him that when you got in a conference with him he would obviously go to sleep as soon as you started talking, but you shouldn't count on this because when he woke, he would automatically ask you the one question that you had been hoping he would not think of about what you'd been doing. He was [an] extremely smart guy.

MERTZ:
This seems to be a trait that runs among some people because I remember Weir during World War II, 1944, being at Princeton at the Institute on shock wave theory which related to shape, he had the habit of falling asleep at conferences. The main building of the Institute has a large lobby where we sat, and there was a man presenting a paper and he had a very soft voice, and Weir's snoring drowned out the voice, but no one had the nerve to wake Weir up and make him stop. After he finished, Weir asked a question which was right on the subject.

DIETZOLD:
You mean Norman Weir? He would.

MERTZ:
That meeting was attended by Einstein.

HOLBROOK:
Bob Mathis was an extremely intelligent man who could filter through his sleep anything that sounded like nonsense that belonged to anybody who was working for him. The problem was presented to me as to how to use resistance noise to get random numbers. Unlike anybody else who was concerned with the problem, I read something or other--I can't remember what--and I pointed to it that you take the integrated spectrum of the resistance noise and divide it into N sections and then use the section point to determine where you stick such and such digits. This was quite an interesting problem in 1941 or 1942. It is now trivial.

MERTZ:
That particular problem I think is applied to another case. It was raised in the question of data retrieval.....

END OF TAPE II, SIDE I

START OF TAPE II, SIDE II

HOLBROOK:
I found that from 1880 to about 1888 there were annual meetings of something called the National Telephone Exchange Association. Now it took me months to find this, but now I have it. This leads to the very interesting observation that the Bell System was the first example of large-scale franchising in the United States. No kidding. Bell and his partners didn't have enough money to promote the thing. They issued franchises to people all over the country to run local telephone systems. They told them that they knew how to provide for all the services. They had the telephones and they knew what the telegraph companies had in the way of telephone-telegraph lines. They didn't know a damn thing about how to do telephone switching.

From 1880 to about 1888 there were annual meetings of something called the National Telephone Exchange Association. After a good many month of butting my head here there and somewhere, I found the reports of these damn things, their annual meetings.

DIETZOLD:
How did you ever get those?

HOLBROOK:
I kept reading things until I found some and finally I went to the Engineering Society Library and found they had a complete collection of them. Just in the last two -three months I Xerox copies of the first ones, and I think I have now put together the history of the telephone switching from the time of Bell's patent until about 1890. It's very interesting because they ran into--in the early 1880's--a certain problem we still have now, and they adopted essentially the same solution but on a very much smaller scale.

DIETZOLD:
Blocking?

HOLBROOK:
Blocking, sure. They had things called transfer tables which were really nothing but these intermediate offices between offices, tandem offices although they were still in the same room, you see. Things were very much smaller in those days. The devil of it is it takes months and months to run references which will lead you to what you really need to know about these things. I don't know the answer to this except trying.

DIETZOLD:
You might write down on your address list a mathematician with the Laboratories, contemporary of mine or maybe a little bit earlier, who was Lt. Campbell in the American Company.

MERTZ:
Is Nyquist still with New Jersey Bell?

DIETZOLD:
No.

MERTZ:
Who became Vice President of New Jersey Bell who was active in the very early years [of?] the system.

DIETZOLD:
Nyquist is a real old-timer who was one of the people of the Laboratories who had not a great administrative responsibility but who was trusted by the high management as an advisor.
[Dietzold requests that the recorder be turned off.]

HOLBROOK:
This fellow worked for our Laboratories until about a year or so ago and then quit to work for some other company.

DIETZOLD:
Hiram Foster, Jr.?

HOLBROOK:
He was R. something Foster. That's all I know.

DIETZOLD:
Look up R.M. Foster, Sr.

HOLBROOK:
I know him.

DIETZOLD:
Lives in Westfield or thereabouts. I mean, if you're really looking for people who keep the records.

MERTZ:
There are a number of things which you don't find in the Bell Labs' archives. Like diaries, etcetera. Such things for example as visits by people, somebody comes to see what you're doing. This is very important in the early people.

DIETZOLD:
R.M. Foster keeps records, papers. He has a file of references. Also, he knows quite a lot. He was George Campbell's man. He wouldn't like me to say that, but he was. There is an interesting thing I might say. He wrote the paper--I think he called it a Network Theorem--which was the most celebrated paper that ever came out of the Bell Telephone Laboratories. He was working for his boss, Campbell, and he took the paper up to Campbell and Campbell said, "Hmmph, I mean after all isn't this pretty obvious?"

HOLBROOK:
This was before he was a telegrapher at D and R at ATT. Campbell never appeared at the Bell Laboratory. He was on the payroll ...

DIETZOLD:
Not until later. Then, after all, Campbell said, "Oh, Jesus, you publish a paper but cut this out, cut this out, cut this out." So, it came out in a little 5-page paper which has been the greatest thing that ever came out of [on?] the network theory from year One. Ronald M. Foster put down by George Campbell.

HOLBROOK:
Let me diverge for a minute. George Campbell also invented (and this is all hearsay, I warn you) the [?] telephone circuit. Campbell got the patent on this. The [?] telephone circuit depends essentially on the use of Wheatstone Bridge somewhere in the works to separate the subscriber's receiver which is on the line. The story I recall is that the patent department then said, "And how many versions of this are t here?" and Campbell made a quick calculation and "Oh, several thousand." The patent department will need all of them. So Campbell disappeared for several weeks and came back and went into the patent attorney's office and deposited a shoebox full of cards and said, "Here are the first sixteen hundred of them." And the patent attorney said, "How many more are there?" And he said, "About four thousand."

And the patent attorney said we had better look at this a little more carefully. The patent department then found out how to write a claim that would read on more than one circuit at a time, which, incidentally, reminds me that a patent which I got in 1943 I believe--two-out-of-five code--our patent department insisted that I had to write the damn things in terms of the actual contacts on all the actual relays. I said, "But, my God, I can't possibly explain it." They said, "Well, draw it up that way and we will explain it." So I drew it up that way and in effect, in fact, issued instructions in how to explain it. I

sent it to our patent department and they said--after several weeks--we can't understand what the hell you're talking about. I said, "Well, that's what I told you." They said, "Well is there any other way to do it?" I said, "Sure, the way I told you in the first place, which was to do it in terms of Shannon's detached contacts." They said, "Well, there might be something to that." So, I got a patent in which there was one drawing of the thing on the actual contacts on the actual relays. The whole specification read in terms of a detached contact specification, and I think I made great progress for the United States Patent Office, and beat the hell out of our patent department.

MERTZ:
Let me ask one thing in relation with your own historical research into the Bell Labs. Do you think it's possible to delineate a number of scheme documents that you think would be essential to be included in a national collection associated with the history of American technology and computing insofar as Bell Lab's contributions.

HOLBROOK:
This is a little difficult because Bell Laboratories sprang into being suddenly with no forewarning on the second day of the second quarter of the twentieth century: January 2, 1925. Essentially, this is the same organization which was called the Engineering Department of Western Electric Company on [the] 31st of December, 1924.

MERTZ:
In terms of personnel.

HOLBROOK:
Personnel were identical. The personnel didn't change essentially until 1932. The Development and Research Department of ATT Company joined the Bell Laboratories in roughly 1932, and didn't help much. Of course, I'm prejudiced.

DIETZOLD:
You say it didn't help much?

HOLBROOK:
Not a hell of a lot.

DIETZOLD:
Att coming? Oh, God, it revitalized ...

MERTZ:
You were part of the original parent, ATT

DIETZOLD:
It brought us into the Bell System. that's what it did.

HOLBROOK:
OK. Slight difference of opinion. But anyway ... They brought the laboratories more into contact with reality.

DIETZOLD:
OK, we've got it now. Didn't you come ...

HOLBROOK:
No, I didn't. I came in 1930 with all the Bell Laboratories. I never worked for ATT.

MERTZ:
Where did you train before that?

HOLBROOK:
I worked as a graduate student under Dr. Compton at the University of Chicago, and theoretically, he was a physicist. Arthur Hulley Compton. He was a great man who later turned himself off by specializing in giving lectures to women's clubs.

MERTZ:
About God and the universe.

HOLBROOK:
Yes. As a matter of fact, I took some graduate school courses under A.A. Michaelson when I was a graduate student.

MERTZ:
He and I, I imagine have both been exposed to the same gadget. I took a course in physical optics in which I used the [?] at the University of Chicago. I was there in the late '30s and early '40s.

HOLBROOK:
I was prior to 1930. Michaelson was then dead.

DIETZOLD:
He was a greater man than Arthur Compton.

HOLBROOK:
I was trained as a physicist until I came to Bell System; and I thought I was a physicist, and now I know I'm not. Bell Laboratories, it hasn't really changed very much since it absorbed the D and R Department in 1933 or '33[?] It has had the advantage of being under the control of people who were extremely persuasive people at 195 Broadway is telling them that they knew five or six directions in which the picture was going to develop, and we better be hep on three or four of them. And on one or two of them they were right. Is that a fair estimate, Bob?

DIETZOLD:
I would say so.

HOLBROOK:
Very few industrial organizations who can say that, and most of the other company's [companies'?] residents haven't had that much competence in their research records. Fortunately,--not Arnie but the next guy--Jewett, Buckley, Kelly and Fisk have been people who have been (a) extremely competent, all of them; (b) extremely good salesmen to the kind of people who are vice presidents at ATT. I don't know of any other organization with which this is true.

MERTZ:
One question quite apart from the history of computing that does interest me, the current involvement of Bell Labs. There are two items of more or less current interest which I'm sure will be of interest historically. One is the appointment of successor president to De Bridge, the Scientific Advisor to the President, to lead Bell Labs.

HOLBROOK:
Ed David, who was my boss when I retired.

MERTZ:
The other is the statement made that Bell Labs, after the ABM project has reached its fruition, they will no longer accept defense related projects.

HOLBROOK:
Let me put in my two cents' worth and then turn you over to Bob. Ed David is one of the most competent men on the place. He worked for me for a couple of years, and I worked for him about five

years before I retired. He's an extremely competent man and an extremely sharp cookie. I regard his appointment as a very good thing because he is the first man who has had the specific title of Scientific Advisor to the President who has not been a college professor; which I think is, by and large, a good thing. Many of the people who have had this title have been extremely competent people, but they have been one step further removed from the actual nastiness of engineering development than Ed David has been. I regard him also (and here you might want to do some censoring) ... because this is a step forward in another direction ... and that is that I recall that in 1960, when Nixon was running against Mr. Kennedy, one of the things that distressed a great many people in my position was that he had appointed a certain gentleman-- located somewhere between Camden and Princeton--as his scientific advisor, who knew as little about science as any local professor of Latin. The gentleman was later a general, I think, connected with RCA. I don't think Sarnoff knew what the hell he was talking about most of the time on science. He was [a?] very able man in several fields, but not including science.

The second thing with regard to small laboratory's general detachment from the military research area: we had to do this in 1938-1939, 1940. Bob may disagree with me and may want to enter a rejoinder, but since 1950 I have always thought that Bell Laboratories ought to sooner or later get out of this, on the ground that in certain fields of communications--radio, things of that sort--the Laboratories had a professional commitment to do research and development for the US Government. But it seemed to me (and I should point out that I was a member of the original team that sold the NIKE system to the US Army) for something like fifteen years, that there are people at least as well qualified as Bell Laboratories to do this kind of work, and we ought to be in the business of communications with 2-3 [?] quotation marks around it, and shouldn't be wasting the time of our extremely competent people in things that were not specifically communications. Do you want to argue with me, Bob?

DIETZOLD:
I wouldn't argue with it the least bit. I buy it one hundred percent. I think we've got it done.

HOLBROOK:
We have done what we can do that other people can't do, and let the other people do it and let us figure out how to do communications in the future. (Have you got that shut off? Shut it off.)

[END OF INTERVIEW]