Computer History Museum

Interview of Art Wilkes

Interviewed by:
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Art Wilkes: American Data Systems was founded when Bill Norred showed up on my door with his wife and said we were going to found a company, and "let's get to doing it."

James Pelkey: Did you call him beforehand to tell him about an idea?

Wilkes: Well, we talked about it on the phone intermittently for six months or so, and he had recently gotten married and was interested in founding a company, and I probably had some technology spotted. We just didn't really have any money to start with.

Pelkey: He said it was your idea.

Wilkes: That the multiplexer was my idea? Yeah, the first multiplexer. I had been at AT&T --

Pelkey: You went to school with Bill at --

Wilkes: At Texas Western. I had been at MIT and then at Reed and then the Air Defense Center at Fort Bliss, and I got a relatively full scholarship at Texas Western to finish off my education there. I was a dorm counselor and I graded papers, etc.

Pelkey: What year was this?

Wilkes: I was trying to think what year I got out of there, but I think I got out of there in -- my guess is '64. No, it wasn't '64 -- yeah it was, '64.

Pelkey: You said you had been at MIT as well?

Wilkes: Out of high school I went to MIT and I went to Reed. At Reed I had my tuition paid to play basketball there, most of it, which was kind of a strange relationship, but Reed was not a place where I was real happy. I went into the service and I went through the missile schools at Fort Bliss, which I liked -- the electronics -- and I liked what I saw there. Then I went with AT&T out of school on their executive training program, and I ended up in maintenance and accounting and in radio engineering and in telegraph, and finally my last job with them was sales manager to the financial industry on the west coast, stationed in Los Angeles. One of my accounts there was an account called Quotron, or Scantlin.

Pelkey: What was it called at that time?

Wilkes: It was called Scantlin Electronics, and Scantlin Electronics had done some interesting things. First off, I sold them a million dollars worth of communications each and every year -- a hundred and some odd thousand a month to go to their customers.

Pelkey: And what kind of communications were you selling them?

Wilkes: Basically, I was selling them lines; in other words telephone lines and telegraph lines, to service their new Quotron machine that they were just putting in all over the United States at that time.

Pelkey: Were they putting modems in as well?

Wilkes: They had modems. They had Bell modems.

Pelkey: 103s?

Wilkes: No, they were 2400 mainly; 201Cs and Ds, and they started putting in a multi-point multiplexer when we got the multiplexer barrier broken down with AT&T and the FCC. This was a frequency division multiplexer.

Pelkey: AT&T was building it?

Wilkes: No, RTL was the company that built it.

Pelkey: I haven't heard that name since my first interview.

Wilkes: And Scantlin bought these modules. They were reported to be really a great module.

Pelkey: RTL was in Boonton, IL or something?

Wilkes: Yeah, someplace. They built filters.

Pelkey: So Scantlin -- S C A N T L O N?

Wilkes: T L I N -- was founded by Jack Scantlin, probably one of the most inventive guys that's ever crossed the area of this business. You look at Citibank -- they funded him next, and he was in a smart-PBX business and he was in a desktop publishing business and he was in one other big business real early on. Citibank took three of those. At Scantlin there was an argument between Vance Holdem and Jack Scantlin. Vance Holdem was out of Dresser Industries and had been backed by the Rockefeller Group. They didn't really get along and to somewhat bridge the gap, I was hired by Quotron then to come in and to learn communications and to take their Quotron system and factor it for sale. Now, the problem is that --

Pelkey: So you left AT&T and went with Scantlin?

Wilkes: Yes, and I had a particularly successful last year at AT&T, where I had taken the financial sales new business up by one to two million a year over the last three or four years, then all of a sudden we did eight and ten two years running, and there just weren't any raises available.

Pelkey: Now this is --

Wilkes: This was all up and down the west coast. AT&T worked through the associated companies, and the way that paid was on the yearly -- the way you got your sales were, if you sold a new long distance service you got a year's worth of revenue, and that was counted as new sales, and then after that it was defending. What we did is we took the transient money -- Transamerica -- there were three of the local loan outfits headquartered on the west coast at that time, and they were mailing their money back and forth, and I set up a telephone call-the-money sequence, which made them a lot of money and which made AT&T $10 million a year on what's called 'plain old telephone service.' Having done that, I thought that I should be promoted, and indeed was offered a job at Bell Labs in the radar, the microwave area, where I was a recognized sort of expert.

Pelkey: So did you go back to Bell Labs?

Wilkes: No, they turned it down for me at that sales office because my boss had promised all the Pacific Bell people he'd hired in that he would get them out of there or promoted before he did anything for the new jet on the seat, and I had been there nine, ten months or so.

Pelkey: Now, what year was this?

Wilkes: I don't have a year on that. I can get you a year for that, but that's about -- I had been with Bell about four years then, so I would say --

Pelkey: '68?

Wilkes: Actually, I must have got out of school about '61, '62, and then I was with Bell about five years overall, and I was the last one in my jet class to leave, and I had had a promotion between every six and nine months that I had been with them. I went to an executive search firm to get a value on my services.

They said that I was at least -- should be paid at least double what I was making, and maybe triple, and Scantlin offered my two and a half times my salary at Bell in order to convince me to move over there.

Pelkey: Do you recall what year that was?

Wilkes: No, but I will get you those dates. I'm a little skimpy on the dates.

Pelkey: Help me understand -- there was 2400 bit per second leased- line.

Wilkes: Right.

Pelkey: That was the top of the line.

Wilkes: That was it.

Pelkey: And in the commercial sector, there was only AT&T.

Wilkes: That's right.

Pelkey: On military and so on, there were a few people --

Wilkes: Just a few. Rixon, Milgo maybe was there at that stage, but very, very low-level stuff. There just wasn't any development there whatsoever. Indeed, the financial service, when Jack put out that national financial network, other than the Sabre System that American Airlines had about that time; that was the only national long-line system.

Pelkey: Did PARS exist at this point?

Wilkes: PARS was --

Pelkey: TWA.

Wilkes: No. Sabre was the first one that I knew of, and it had just been up. Indeed, IBM had all the pieces. They were very fragmented and not organized very well, and some of them were built in far-away places, such as Australia, etc., and it was very hard to get changes. If you wanted the modem to switch back to 2400, you had to get the instructions from Australia, and they'd come out with a wire-wrap gun and change the speed of it. So AT&T just won all those battles at that time.

Pelkey: What was pushing data at 2400 bits a second at that point?

Wilkes: Basically, the inquiries to the stock market. Airline reservations --

Pelkey: But it was all teletype machines mostly that were the nodes, weren't they, which were 150 characters per second?

Wilkes: They were 75 baud, which was ten characters per second, because they had the five bits per character at that stage, and a 1.42 bit stop bit, which led us into all kinds of problems with the early multiplexers. That stuff we started with was a disaster.

Pelkey: So why, at that point in time, would anybody have bought 2400?

Wilkes: Because we were starting to get some concentrators. IBM was starting to put concentrators in places where they could concentrate their video stream. There were a few multi-screen things at that point in time, and IBM had the first decentralized, but Jack Scantlin had built a concentrator that would concentrate up to 150 local consoles onto a 2400 bit per second line, and this was the most remarkable thing you've ever seen in your life.

Pelkey: That was pretty innovative at that point.

Wilkes: In the first place -- well, he got started, he built the encrypter for the President's key box to tell him if there was a nuclear holocaust going to be there, and a very clever individual. When I arrived on the scene, what we were using was little inch and a half by inch and a half cards with a connector on them, and they made up a logic function. He bought his leftover transistors from TI, and he graded them and he dipped them in a thing. If they were fast, they got a red paint on the top of them, and if they were slow they got blue, and there was a middle color. So these would be matched on a little card with some resistors, and then there'd be a whole set of connectors on the master card. It's really a forerunner to a dip package.

Pelkey: Absolutely.

Wilkes: When I got there it was just absolutely amazing. I saw these things, and we had rooms full of these things with air going out the middle and all that sort of stuff. One day in LA, we had -- oh, we must have had 300 customers in LA on two of these things and two lines running to New York. The wind blew the top off -- we always had to have our stuff on the top of the building so that we could have the exhaust out the top. They were hotter than you could be.

Pelkey: These machines would run hot, huh?

Wilkes: They were sometimes 12 and sometimes 24 volts, but mainly 12 volts all the way through -- but it blew the tin off the roof where we had it, and then the rain came in, and we lost all of LA due to this thing. We had to go swipe one out of Houston, where we weren't selling very well. I think it was Houston where we swiped it out of. Flew it in, and had it installed the next business day, because every transaction was a quarter or 50 cents or something running through the thing, and we'd run a lot of transactions. It was a very efficient system, because it only needed three or four symbols in and then only about ten back out. The back out could be buffered, and it was a relatively efficient sort of item, and it only had one or two characters of buffer. Actually, when they got three characters of buffering in there, that was called a long module, and that was for a really busy customer. So, there was a structure in place, and about that time came the IC. TI was in the IC business, and there another company called Amelco that had a 12 volt logic that could just go in and replace these parts just straight away, and I figured that was going to be a big seller, but not Jack. He got -- we had a logic called RTL. It was a three dot high volt or six volt logic, just really noisy, and really unreliable -- just all kinds of things wrong with it -- and on each card you had to have a resistor and a Zener diode to regulate the voltage, and it was just hot as it could be, whereas the Amelco was 12 volts; it was twice as expensive, but it didn't need the Zener diode and it was cool. So, one of the things that we were doing at the time was trying to lower the cost of our stuff to the customers, and we built an in-house multiplexer out of these RTL units, and the idea came: "Well, there's a lot of telegraph in the United States. Let's sell them to the telegraph people." So, we put in the RTL and it didn't have a good enough distortion coefficient to handle everything, so he built a regenerator on it, and this product was all done. Now remember, this was a real reliable product. We had never had any come back to the factory for repair. Well, I went out with the first one of those products -- was going between St. Louis and New York for Merrill Lynch, and it was going to run ten lines on there. Of course, AT&T didn't like to see us encroaching in that business at all, so I got there and about half the modules fail, and I was all upset thinking we'd done something wrong, and the station manager said: "Oh no. Guess what, I've got a whole closet here full of those bad modules," and he went in there and we sorted and found modules that worked. It turned out that Scantlin didn't have any equipment return procedures. There was no way to turn it back into the factory.

Pelkey: Is that a true story?

Wilkes: Yes, true story.

Pelkey: So you sorted through this closet hold --

Wilkes: Yeah, they had a whole closet full of them, so I walked back in, and we took it offline. I went back in to see the president, the guy by the name of Vance Holdem, and I said: "Vance, you're not going to believe this" -- there was an executive vice-president whose name I can't remember who had been there a long time, and I said: "You're absolutely not going to believe this," with this guy in here. I said: "I've made my whole year's salary already," and he says: "What do you mean?" I said: "Do you know this company doesn't have a return equipment policy?" He said: "No." I said: "We can go, and we don't need to spend any capital next year, because we can pull everything back from the field and fix it, instead of running a factory." It was almost mean around that company for weeks. It was almost mean. They went out, physically took all the spares and everything from the field so they could figure out what they had in that company. Now, Vance had only been there about a year up to that, and he apparently didn't know there wasn't a method by which a guy could send it back.

Pelkey: You said "mean?"

Wilkes: Yeah, mean. It was --

Pelkey: I don't understand the expression. Intense?

Wilkes: Intense would be another sort of word, but intense sometimes is intense good, but this was all intense bad. It was just intense around there. Jack came flipping in around the door and says: "What do you mean?" I said: "You don't have a return policy. Those guys can't return them." Then I told him the story of the closet, and he goes booming off. Now, both of them are trying to blame the other and go in at the board level. That's what was going on. It was really hilarious. So I was there about --

Pelkey: Did you get them working at Merrill with the parts that you had?

Wilkes: They failed altogether too often. It was bad. We yanked it offline.

Pelkey: So that product, although you shipped it --

Wilkes: Yeah, we had it all the way to shipping. We didn't know that those things failed in our lab. They didn't have any of them fail. It was only when I got out into the field --

Pelkey: That you found out that they didn't work.

Wilkes: Yeah, not only didn't they work, they didn't work two weeks in a row. The guy was out there swapping his whole inventory out as he went, and it was partly that compatibility problem that was one of the things that the filter company had ongoing problems with forever. We finally talked to them and we -- there were some resistors that you changed to make it compatible with the various lines, and it was a real rinky-dink sort of thing when you really got down to it, but it was my first experience in a manufacturing company, thinking that I was going to take this nice product out and make all this money, and then I found nothing worked, I mean just nothing worked. So, I'm sitting there thinking I've made all this money and I'm going to get my option and all that sort of stuff, and the president told me that I hadn't done very well, and indeed they didn't have any more money. I thought I had saved them a whole bunch of capital expense, but to go on with the communications products, I said: "Well, alright." Bill Norred showed up about then. I said: "Is it alright if I leave with many of those concepts." He said: "Fine, as long as I don't have to pay this option," so that's how the multiplexer stuff came from. The 660 was a --

Pelkey: Now, when did you found -- Bill showed up, and something happened where he moved in with you?

Wilkes: Yeah, he and his wife came from Texas and they moved in; stayed in our lower bedroom, and we built the first 660 in the garage. My wife talked the attorney next door into funding it to the tune of $100,000.

Pelkey: Now, can you remember what year this was?

Wilkes: No, but I've got all those down. I'll give you a chronology, a time line, of this process. One of the good things is we got $100,000 from the attorney next door, the bad thing was that we ended up with him and his financial people. I thought they were good financial people; they were out of First LA -- one of the savings & loans in Beverly Hills -- and they should have had good items, but the time or two we had to sell the company, our balance sheet had problems with the auditor, and we couldn't get a sale off because of balance sheet problems.

Pelkey: CLB and IPO?

Wilkes: Yeah. Well, one IPO and one sell-off to another company that was interested. We were a bullet going up, and all of a sudden, we couldn't get our balance sheet -- well, I'm getting ahead of myself.

Pelkey: Going back, how long were you at Scantlin?

Wilkes: About a year and a quarter.

Pelkey: So you really saw that there was a market?

Wilkes: Oh, yeah, it was right there.

Pelkey: And a lot of it was the fact that people had all of these slow-speed devices, and if they could multiplex them to a the higher speed modem, they'd save all kinds of money?

Wilkes: Right. The other thing that happened when I first got to Scantlin is that Dan McGurk, who had been the other candidate for president when Vance came in, went over and became the number two man at SDS. SDS had the first real timesharing computers that were in that marketplace, and I knew that the 940, which was the master part of that, was also right into production or close to it. There was another company in downtown Los Angeles, who I will think of in a minute, but they were taking the IBM Model 360-50, and connecting 20 terminals on it instead of four, which was its capacity at its time. That was called an incremental compiler. There's an interesting story associated with them. I don't know whether it's true; I've heard it a number of times, but I was never quite sure. There were these three guys who started that company, and there was a lady there, and she was a very wealthy lady, and they flipped coins to see who was going to marry her to start this business. They did a tremendous job, but pretty soon they all got kicked out of there, I think as this story leaked out, and we ended up with two of the people out of there at American Data Systems, but you could see the development of the IBM and of the SDS timeshare computers coming along.

Pelkey: So there was timesharing going on at that point?

Wilkes: It was just starting, and you had to be very close to a timeshare machine. There weren't any foreign cities or any of that sort of stuff. There was one in downtown Los Angeles. When American Data was founded, there was one in downtown Los Angeles, there were a couple in Chicago, there was one in New York, and there was one in Texas.

Pelkey: Were these video display terminals that were timesharing --

Wilkes: No, no, these were -- let's see, they were the 110-baud teletype port, AT&T typewriter with an acoustic coupler on the side and you dialed in, 110. Normally, a lot of it ran APL or Basic. It was the first distributed capacity for programming that we had in the United States. Before that, if you didn't have your deck of cards and go down there, or your tape, you didn't have access to one. Now, all of a sudden, everybody who had this modest device, which rented for -- get a typewriter for about $200, and then you had phone time and you had your storage time at the computer and all that sort of stuff, and they would -- salesmen would go around and sell this time, and it was a very lucrative business. You buy yourself a 940. When American Data Systems first started, they were just coming on with both the IBM and the SDS machines.

Pelkey: And you saw this because you were trying to sell to them and getting them to be customers.

Wilkes: Right.

Pelkey: When you were at AT&T there wasn't timesharing?

Wilkes: No.

Pelkey: So that happened during that interval --

Wilkes: It was coming and we had forecast it and we knew it was coming; it just wasn't -- the programs weren't stable. Indeed, for the first two or three years, you were liable to lose all your data on there unless you had a back-up with a tape. They crashed every day, sometimes several times; power outages would cause them problems, and we had a lot of parts flying around the United States to keep those real rickety machines up, but when the IBM started up with 20s, and then when the IBM model 65s and 67s came out, there was a real market sitting there. The market for the decentralized, 75, 110, 135 baud machines -- the 135 were the IBM machines, 75 and 110 were AT&T machines, easy to come by and a very, very large market there; a continuing market. The only real fragment of the market was the SDS machines had a return; a character went in and then typed on your machine as it came back, so it couldn't stand any delay. The IBM machines just took it in and it was fine. The delay ones were what really fragmented our market, because SDS really got a leg up on IBM for a while at that time, and the market started swinging to the SDS machines, which didn't favor our delay item.

Pelkey: Because of the error, the precision --

Wilkes: Not because of the precision. Because they were a lot cheaper than the IBM, and they were getting put in everywhere. SDS was competing very well with IBM at that stage in that marketplace. You could get one of those machines, put 20 on it, and be right in town with everybody, whereas to put in an IBM center was a little more effort. So, SDS was just growing hand over foot --

Pelkey: Because the end devices were much cheaper than IBM's.

Wilkes: Right.

Pelkey: Because they didn't have as much logic in them. They were dumb devices --

Wilkes: Right.

Pelkey: Because they just sat there, signaling and re-signaling back.

Wilkes: So our first competitor, and the only one that I ever remember taking much business away from us, was one called Tel-Tech. Tel-Tech had a bit time division multiplexer, as opposed to a character one.

Pelkey: Where were they located?

Wilkes: They were in -- I'd say Bethesda, MD, but they were on the east coast someplace, and where that technology came from I have no idea. I knew the people, and they eventually went bankrupt in about two years. They really ate into a large part of our marketplace --

Pelkey: Because they could handle the SDS?

Wilkes: They could handle the SDS; did it better than we did. So we were losing to them for a period of time while IBM was bringing out more and more pieces so that we could have -- but we did get a very large IBM contract of around $1 million a year, which was nice for --

Pelkey: What were you guys selling IBM?

Wilkes: I'll get you a time line with the IBM contracts and all that sort of stuff. I'll have to go look at that; the balance sheets and all of that sort of thing. Actually, talking about one of the other -- I don't know if you're going to have some anecdotes in here or not --

Pelkey: Oh, absolutely. It's a human story.

Wilkes: One of the things these guys used to do is there would be -- there were two kind of national franchises for timeshare business, and one of them, I think, was TimeShare and I don't know who there other was, but in the morning, they'd give their salesmen a roll of dimes, and your problem was to call the other guy's numbers in the morning and get them out of the rotary, because in those days a telephone, if you left it off the hook at your pay station, the other guy couldn't disconnect it from the other end. The first thing that would happen every morning is --

 Pelkey: Your competitor would call and tie up all your lines and leave the phone off the hook!

Wilkes: So the guy would get his ten salesman or six salesman and they'd give them all a roll of dimes and they'd have to have -- so you'd say: "The other guy is always busy. Let me call him and show you." So the other guy -- and indeed, that did a lot to speed up AT&T two-way disconnect on their phone service, which is a standard feature today. One of those little known facts. Anyway, charging along there --

Pelkey: So you saw the need at Scantlin and saw the timesharing coming and Scantlin was doing RTI logic and the product wasn't working, and things didn't work out for you financially, and you were talking to Bill and saying: "Bill, there's this real opportunity here. God, this multiplexing; this timesharing is coming along." He was in Texas or something?

Wilkes: Right, he was in Texas working at White Sands Missile Range.

Pelkey: Finally he just --

Wilkes: -- picked up roots and came down. We were in a little house in Woodland Hills.

Pelkey: So the two of you sat around and said: "We've got to design a product -- "

Wilkes: I had it designed pretty much. The big design decision was that a flip-flop cost two dollars. That was the price of it, and we could buy MOS logic for ten cents, the storage element, but it had to circle, it had to be a circular thing. In order to control a channel, it took 64 bits; that's what you needed. So we built a circular, on 66-bit long MOS chips that were military designed -- there was a lot of math in this thing so it came out right -- but this thing would sit there and cycle. Not only would it sit there and cycle, but it would take in a 75 and a 110 and a 135 baud, and it was -- I don't know if you remember the old drum computers.

Pelkey: No.

Wilkes: They were computers built on a drum. They didn't have any storage, so your index register picked out where on the drum the eight bits of data was that you got next. Well, this was the same sort of principle; only it was in cyclic logic. So, we had a thing in there that looked at eight registers -- four transmit and four receive, eight bits wide -- and it was just kind of a little processor. As a matter of fact, we called it a processing section, and from that design, which was quite advanced at the time, the MOS logic at that time took 20 volt clock pulses -- they had to be sharp and shaped and everything just right, so they were noisy -- and we built 28 channels to work on a 2400 baud phone line, stripped everything out, and a very successful product. As fast as we could make them --

Pelkey: Did you use RTL?

Wilkes: No, we used TTL. By that time, we had gone through DTL and we were at TTL logic, which is really a standard today. It still survives.

Pelkey: So yours was one of the first TTL products --

Wilkes: Yeah, and one of the largest TI customers in the early days of that. We had some problems like, in order to swing the voltages on those things, we had to put our ground plane up at +12, which meant that every time anybody hooked an oscilloscope up to the machine it tended to blow out. There were all kinds of things that were just -- because we didn't have a driver plus or minus 12 volts, and since there weren't any drivers available, you built them up out of one transistor and then the one side of that transistor had to be at a power voltage, and it was just a disaster. Some real fun things happened along that line. One of our larger customers -- we built a 660 --

Pelkey: How long did it take you to design?

Wilkes: I think we were out six months.

Pelkey: Six months -- and you raised the $100,000. How many of you were there, there was you and Bill -- ?

<p style="text-align:center">Tape Side Ends</p>

Pelkey: After you started, you and Bill started working together.

Wilkes: Oh, three months.

Pelkey: You were funding this out of your savings and --

Wilkes: There wasn't any savings. We were eating real poor. It was down to the bottom of the barrel. My parents were helping us a little, my wife's parents were helping us a little. Bob Schaaf, who was a partner in this who was the sales guy -- he came on a little later, but still was a partner in the thing -- helped us a little with some money through there. Then the next door guy funded us, and the way it was funded was with -- they moved some savings from one bank to another on the condition that that bank make the $100,000 available. It was like $12 million they moved across, and that bank just funded that, and it turned out that they signed for the notes and everything, and we thought it was equity. Bill and I and Bob Schaaf thought it was equity. It probably wasn't equity really, but we were a little -- it was our first venture into it. I was about 27 or 28 and an engineer. Bill was an engineer. Bob Schaaf would be about 37, and he was a sales type, and we were depending on the guy with the MBA and the attorney to produce our business. We thought we produced a pretty good business, but the times we had to secure our income were really stopped by mistakes that they made along the line.

Pelkey: So you introduced the 660?

Wilkes: We introduced the 660.

Pelkey: And then what happened? Where did you introduce it?

Wilkes: Oh, we just started telling people it was available, and they just came and bought it. There wasn't any shows or any of that sort of stuff. "You only have one? I don't believe it." "I have one working at IBM. You go look."

Pelkey: Who was your first customer?

Wilkes: The company with the three guys that married the lady, as a matter of fact. Allen Babcock was the name of that company. Her maiden name was Allen, from Allentown, PA or something -- and we

need to be fairly careful about how you use that quote -- they bought the first four or five of them. As a matter of fact, IBM saw them as --

Pelkey: Did you know them before?

Wilkes: Oh yeah.

Pelkey: From Scantlin days?

Wilkes: I knew them because they were asking Scantlin if they could do that. I, at AT&T, and Jack Scantlin, pioneered the multi-use of a line by various customers. Up to that time, any time -- that was the common carrier function, so a departure of a shared use line was something that Jack and I and several other people at the FCC pushed through AT&T. Once that was through --

Pelkey: You got the FCC to --

Wilkes: -- side with us.

Pelkey: When you were at Scantlin?

Wilkes: Well, when I was at AT&T. Scantlin wanted to do this, because they were going to give us all this business if --

Pelkey: So Scantlin was -- you were at AT&T, and working with Scantlin --

Wilkes: It was really illegal for Scantlin to do what they -- the question of a computer sharing a com line is how much of a computer does it have to be before it's sharing, and how much of it is multiplexing? Well, the advantage of the 660 was, since it had a processor, it met all the criteria of being a computer. So, I could put these out there under the guise of having a computer at each location. Now, as soon as I was out, the tariff and the old laws were gone. We just rewrote a chapter in the history there, and I was at AT&T fighting one side of it, and I think Scantlin I think liked my fight. That's one of the other reasons I think they hired me.

Pelkey: You were fighting it because you knew that, if you could allow this share, you could sell the Scantlins and put lines in all day long, even though you were putting fewer lines in per customer?

Wilkes: Well, I really felt that, for some period of time, that the information was just going to go up and out. I had been at AT&T headquarters for a short period in a marketing study on a data service offering; were they going to stop this or were they going to do this? The market study graph looked just gigantic. Will, by the year 2,000, we have "a terminal per person" -- was one of the statements -- in the United States. If we do that, how many lines do we have to have, and what services might we prepare? I don't know if we have a terminal per person today, but we're running very close to that.

Pelkey: So even in the mid '60s when you were at AT&T, there was a recognition that things were going to change?

Wilkes: We felt that the way we compete with the rest of the world is by moving data faster, and hence improving our distribution control system of our industrial plant, to compete with the lower labor countries of the entire world. In order to do that, one needed to move information rather freely over our total population base, and indeed that's one of the reasons we still compete to the extent that we do.

Pelkey: Do you know who I could talk to at AT&T to get access to a document that would have that concept in it?

Wilkes: No. There are study teams -- there's a new president there at AT&T. I was just reading. It may be just gone in the drama of history. I don't even remember who I was there with, to tell you the truth.

Pelkey: That's a critical spot; that point in time -- Computer Inquiry I was going to come up in '67, '68 -- actually '66, I'm sorry -- and this whole concept about computers and communications was a critical issue, and AT&T never became a factor in the data side, and what you're sharing with me is that they even knew that this was going to happen --

Wilkes: Oh, yeah, they were --

Pelkey: At ARPA, they were actually -- Arpanet, around that period of time -- they turned it down again in the mid '70s --

Wilkes: Asking for the data studies. There were the Data Group Studies, and we had several of them partially implemented, real early on, and they killed that, partly because of the frightening cost of the reliability of it. It wasn't hard to build something that would kind of work, but it was real hard to build something that worked really well all the time.

Pelkey: That was a Western Electric condition, and Bell Labs, and the Bell System. It had to work all the time.

Wilkes: Indeed, we didn't get to that for another ten years from that time, but at that time, that was the problem. My numbers are probably wrong, but I remember them on a first data switch, forecasting it was going to cost them $10 million, and $10 million got it working, but not very reliably, and they ended up putting $40 to $50 million in to make it work reliably, and that was the frightening part. That's what frightened all the executives off, I think, was the difference between working and working reliably. In a telephone, it was pretty easy to say: "I didn't hear you, say it again," but in data there wasn't enough logic around to do the retry. With the lack of a retry, it was a real pain, so they --

Pelkey: Did you work with the FCC -- did you ever talk to the FCC?

Wilkes: Oh, yeah.

Pelkey: Did you talk to Bernard Strassburg?

Wilkes: No, I had a staff contact at Kansas City and I had a staff contact in New York, and we chatted jointly with a staff person at the FCC. I was never allowed to talk to him alone. All things at the FCC were fully documented.

Pelkey: And you were trying to get tariffing?

Wilkes: What I felt was necessary was that Western Union was going to allow it. There was no doubt they were going to allow it, so I was going to lose a large part of not only leased lines, but all of the other lines that I foresaw, to Western Union.

Pelkey: You put the multiplexing and these terminals over their lines to the computers?

Wilkes: Right, and since they didn't have much of the business and we had most of it, I didn't think that we would lose our normal voice business, which was the fear that everybody else had.

Pelkey: But the data business --

Wilkes: It was the new emerging data business. It had nothing to do with their older telegraph business, which was basically not profitable anyway. Here was a chance for us to take our normal voice lines, turn them into data lines, and make money on them, as opposed to having these specialist telegraph people and telegraph machines that were scattered everywhere, and really didn't make us a lot of money. They were not profitable. One of my big sales --

Pelkey: Was there money in telegraph at that point in time at Western Union?

Wilkes: No, no, we had most of the telegraph business too. One of my big sales when I was there was to the Southern California Auto Club, and I built a 192 station telegraph network on three nodes -- all poled, all these nodes -- with tape interconnecting the 66 channel nodes running between clubs, and they had this funny thing called a stun box on the telegraph, which was the first mechanical computer you've ever seen in your life. I got there, I just saw what I had, but the problem was that, if you were a member at some other location, they didn't have centralized membership, so if they wanted to help you someplace, they had to have this big network say: "He's ok, he's a member, he's got insurance," or "put him up," or "o it." This was handling a lot of traffic at 110 baud in those days over all these places, and I made this big sale and I'm all proud of it, and I had been there about two months and they needed this thing, and I just ordered it right up and walked out there and had the VP sign it; there wasn't anything to it. He said: "Oh, can you do that?" I said: "Sure," being a little new and dumb, you know. "Sure, I can do that," and boy, we had some high-speed tape units that went back and forth -- I had just been in school. Field had never seen them. I had never been in California before. I had been in Cincinnati at the training school. About a third of my time at AT&T I was at school. It was absolutely the greatest place to get out of school and go that there ever was, but these high-speed tape machines tape this and dump them over here, dump them over here, go over here -- and they were 1200 baud modems. It would pick these tapes up out of these local polling loops, and each one of them had a mechanical computer. What it did for what it -- as a matter of fact, the whole Bell System, in those days, was a mechanical computer. The switching system -- if you dialed a number, you went through a mechanical selector to tell them what digits to dial on the next line. Those were mechanical points. Have you seen those?

Pelkey: Lots of relays.

Wilkes: No, no. They weren't relays. They were a machine and they held what was called a marker. They held about 60 plates, and these plates would fall down until the right one hit the tines, and then it would go out and it would read it on, and out it would go. That was the high-speed market, and that's how all the high-speed communications -- that's how all of our data network worked in the United States, and with those, they were able to even do things they called torquing which, if you wanted to call from here to San Francisco late in the day, they would send you first to Alabama, their switching center in the southeast, and then you'd go probably from there to San Francisco, but if that line was busy, you'd go to the next switching center, and then on to San Francisco, and those were all mechanical computers. AT&T built more mechanical computers than any place you've ever run across, and they were brilliant at it. They had some brilliant design engineers. They knew the life of them, they were reliable, they were fast enough, they were just unbelievable. They used it in their Teletype equipment and they used it in their telephone switching center. It was -- you look at those things, and they went: "Klink, kalunk, kalunk," and they'd be noisy. The centers were noisy. They had glass around them to insulate them, and that was the forerunner to what's called, I think -- if that was the number five office, the ESS was the first all digital one, and there was a real problem bringing the ESS on line. They had all the problems they had with the data, but worse because of the reliability problems. Anyway, these telegraph and Teletype machines had this little mechanical stun box in there, which was a mechanical selection computer. It was the weirdest little thing you've even seen in your life.

Pelkey: So what happened when you took this Southern California Auto --

Wilkes: Well, they told me it was unprofitable. That was the first time I found out our telegraph business at AT&T was unprofitable. I got really complained at because I should sell regular telephone service, regular data lines, and "don't sell any of this damned telegraph stuff, because, while we like to keep Western Union in its place, it doesn't make us any money, and for Christ's sake, don't put something in with all our new stuff, use the old stuff that's in the warehouse." That's the way it was. It was a really well run company. So as I'm going with the FCC, I find out that the telegraph business is unprofitable. Well, we're not going to put this big data network in our telegraph business if it's unprofitable and it's more expensive than our multiplexer business anyway. A multiplexer, a 12-channel multiplexer that AT&T use for telegraph lines, cost in the neighborhood of $50,000 an end for the coils and everything that were all matched up. It was really a superb item. It could run a telegraph loop up to around 450 volts, I think;

three something, and then there was a booster that you could put in there for 400 volts, to run the telegraph at a high speed. It was a tremendously big, engineered thing, and there were repair centers and all kinds of stuff. It was one of the first times I realize that the American government monitored all our overseas traffic. First glimpse of that came out of the telegraph business.

Pelkey: So you got involved at the FCC in terms of trying make sure the multiplexer onto the voice lines.

Wilkes: Well, Scantlin was asking these questions of: "How much of a computer does a computer have to be before it's a multiplexer, as opposed to a computer?" The line was really vague, and that's why the, what we call, 'regens' on frequency division multiplexers, turned them into computers, because there's digital logic between the lines. What they were afraid of is that noise would propagate through our equipment once we amplified it, and noise would affect the entire network, but the minute you went through a digital decision, noise was gone, and you were allowed to do whatever you wanted to do.

Pelkey: Once you went to a digital --

Wilkes: Decision. In other words, if the noise was just there and amplified, without any digital timing stuff in it, then that was illegal, but if it was digitized, the decision made, time duration, it was fine. They didn't have any problems with that. That was finally the compromise we all settled on in that business, and has really been, to some extent, the decision ever since, although they have much better equipment now that's not near as sensitive to that sort of problem. I think they're a lot more confident of their equipment than they were in those early days.

Pelkey: So you were pretty aware that -- Allen Babcock was the first customer for ADS, and they bought the first number of units, and at that point in time --

Wilkes: Then IBM bought the next bunch, and then we had -- what we had is we had about five big accounts --

Pelkey: They were all buying it for timesharing at this point?

Wilkes: Well, mainly -- yeah timesharing worked real well, although some of our telegraph business was -- for example, we sold to Shell Oil, and we had all kinds of trouble integrating into the telegraph business, because the telegraph business had these relays, and if you didn't have the right mercury wet relays that AT&T had, you had all kinds of problems. So we designed an electronic relay, thinking that we were just as smart as we could be, and this electronic relay, limited to 150 volts, it would switch through this. Well, we had a minor tolerance problem on here; indeed, it wasn't only our tolerance problem, but the first time we ran into a problem with that is when we got a call that Shell Oil was out, and we went down there, and one of our cards was absolutely burnt to a crisp. The reason it was burnt to a crisp is this guy doing his telegraph thing was going to push 60 milliamps of current through there, no matter how much voltage it took, and our resistors stopped him at 140, or at 59 milliamps, so he had something like 800 volts running through our system. [Much laughter]

Pelkey: "I'll make it work. I'll get it through."

Wilkes: Well, once they burned these things out. Well, once they found they could burn us out, they burned us out everywhere in their whole damned net over the next -- I mean every place we had a telegraph installation, and we only had about 20. We lost them all; just 'boom,' and that story went around inside at -- AT&T, in those days, had those big calling nets, where everybody -- they were kind of party lines -- through all the central offices.

Pelkey: And this is the ADS equipment that got burned out?

Wilkes: Oh, yeah, just -- well, 800 volts, we only had limiters in there that would handle about 450, because all I knew that they could make, but somehow they got 800. They put a positive on one side and a negative on the other, so it was probably facing 900 volts or something like that, and this thing was just

burning up. I mean we were in technical combat; that's really what it was, it was technical combat at that stage. Anyway you could fight. You fought with the tariffs, you fought with the equipment, you fought with the price --

Pelkey: Now, were you aware of Carterphone at this point?

Wilkes: Oh, yeah. Carterphone had kind of passed.

Pelkey: Did you think Carterphone was a significant event, or does it loom bigger in retrospect than it did at the time?

Wilkes: What it was is it was a signal that the FCC wasn't in AT&T's pocket. More than the decision was the atmosphere that was created from it. We didn't use connectors.

Pelkey: People who you knew who were out there, were you monitoring Carterphone? Were you --

Wilkes: Not at all. Carterphone had happened, it had kind of gone on, and they were a nothing company, so what was the big deal? What it did is it told us what the commissioners of the FCC had in mind.

Pelkey: And how did you become aware of it?

Wilkes: It was in all the trade press. There wasn't a lot of trade press in those days, but there was some. Actually, Pat McGovern, who owns most of the trade press, was a fraternity brother of mine at MIT. You're talking about personal relationships and how they go back.

Pelkey: I thought this was going to be a half hour conversation. You're just a wealth of facts.

Wilkes: Anyway, Pat McGovern had a -- what was it, ComputerWorld out, and we were all charted in to how much IBM gear was at each place at that time, so Pat was doing that, and most of the reporting came out of ComputerWorld. It was one of about three publications. Datamation was big at that time, but ComputerWorld was then a long-standing thing in that area. I knew him and I could talk to his writers and the like, so that was helpful, at least.

Pelkey: So you started ADS, and then six months after you started, roughly, you get your first product out.

Wilkes: And we're getting booming success.

Pelkey: Business is coming your way?

Wilkes: Business is coming our way, and our real problem right then was modems. The more modems, the more multiplexers we could sell; 4800 we could really sell.

Pelkey: Where were you getting the modems from?

Wilkes: We were getting them from Milgo, mainly.

Pelkey: Milgo had the 4800 at this point?

Wilkes: They had a manual-equalized 4800, and it was a real pain, because you had to go out and adjust it if it rained, or something [much laughter]. I mean, once a week you needed to adjust it, and we were very susceptible to errors, as was everybody else, because there was no error checking in these early units. So, Rockwell had done for the government and the military, an auto-equalized 4800 bit per second modem, and that's how we got involved with Rockwell.

Pelkey: How did you hear about Rockwell?

Wilkes: I don't know.

Pelkey: Was it an internal memorandum you saw? Someone was making a call on Rockwell to sell them something, and somebody picked up something from the lobby that said --

Wilkes: It was a chance occurrence of one sort or another. So anyway, we bought this modem -- bought the rights to it -- and what it netted us --

Pelkey: Now, when you say you bought the rights to it, you make it seem so simple. You contacted them?

Wilkes: We contacted them. I contacted them.

Pelkey: Who did you contact?

Wilkes: A guy who was later president of the company, as a matter of fact.

Pelkey: His name is?

Wilkes: Don -- I could get you his name.

Pelkey: So you contact him. What was he doing at this point in time? Did you know he was responsible for this?

Wilkes: No, actually, there was a guy by the name of Hal Downs, who was the Business Development Manager at Rockwell, who we got shuttled off to real early, and Hal Downs was a -- finally, he was over at Lynch; he ran Lynch Communications or was an executive vice-president there for years -- I don't know if your familiar; they're in Reno, and they're a big -- for years they sat in that $20 to $40 million annual sales range. Anyway, Hal brought us in and we cut a real complicated deal, and the thing is that we got --

Pelkey: You wanted rights to the modems. What did they want?

Wilkes: Stock. The deal was that we would go -- they would see us to $100 million in sales, and -- their interests were, philosophically stated, but not a lot of money behind it -- that we would grow to be -- well, we got $2 million dollars worth, and we really needed it at that growth stage.

Pelkey: You got a million dollars from them?

Wilkes: Two, I think. I believe it was two.

Pelkey: For how much of the company?

Wilkes: About 25%. Very good deal for them, but we also got the modems, their modems. It had about three problems in it that we were relatively aware of when we purchased the modems. One was it was twelve db off, theoretically, which meant that it needed a line that was 29 to 30 db signal to noise or it wouldn't run, and most lines are spec'd at 23. The theoretical was down in the 20, as I recall. My numbers may be off there a little bit. Certain lines caused it problems with one sort of transient, and it had a higher error rate than Milgo's, but its burst rate was about a third of Milgo's, and we were really more burst sensitive than we were actual noise rate sensitive, which really means that we didn't -- if you had one error, we didn't care if you had ten more.

Pelkey: Once you had one, that was it.

Wilkes: Right, we'd lost a channel or two.

Pelkey: So bursts were ok, as long as there weren't too many of them.

Wilkes: Right. So it had a better burst error rate than Milgo, as long as the channels didn't have a lot of things called a pre-transient. So we had pre-transients, we had the burst error rate problem, and we had the theoretical noise limit problem. We got the $2 million, they got 25% of the company.

Pelkey: This was probably, what, '69, '70?

Wilkes: We had been in business about two years, at that stage, almost three, and we could have sold the whole company or gone public at that time, but our books weren't good enough, and Rockwell bought it with the books in really poor shape.

Pelkey: So you had been approached to go public at this point?

Wilkes: Yes.

Pelkey: How big a company were you?

Wilkes: We were probably about $5 million in sales, but growing very rapidly.

Pelkey: This was the heyday, so a lot of companies were going public around you?

Wilkes: We certainly could have, easily enough. We had an ad -- it was a brilliant ad showing all the pieces, even though some of them weren't completed yet but they were all there, and it was the first --

Pelkey: Do you still have copy of that ad?

Wilkes: I do.

Pelkey: Can you get me a copy of that?

Wilkes: Yeah, I will. It's the most brilliant ad that you've ever seen, done by Bob Schaaf. Bob Schaaf added significantly to that growth period. There was many things that rub you hard about Bob, but Bob could use his personality, his humor, in a tough sales situation, and get you right through. He closed the IBM contract, and it was large contracts I talk about, so easily it's all attributable to Bob Schaaf. He was -- one of the other problems we had in the company is it was a third, a third, a third -- the three of us, Bob Schaaf, Bill Norred and I -- so we never quite knew who was boss. We were real dumb in the starting of it.

Pelkey: But you had the title?

Wilkes: I had the title, and I knew a lot more about that part of the business than the other two did, but Bill Norred ran very efficient manufacturing, and Bob did the selling, and I really wrestled with the technology, and to some extent the financials. The next door neighbor was later disbarred and sent to prison, among other things.

Pelkey: The guy you looked to for competent advice?

Wilkes: Right. Well, you're never quite sure. Anyway, we got the modem coming in, and a guy by the name of Fred Wade, who was one of the best engineers I've known in a long time -- W A D E, I think -- we had this modem in and we were making it and we were starting to sell it, and we finally had it down to around 26 db signal to noise, a little worse than the line, but it was working out now. All the equalizers were analog in chips; it had about eight cards in it, there were MOSFETs and all kinds of stuff in its design, and the problems remained: the pre-equalization theoretical limit, and ARPA was spending, at this time, six to ten million a year in mathematical research to find out why these matching modems, the

matching lines or channels in the modem, were not close to theoretical. They were really off from theoretical.

Pelkey: ARPA was spending that?

Wilkes: Yeah, Advanced Research Projects were, with professors and whoever would study the thing.

Pelkey: Like MIT, probably.

Wilkes: Well, it doesn't ring a bell, but there were like six or seven guys who were the modem filter gurus, right, and I was sitting in my office, and by then the little minicomputers had started to appear; Auto Data . . .

<div align="center">

Tape Side Ends

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Wilkes: . . . The little, five-register, discrete minicomputers. I think the one we settled on initially was the Automatic Data, which went out of business eventually, but we had about six of those. We did a lot of our engineering on them. The timeshare business was going away because the little computers were showing up, and indeed the on-line systems were just showing up. We felt the market would be very good for those on-line machines, because they were designing us in, particularly the modem business looked like it was going to be good. We had about five of these microcomputers, but we couldn't meet the theoretical on this and it was really stopping our sales. We had a sale for at least 30,000 of those units if we could MOS-ify them and send them into the digital fax people, which looked, to us, to be a great business. Well, I'm sitting there struggling with this, and Fred Wade walks into my office and says: "Hey, I can solve that filter problem," and I said to him: "How are you going to solve that filter problem? The best minds in the world are on that filter problem." He says: "There's no sweat. If you give me the computers from five in the evening until eight in the morning for the next three months, I'll try all the answers." That's what he said to me. That was the first time I had -- so we programmed them up. It took us about a month, and just searched for the best answers for three months, and in about a month and a half we had a brilliant answer; one that was right on theoretical and everything. So, with that search algorithm, we had that part of our problem solved, and one of the mathematicians came up with a solution, so we went back to Rockwell and took the order for the 30,000 MOS modems. Our deal was that we got the MOS chips for around $100. Well, a 4800 bit per second modem, in those days, was selling for $4,800. We figured we were going to come out for $2,400, half the market, and just take the whole damned thing. What Rockwell didn't tell us when we signed the contract is that while we had a price for $100, every one beyond the first unit that they shipped to us, they wanted $1,200 for it. They were just awful. I mean, they were stockholders -- it was really over that straw that I left. That's when we -- the 660 was being -- it wasn't phased out, but the 670 -- well, the modem was out. We had the MOS modem contract, we had the first articles. The 660 had a lot of labor, because each of the channels was connected by cable to the back panel. We had a 670, the successor product, that had printed circuit boards that had connectors going both ways; cables one way and the other ones the other way. It cut our labor extensively, and, indeed, the 670 sold for many years after that around the world as a multiplexer system. The real reason -- my argument with Rockwell and the problems I had -- and by then I had a chairman that I reported to that was a Rockwell vintage person.

Pelkey: How were the company's finances?

Wilkes: Our financial fortunes weren't dwindling yet.

Pelkey: But this modem contract was the one that broke the back?

Wilkes: That's what broke the back of ADS.

Pelkey: You took this contract to perform that --

Wilkes: Oh, we did. Those were no problem, but we were going to sell the modems at $2,400 that we bought the chips for $100.

Pelkey: But all of a sudden you find out you have to buy these chips for $1,200?

Wilkes: And they wouldn't make them, beyond that, or couldn't make them, or whatever. They just dried up that source, and all of a sudden we were high and dry, and there was nothing we could do.

Pelkey: You had 30,000 modems you had to deliver to --

Wilkes: Oh, the 30,000 we delivered. They were part and parcel of that, and they delivered on that. We made $50 bucks a piece, or something, off of those, but it was the other 20,000 we thought we could sell out in the commercial world that was the real bone of contention as to who would get the profit from them, because we had a contract that said those chips came in at $100. They said: "Aha, you might have that contract, but we didn't tell you how many we would deliver. We're only going to deliver you one, and every one beyond that sells for $1,200."

Pelkey: So they delivered on the 30,000 contract ok, but once you got beyond that, they figured it was time to make some money. You must not have been a very happy man at this point.

Wilkes: I really wasn't. One of the things I figured out is that the modem equalization algorithm is applicable to speech. Out of the algorithm, I could have an artificial head, set the head, only send the parameters down to the other end, then I could compress speech by a factor of 20 or 30 to one. So I thought: "Alright, I'll get as much money out of here as I can, and I'll -- "

Pelkey: Roughly when is this?

Wilkes: This was about the fourth year or the fifth year of ADS's life.

Pelkey: Would that be '70 or '71?

Wilkes: That would be '71, I would say.

Pelkey: But '70 --

Wilkes: There was a real recession in there.

Pelkey: A real recession which all of a sudden, all of these timesharing systems -- it's going crazy. Everybody is buying everything, and buying your equipment --

Wilkes: And then stopped, but if we had still had the modem business, it would have been just fine. We would have been dominant. We got stopped in that in our damned tracks, and we just absolutely stopped.

Pelkey: At this point in time, in 1970, was this recession -- you mentioned Tel-Tech before. Were you aware of people like Timeplex or --

Wilkes: Timeplex was coming on, but their products weren't worth a damn at that stage. They were first generation, and we were introducing second.

Pelkey: Who else?

Wilkes: Milgo was coming out with a multiplexer. Everybody said they had them, but nobody had them out.

Pelkey: You were really -- you had that marketplace.

Wilkes: Tel-Tech bothered us.

Pelkey: Because of the SDS issue?

Wilkes: But the bit people didn't bother us much. We had Europe.

Pelkey: 'Cause we were character interleave, as opposed to bit interleave.

Wilkes: Which takes more delay, going and coming, it's two character delay, as opposed to a two or three bit delay. If your in the SDS world, you've just got a problem, but IBM is catching up real good now.

Pelkey: Because they don't have their own multiplexer?

Wilkes: No, they didn't have their own multiplexer, but they're starting to get the timeshare business back from SDS at this stage.

Pelkey: So you're benefiting too?

Wilkes: We're benefiting from that.

Pelkey: Had SDS been sold by this point to Xerox?

Wilkes: No. It was still producing, and it did well into the first two or three years of Xerox owning them. See Dan was, by then, president of what became Xerox Data Systems. Dan Mazurek, who had been at Scantlin, was president of that company.

Pelkey: Say that again.

Wilkes: They guy at Scantlin, who had lost to Vance Holdem as the president and went over to SDS, was now president of -- when it became XDS, he was president; later Assistant Director of the US Budget; later one of my board of director members of the venture company. The real problem was the costing and the availability of the 4800 bit per second modem, and the fight of who owned that, and their stock interest and the fact that they had the Chairman in and they had the VP of Finance in, and then they bought Collins. That was the final shot. Collins had modems, non-standard modems. Collins was at $300 million, we were at five, maybe -- yeah, five would be a good value for us. They were $350 million, and indeed our chairman, who was let out the same time I was, went over as their Vice President of Sales, and our VP of Finance went over as their VP of Finance. They just took us and: "We're going to do this. This is a good business. You guys were right. We want to do it with a $350 million platform," and they bought me out, and I don't know what they did for Bill. Bill was there a year after I left, and he and a division manager from Rockwell were running that place. The division manager was the worst guy I had ever seen, the worst manager.

Pelkey: Did you and Bill -- even though you had this disagreement, did you and Bill stay friends through this period of time?

Wilkes: I don't know that we had a disagreement. He never said to me we had a disagreement.

Pelkey: But he stayed on.

Wilkes: Well, they canned me. I mean, the board of directors said: "You're gone." What I said to them was: "I think that there's fraudulent intent on your part."

Pelkey: Right, and they said: "Goodbye."

Wilkes: "We'll buy you out." That's what they said, and I went to Bill, and I said: "Bill, do you want to be bought out?" He said: "Well, I don't know, what are my choices?" I said: "Well, it's a good salary here and you're still here. I'm the one they're after, and they're not paying me very well," and he said: "Well, I don't know," and by the next day I was gone. I went back and saw him several times, but actually, when he moved out of my house, our relationship changed at that time, and it had to do with his wife wanting their own apartment. As many partners find over a period of time, it really has to do with one of their wives wanting something, and she wanted her own apartment in the worst way. From that time on, I got a lot less communication out of him, and at that stage he always had a habit of just kind of clamming up --

Pelkey: Yeah, he's a quiet man.

Wilkes: -- and not really saying what was on his mind.

Pelkey: He's still that way.

Wilkes: Is he still that way? You never quite know -- and he would always put a decision off until tomorrow and make it overnight, and sometimes when you didn't have the luxury, which I didn't that day -- I mean, I was setting my price, and the chairman and I went, and I got this awful manager from Rockwell, and they had the contracts in their -- they really did, but they were -- the MOS division wasn't going to share their profits with them any way in hell, and they had that MOS mask, and they thought there was, and there turned out to be, a lot of money in it. I understood their earnings were $50 million a year -- not earnings, but their sales were $50 million a year on their MOS chip set for like five or six years running. You learn something about -- you know, today what I'd do is I'd go to the Feds, and I'm not sure which division, but I'd go loudly and I'd go with a lot of letters and I'd go to the Federal Trade Commission. I'd go to the FCC and I'd go to their auditing committee, and I think I could break that problem out, but I was a very junior executive who they got out of there very rapidly.

Pelkey: Going back -- you tried to raise money, right?

Wilkes: Well, we couldn't because of the --

Pelkey: The books.

Wilkes: What do they call that?

Pelkey: Did you every go around to other datacom companies, like Codex, for example?

Wilkes: No, Codex was a real competitor. They were a 9600 and 4800 bit per second modem competitor, and knew that we would be there, so they weren't a possibility.

Pelkey: So they came in afterwards to look at buying ADS as soon as Rockwell got tired of playing with it?

Wilkes: Well, when Rockwell --

Pelkey: That's how Codex found out about Rockwell.

Wilkes: Is that how they found out about Rockwell? Did they find out not to do business with them?

Pelkey: No, they found out who the person at Rockwell was that eventually led to Rockwell designing and building the modem chip set for them that made them a success.

Wilkes: Well, they must have had a better negotiator for the contract than we were.

Pelkey: It wouldn't take much.

Wilkes: Well, there's a certain truth to that. I had never written a contract before or since then that doesn't say: "I get to set the level."

Pelkey: Well, it sounds like you got ripped off.

Wilkes: And, had our books been better, not that there was anything that --

Pelkey: Were investment bankers calling to take your pulse?

Wilkes: Oh, yeah. H&Q was down. Bill Hambrecht made a pitch to the board, and that was in his early days. I think it was Bill.

Pelkey: Could be.

Wilkes: What we had was we had a qualified statement, and indeed, after -- some of the stories about our books are really -- they found a shoebox full of receipts of the treasurer's, one day after the guy that came from the savings & loan, that he used to make up the books as he went along. It was really just an awful sort of thing. Here they are, they're professional people, a trained CPA out of a savings & loan, and an attorney who was general counsel for five savings & loans. You would have expected a certain amount of integrity running through there, but it really wasn't to be had. We needed an auditor's statement from a national auditor, and we weren't going to get it. That was just the way of it.

Pelkey: Did you ever hear of a company named Viatron during this period of time?

Wilkes: No.

Pelkey: Now, when you left -- after you got bought out, what did you do? Did you ever get back into the data communications business?

Wilkes: After that? Well, basically we got into voice and video and compression and transmission and that sort of thing, but never got back into it. We had a product called a 'modem sharing device,' and the modem sharing device was a thing that allowed a bunch of terminals that were relatively local to share a modem, and it was a hot device. We sold a lot of modems; something like 60 or 70% of our modems went out with a modem sharing device.

Pelkey: And what did this sharing device really do?

Wilkes: It allowed two terminals to find out if the other one was using the modem.

Pelkey: And if not, it could use it.

Wilkes: If not, it could use it, so this device was a relatively simple device, and it just turned it off on the basis of a lead, but a lot of people were asking if we could do that with X-Off and X-On, which were the IBM standards at that time for turning things on and off, and it was kind of a terminal standard. So, the next big change was the 8080, and that modem sharing device that Norred took out and became his bread and butter multiplexer. It was very chancy, but he had about four things right, and even then, there was a digital carrier that went bankrupt that caused him all kind of --

Pelkey: Datran.

Wilkes: Yeah. It was much along the patterns of the AT&T plan. That was planned after the AT&T Digital Carrier Plan. First, he picked Intel. I don't know how he picked Intel.

Pelkey: He went with Zilog.

Wilkes: Did he pick Zilog? I thought he picked Intel.

Pelkey: Zilog.

Wilkes: No, his first ones were Intel. I know they were Intel, because Zilog wasn't there yet.

Pelkey: Zilog wasn't there, was it?

Wilkes: No, it wasn't there. He picked Intel. He picked the 8080, and everybody else -- I mean Apple and --

Pelkey: It couldn't have been the 8080.

Wilkes: No, it was a 4040. No, it was an 8080. It was an eight microsecond chip that he picked.

Pelkey: It was the 8008.

Wilkes: Yeah, 8008. It wasn't the 8080, but it was the eight microsecond, eight bit processor in his early things, and by golly if they didn't make it. Now, if you had picked any of the other processors, you would have had a real problem. That brought him right along, and he picked the modem sharing device that was selling all the modems, and said: "Oh, I can improve on that a little bit. I just need to make that decentralized;" not a particularly hard set of software even, and you could see that coming. That wasn't -- the size of the eventual market was a surprise, I think to him and everybody else, and he ran a good company. But you'd go to -- the pieces just weren't available. You had to make them all. As a matter of fact, one of the things that Bill built was the EIA connector hoods. I don't know if he told you that was one of his inventions or not, but it was, and it was used for years. It was very trademark-y of their business to have that.

Pelkey: EIA?

Wilkes: The early hoods on the cables had little prongs on them, and they'd always break off. He had a really nice one.

Pelkey: Well how about that. When you got in the business, was RS- 232 standard?

Wilkes: (Affirmative). Just established, but established.

Pelkey: And the teletype was a standard.

Wilkes: 60 milliamp, 20 milliamp, and EIA.

Pelkey: When did EIA come into being?

Wilkes: There had been a conference about six years earlier.

Pelkey: So early '60s.

Wilkes: Yeah, and all the modems came out with that. One of the big problems is the modems and the terminals, so when you put multiplexers between them, you couldn't -- you had to have cross cables for the first time, and that was a big problem.

Pelkey: Now, everything you've mentioned, when they started to come out with the terminals and such, weren't there different standards -- X-On/X-Off, and how every manufacturer did it a little bit different.

Wilkes: Right, oh yeah. And today they're all different.

Pelkey: They're standardized some.

Wilkes: Not a heck of a lot. I mean the printer pins that turn printers on and turn terminals on vary 19, 24, X-On/X-Off -- I'm trying to think of some of the others -- but I know of at least 20 that exist today.

Pelkey: Back then, their weren't such things as real networks.

Wilkes: We were building them all.

Pelkey: So you had to have a link there that wasn't very high speed -- 2400 was the fastest that you could go -- and some people use 2400, but you didn't --

Wilkes: Multiplexers were one of the big modem sellers.

Pelkey: Why didn't AT&T sell the first 2400?

Wilkes: AT&T never seemed to get into that equipment business. They got kicked out of the modem business.

Pelkey: Now the military -- Cape Canaveral back then, they were just one of the applications, remote radar, they had a need for high speed.

Wilkes: That's where Milgo came from.

Pelkey: Yeah, but there wasn't out in the commercial sector that same demand for data that there was in the military --

Wilkes: Yeah there was, there just was no big person to pay for it. The funding was different.

Pelkey: The funding was there on the government side, there wasn't on the commercial side.

Wilkes: But the minute Milgo had one operating for the military, they went immediately into the commercial sector and were a tremendous success.

Pelkey: They were the leaders then. Well, Codex came out with the 9600.

Wilkes: They had a good 9600. Milgo ran out of steam because the management stock got too thin.

Pelkey: Management stock got too thin? This is back when it was Milgo. It was CCI or something they were selling out here?

Wilkes: They got purchased by a company in England.

Pelkey: But that wasn't until the late '70s.

Wilkes: They were good until then. They were a hot company until they got purchased by the English group. They were having more and more problems.

Pelkey: ADS was trying to take them over.

Wilkes: I don't remember. ADS was trying to take a lot of people over.

Pelkey: ADS was trying to take over Milgo, so Milgo ran to Racal.

Wilkes: Yeah.

Pelkey: "Save us."

Wilkes: But the management didn't have enough stock in there to have any interest.

Pelkey: After they got bought.

Wilkes: No. The whole management team had less than 10% of Milgo at the time it was being purchased and bandied around. It wasn't a close sale. I think the president had 4%. The head guy there had only 4%. He had a plantation up in North Carolina, and he was up there often making a lot of money on his plantation, and his Milgo stock wasn't all that important to him anymore, and he had a twin turbo-prop plane he used to go into New York for his conferences on, pretty much at his disposal. My estimation of them is that it would have been easy to have taken them, because of the management disinterest. I just find that when the management group drops under 10%, it's pretty easy to -- I was starting to formulate some of those thoughts about that time. They dropped under that. They were all selling their stock. It was a pretty good market, so they -- I knew the sales manager there better than anybody else. He had a daughter die.

Pelkey: Matt Kinney?

Wilkes: Matt Kinney, yeah. Matt's daughter died in a tragic auto accident. It just took an awful lot of steam out of him for several years during a large part of their -- when they flattened off.

Pelkey: Mid '70s?

Wilkes: They went up like a roller coaster and flattened off. He bought her a Japanese import, one of those smaller cars, and she got killed in it. She was like a senior in high school, a brilliant girl, just doing everything -- off to some speaking engagement someplace.

Pelkey: That's a sad story.

Wilkes: Really took the steam out of him for two or three years, and their sales really showed it. He was a real creative person selling to reps.

Pelkey: He made reps work. Where did you come up with -- you did a deal with Case?

Wilkes: Right.

Pelkey: How'd you ever do that deal?

Wilkes: Well, the US government sponsored a trade mission to England. We went, Case was there, and I think our ambassador introduced us to him -- the US ambassador to England introduced us to them. I don't know how he knew him.

Pelkey: Interesting.

Wilkes: Well, I think they gave us an order for like $1.8 million. Some introduction.

Pelkey: Was Roger Evans there at that time? Milgo was selling you Racal. Racal was distributing your product. So they knew -- Case was going to do data communication products. Did they try to tell you about what was happening, how well Milgo was doing or whatever else, as a consequence of the Case relationship?

Wilkes: Sure. We knew. We were trying to get into the modem business as fast as they were trying to get into the multiplexer business. They never got into the multiplexer business, and we never got into the modem business. That's really what happened. Doing it over again, one would say: "I'd stay at the multiplexer business and just get better and better at it and to hell with the modem business and Rockwell and so forth," but at the time it looked like whoever had both of them maybe even integrated into the

same product offering -- but the technologies were vastly dissimilar, and the modem technologies was much more expensive than it would look like today. Things like that were not well understood, and taking and managing the time to understand the modem issues took away from the multiplexer business issues, and we should have stayed at the multiplexer business issues instead of diverting ourselves to the broader range --

END OF THE INTERVIEW